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THE FERNS
OF
SOUTH AFRICA

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THE FERNS OF SOUTH AFRICA

CONTAINING
DESCRIPTIONS AND FIGURES
OF THE
FERNS AND FERN ALLIES OF
SOUTH AFRICA

BY
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Pietermaritzburg, Natal
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Forest Flora of Cape Colony; Forest Flora and
Forest Resources of Portuguese East Africa
Tree-planting in Natal
&c.*

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Botany

PREFACE

THE vast and varied flora of South Africa, despite the beauty and usefulness of many of its species, has always received from the general public an exceedingly small amount of attention, and still continues to do so.

There have been a few men, each of whom has made himself acquainted with the flora of his own district; there have also been a very few who have in some measure mastered the main features of the whole flora of South Africa; but even now the beginner who hopes to receive assistance from earlier botanists must soon discover that the plants themselves are much more easily found, than is their written history.

Descriptions of species from many pens and in several languages have been scattered through numerous books and journals during the past hundred years, but some of these are not now obtainable. Some unpublished species named in manuscript are known only by single specimens hid away in European herbaria, and the work of compiling from these scattered data a *Flora Capensis*, begun in 1859 by Harvey and Sonder, is only now nearing completion.

The present work is one step in that direction. By taking in hand one group of orders, and collecting from all available sources such information as seemed desirable for the end in view, I hope that I have been able to prepare a work which will lessen to a considerable extent, to

future students of this subject, the difficulties that have hitherto presented themselves ; and which will give, in a collected form, most of the particulars required.

Such a work must necessarily be in part compiled from previous writers, and I have, throughout, given the authorities quoted, and have collated as far as possible.

The whole of the descriptions, however, as well as the figures, are my own, and taken from live specimens where these were obtainable, or from dried specimens in my own herbarium or in some of the leading Cape herbaria.

In the cases where all these were defective, the authorities of Kew have, with their constant willingness, assisted greatly by sending specimens collected in this or other countries of what were known or recorded to be South African species, and I have not hesitated to describe and illustrate from foreign specimens species recorded from South Africa, but concerning whose occurrence I have doubts, in order that attention may be drawn to these and their presence confirmed or otherwise.

The earlier chapters are reproduced from my *Handbook of Kaffrarian Ferns*, but altered so as to meet the wider area ; and most of the plates prepared for that work are again used here.

The synonyms given are mostly what occur in works on African plants, and do not by any means exhaust the list of names applied to some of the species.

Without a visit to Europe, it is of course impossible for me to verify all these synonyms, but I have found occasion in a good few cases to differ from Kuhn, mostly regarding species originated by Pappe and Rawson.

The area dealt with in the first edition of this work was that portion of Africa lying south of the Tropic of Capricorn,

but in the present edition the whole of Africa south of the Zambesi is considered, on purpose to include the whole of Southern Rhodesia as well as those portions of the East and West Coasts in the same latitude.

This extends enormously the area under review, especially in view of the increased facilities for comfortable travel which have come into existence during the twenty-two years since the first edition was published.

The first edition was based on Hooker and Baker's *Synopsis Filicum* (2nd ed.), and the nomenclature and arrangement followed were those of that work.

But since that date the adoption of fixed principles in regard to botanical nomenclature, and especially in regard to priority of name, has so upset the practice then in vogue, that very few of the names then in use now stand, and on this account, if for no other, a second edition became necessary.

The publication of Carl Christensen's *Index Filicum* has set a standard of arrangement and nomenclature which gives promise of permanency, and this has therefore been followed with very little variation in the present edition, and the nomenclature used in the first edition has been reduced to synonymy.

In connection with the distribution of species, it may be remarked here that localities which are now in the Transvaal had, by Sanderson and others, been marked "Natal" before the Transvaal existed, and that some confusion has been caused thereby; also, that "the Cape" is occasionally given for localities which are now outside Cape Colony.

Among those who gave great assistance in regard to the first edition, my best thanks were due to Sir W. T. Thiselton-Dyer, K.C.M.G., C.I.E., LL.D., F.R.S., at that time Director of

the Royal Gardens, Kew; and J. G. Baker, Esq., F.R.S., F.L.S., at that time Keeper of the Herbarium there, for the specimens already mentioned, and for notes on other South African Ferns as represented in the Kew Herbarium; to the late Prof. MacOwan, B.A., F.L.S., Hon. D.Sc., at that time Botanist to the Agricultural Department, and Curator of the Government Herbarium, Cape Town; and Dr Schönland, F.L.S., Curator of Albany Museum, Grahamstown, for kind assistance while examining the herbaria in their charge; to the late H. Bolus, Esq., F.L.S., Hon. D.Sc., for the use of his splendid Herbarium and Library; to J. M. Wood, Esq., A.L.S., Hon. D.Sc., at that time Curator of Durban Botanic Garden, and of Natal Government Herbarium, for a fine set of specimens of Natal ferns; to H. G. Flanagan, Esq., of Komgha, for a similar set of the ferns of his district; and to all the other ladies and gentlemen who assisted with specimens; also to the late Mr John Roy, LL.D., and the late Mr John Bulloch, both of Aberdeen, Scotland, for most kindly seeing that edition through the press in my absence, as they previously did my *Handbook of Kaffrarian Ferns*.

In respect to the present edition, my thanks are again due to the many collectors who have contributed specimens to the various herbaria or sent them to myself, and thereby assisted in rendering available the further information which is now incorporated into this work, most of whom are mentioned in the locality lists; also to Prof. Petrie who undertook the translations, and to all who have helped in other ways.

But especially am I indebted to Dr H. H. W. Pearson, Professor of Botany, Cape Town, who has been the moving spirit in making arrangements whereby the publication of this edition could be undertaken; to the Witwatersrand Council of Education, which contributes £100 toward the

expense; to the Superintendents General of Education for Cape Province and for Natal, who have assisted by placing orders; and to Senator the Hon. Marshall Campbell and others, through whose assistance the financial arrangements have been completed.

In 1892 I closed the preface to the first edition with the words "I do not anticipate that many more species of Ferns will ever be found in Cape Colony, but the whole region north of the Orange, Vaal, and Umvolosi Rivers is still, botanically, almost a *terra incognita*, and doubtless contains many still unrecorded species."

Such has proved to be the case. The northern colonies have proved much richer in ferns than the previous lists indicated; the coast colonies remain nearly as they were. But the northern Drakensberg ranges, the Portuguese mountain slopes, and the Zambesian valleys are even now far from closely investigated, and I still expect more species to be found in these localities and probably also on the west coast. The present edition enumerates 220 species as compared with 179 species in the first edition.

T. R. S.

MARITZBURG,

NATAL.

26 November, 1914.

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CHAPTER I

FERNS

THE plants included in this work form, together, a group known to botanists as *Vascular Cryptogams*, and have certain characters in common by which they are distinguished from other groups of plants, but among themselves they present a considerable range of variation in structure, and no one who knows anything of botanical classification would think of associating with ferns such plants as *Marsilia*, *Isoetes*, or *Psilotum*. The connection will be explained further on; but restricting ourselves meantime to the ferns, though most readers are familiar with them as a group, there are many who, while they recognise a plant as a fern, can give no definite character which identifies it as such, or which distinguishes it from other plants resembling ferns. This is not because they possess no such character, but rather because their reproductive parts are so small as to be difficult to understand aright. Anyone who examines a fertile frond of the common Bracken will find that the margin all along is closely folded back upon the underside of the frond, and that under this reflexed edge there are numerous small bodies which, when examined under a magnifying glass, are found to be cases containing abundant dust-like particles, differing in structure from true seeds, but generally supposed to act as such. If the common scented fern be examined, it will be found to have these *sporangia*, or *capsules*, as they are called, under the reflexed edge all along the upper part of the frond only, while in the larger tree ferns, and in many other ferns, they are arranged in round dots which have certain fixed positions on the under surface of the frond.

In all ordinary flowering plants, where seed is produced, it is formed after the flower, and is the direct result of the sexual fertilisation of one part of the flower by pollen grains produced on another part of the same flower, or of a different flower of the same kind.

In the ferns, however, neither the seed-like capsules, nor the dust-like particles, or *spores*, contained in them, are the result of sexual fertilisation; indeed, until after the spores are set free there is no flower or anything analogous to a flower, nor any sexual parts, produced on the fern, and from the first appearance of a young frond it bears these capsules and spores which grow simultaneously with it, and reach maturity also at the same time.

It is this production of reproductive spores, without flowers or evident sexual connection, that is used as the first division in systematic botany, separating plants into two groups, flowering, or *Phanerogams*, and flowerless, or *Cryptogams*, the latter including, besides the plants now under study, such plants as mosses, lichens, seaweeds, and fungi, or mushrooms, each having its own method of reproduction.

The further life-history of the spores will be explained later on, but enough has been said to distinguish clearly between a fern and a more highly developed plant.

There remains, however, the difficulty that these parts are too minute for examination, except under a powerful microscope, and some readers may want a distinction which they can see for themselves without the microscope. This is not obtainable in every case; but with ferns a little practice will enable anyone to identify the regular lines, or dots of capsules, along the edge, or on the surface, of the underside of the mature fertile frond, but which are not to be found on the leaves of any flowering plant. Another easily seen character, which holds in all except *Ophioglossum*, is the manner in which the young fronds lie rolled up before they unfold, *i.e.*, every frond is rolled inward like the mainspring of a watch, having the tip of the frond for its centre, and each curve outward is rather larger, and contains all the rest. The divisions of the frond are also folded in the same way.

This is what is known as *circinate veneration*, and is almost confined to ferns, though it also occurs among the Cycads or Kaffir Breads, and several other plants.

We now come to the characters by which Cryptogams are divided into groups; and here some knowledge of plant physiology is necessary.

If the leaf of a moss be examined under a powerful microscope, it will be seen to be, not a solid mass as it appears to the unaided eye, but composed of numerous little sacs, or cells, containing liquid, and pressing one another into more or less regular geometric forms. The frond of a fern examined in the same way shows similar regular cells, seldom much longer than wide, and often roundish, square, or hexagonal.

If, however, a longitudinal section from the stalk of a fern frond be examined, it will be found to consist of very much longer cells, cells so long, indeed, as to form continuous tubes up the stalk, for the free passage of the water, etc., sent up by the roots. These long cells are known as *vessels*, and plants formed of this tissue are known as *vascular*. Now, this is exactly the difference between *cellular cryptogams* and *vascular cryptogams*—the former including lichens, algae, and fungi, having cells only, while the vascular cryptogams, as well as almost all flowering plants, have vascular tissue throughout their stems and leaf veins, along with cellular tissue which is most developed in thin leafy parts. The mosses (Bryophyta) form a group somewhat intermediate between the two, but the method by which these are reproduced distinguishes them easily from the higher vascular cryptogams, which are spoken of as Pteridophyta. We find, then, that the Pteridophyta or, as they are familiarly termed, the ferns and fern allies, are plants, which reproduce by spores; the sexual organs are borne on small and usually green structures (*prothalli*) which are formed as the result of germination of the spores, and the fertilized egg of the female organ (*archegonium*) grows into the fern plant, the stems and veins of which are formed of vascular tissue.

CHAPTER II

PARTS OF FERNS

THE component parts of a fern differ considerably, both in formation and in purpose, from those of a flowering plant, and to avoid confusion distinctive names are applied to them. Very many different terms are in use, but as it is more useful thoroughly to understand one set of words, and adhere strictly to them, than to wander through the whole category, the terms here explained are those used in the descriptive pages following, and they are used only in the sense here explained.

A fern consists of roots, stem, and fronds, and the more minute parts situated upon these.

ROOTS are either wiry, or like very fine hair; always present, but affording us almost no characters, and therefore they require to be carefully distinguished from the rhizomes, which are always characteristic.

STEM.—The stem in what are known as tree ferns is erect, and several feet high, bearing the fronds at its summit; but a much more frequent form is for the stem to be prostrate on, or under, the ground, when it is known as a *rhizome*.

The *rhizome* may be stout and short, or, as in the Bracken, very widely creeping, slender, and sometimes branched. In some it is underground, in others creeping on the surface, and in others creeping over tree trunks. The *fronds* are sometimes scattered along the rhizome, and sometimes clustered at the growing point only—which is then known as the *crown*.

Some ferns have almost no rhizome, but the crown only, standing erect, like an undeveloped tree stem. In a few cases

the fronds are jointed on to the rhizome, but most frequently the tissues of the stem and frond run gradually into one another without any joint.

FROND.—The leaf-like parts of a fern are known as fronds, and are connected with the stem by more or less evident *stalks*. When the frond is divided, the continuation of the stalk between the leafy parts is known as the *rachis*, and the same term is applied to its further continuation through the branches, while the still further continuations of it within the substance of the frond are known as *veins*. If the frond be undivided it is said to be *simple*, and if cut down to the rachis it is *pinnate*, and each division known as a *pinna*. When these pinnae are cut down to the rachis the frond is *bipinnate*, or *2-pinnate*, and when the pinnae of these are again similarly cut, the frond is *tripinnate* or *3-pinnate*, and a further repetition of this makes them *4-pinnate*.

If instead of being cut to the rachis they are only partly cut, they are *pinnatifid* instead of pinnate, and frequently a frond, or a pinna, is pinnate below, and only pinnatifid above.

When the pinnatifid lobes are very unequal as to size, and are sometimes reduced to a waved outline, the frond is said to be *sinuate*.

When the stalk of a frond forks into two pinnae and these again into two, it is said to be *dichotomous*, as in the *Gleichenias*, where the main divisions are dichotomous, and the final cutting pinnate. When a frond is 2, 3, or 4-pinnate, the final or undivided race of pinnae are known as *pinnules*. A *sinus* is the bottom of the cut separating two lobes.

CAPSULES or sporangia occur either in lines, or groups, which are known as *sori*, one line or group being a *sorus*. In many ferns the sorus is covered, when young, by a thin membranous covering known as the *indusium*, and when the sorus is *marginal* (in a line along the edge of the frond), this indusium is generally formed of the turned back margin, changed in texture more or less. Instead of this in some ferns the sorus is placed inside a little membranous cup known as the *involucre*, and this term is also used where,

instead of the cup, there is only a scale placed under the sorus. In some other ferns there is no indusium or involucre whatever.

The sorus is generally placed on a vein, and the part of the vein to which the capsules are attached is known as the *receptacle*, which in a few cases projects beyond the substance of the frond, and in a few others is sunk into it. The *capsule* or sporangium is a roundish body, sometimes tapering downward into a stalk (Plate 7, Fig. d), and in all our true ferns is surrounded by an elastic jointed ring which in some is placed horizontally, and in others vertically, but in all it seems to assist in opening the capsules for the exit of the spores. The sporangia of the allied Orders differ somewhat from those of true ferns, and are described under each Order.

SPORES are minute dust-like germs, from which young ferns of the same kind are produced in the manner explained in the next chapter.

Besides the above there are several other appendages, such as scales, hairs, glands, and woolly tomentum, which, though of less use to the plant, are of considerable value to us as a means of identification. The other terms used in the descriptions are explained in the glossary at the end of the book, and the parts of the allied plants are, in each case, explained in the description.

CHAPTER III

REPRODUCTION AND PROPAGATION

THE spore is the natural reproductive organ of the fern, and its method of development is most curious and interesting, though difficult to examine on account of its small size. When released by the bursting of the capsule, it floats in the air until some damp spot is reached, when growth at once commences, and in two weeks the small green growth may be detected without the magnifying glass, and, if given suitable conditions, it continues to grow on till about half-an-inch long and wide, by which time it will have assumed the two-lobed shape shown in the young plant of *Pteris cretica*, figured (Plate 126, c).

At that stage it is termed the *prothallus*, and looks like a green lichen or liverwort, attached by minute hair-like roots to the ground. Its growth then ceases, but, if very carefully examined under a powerful microscope, a few small tubercles may be seen on the under side, just below the notch, and those who make this a special study will find that male and female organs are there produced, and that sexual *fertilisation* is accomplished by them.

The male organs (*Antheridia*) usually occur among the root hairs near the base of the prothallus, and each consists of a raised cell containing numerous smaller cells, each of which contains a spiral body known as a *spermatozoid*, crowned with a brush of fine cilia at the smaller end. When mature the wall of the main cell disappears, and if a drop of water comes in contact with the minute inner cells these also burst, and the spermatozoids begin an active motion through the water, the ciliated end going first.

The female organs (*Archegonia*) usually occur just below the sinus of the prothallus, and each consists of a raised tubular projection, having an *ovum* at the base of the tube. The mouth of the tube opens when wet, and by some attractive power the spermatozoids moving in the water find their way to the archegonia, and fertilise the ovum in one or more.

Instead of this resulting in seed, as happens among the flowering plants after fertilisation, the product in this case is a young plant, which, growing like a bud out of the fertilised prothallus, soon produces fronds, then roots, and in a few weeks is fit to provide for itself, when the now useless prothallus gradually withers off. It is by this means that all seedling ferns found in the forests or raised in the nurseries are obtained, and occasionally they come up unexpectedly in the greenhouse of the amateur.

The prothallus of each species has a distinct form of its own, and usually both archegonia and antheridia occur upon it, but in some cases antheridia alone are produced upon a prothallus; in these cases the prothallus is smaller or irregular. It may be that in some species the archegonia occur on separate prothalli, the fern being then dioecious; and this may account for the difficulty experienced in propagating some kinds.

To obtain the spores artificially, dry some half-ripened fronds in paper for a few days, then crush and sift, keeping the fine dust for sowing. Prepare a pot, as if for planting, giving plenty of broken brick drainage, covered with moss, on the top of which a layer of finely sifted sandy soil is placed. The pot is then placed in a saucer full of water, which finds its way up into the soil, making it all damp and fit for a growing place for the spores. The spores should be gently scattered over the surface, but not covered with any soil, as the moisture keeps them in place, and if the saucer be filled up occasionally no watering over-head will be required, but a piece of glass should be laid over the pot so as to retain the moisture better. Care should be taken that spores only are sown, and not pieces of broken frond, or empty capsules, as

these, decaying, often start a mould which carries off the young plants. The pot may then be placed in any dark, damp corner in a greenhouse, or frame, or even behind a wall, and should never be allowed to get either too dry, or too wet. When the young plants have about two to three fronds, they should be carefully transplanted an inch apart in fresh pots, as the first soil will probably have become a little sour, and when three inches high they may be potted singly. Some ferns persistently refuse to grow from spores; but whether this is owing to a defect in the spores, or to the want of proper conditions, still remains to be demonstrated.

In some known cases, as in *Osmunda*, the spores are green, and will only germinate if sown at once; in others they grow after being dried and kept. It is claimed that cross-fertilisation has taken place in some cases where prothalli of different species were growing together and that the resultant ferns are hybrids retaining permanent distinctive characters. If this be the case it opens the way to the explanation of all variation in ferns (as in other plants) into varieties, species, genera, etc. But accidental variation, or variation due to surrounding conditions or circumstances, may also have a share in this, as such variations often become fixed and permanent if reproduction only takes place by division of the plant, and sometimes also if reproduction is by means of spores.

There are several other methods of propagating some ferns besides by spores, such as by *buds* produced on the frond, by division of the rhizome, and, in rare cases, by buds produced on the roots. Buds produced on the frond are remarkable for the regularity with which they occur in the same part of the frond. Thus in *Asplenium monanthes* the bud is a few inches up the stalk, in *A. lunulatum* it is at the tip of the frond, and in *A. gemmiferum* it is below the terminal pinnule. Some forms are seldom seen wild without bearing buds, and in the moist close forest this peculiarity seems to be even more developed than in cultivation.

Any form having long rhizomes may, with proper care, be propagated by division, but in several this is found to be most difficult, especially the *Gleichenias*, and the *Bracken*.

Some with short rhizomes produce several side buds if the terminal bud be removed, and with some others buds are produced on the very base of the frond stalk, after the frond itself has been withered down for years.

The only South African kind in which buds are produced on the roots is *Hypolepis Bergiana*, which is so common where it occurs that it is seldom examined, and consequently this is often overlooked.

It is necessary to revert again to the spore, in order to make more clear the life-history of the fern. The spore itself has already been referred to as the natural reproductive organ of the fern, and as such it takes the place of the seed in higher Orders of plants. But the spore is not the direct result of sexual fertilisation, as the seed is, and still sexual fertilisation does actually occur on the prothallus. This brings us to the fact that there are two distinct vegetative forms of plant, alternating in the same individual. Beginning with the spore there is produced from it the small green vegetative prothallus (*Gametophyte*), which bearing the sexual organs must be considered the more perfect plant. Then comes fertilisation, and instead of a seed we get the more complex vegetative plant of another form, which in common language is spoken of as the "fern" (*Sporophyte*), and this, without further fertilisation, produces, in every species, its asexual reproductive spores. This alternation of generations, which occurs in varying forms and degrees in most cryptogamic plants, and also in some forms of animal life, is much more difficult to trace in the higher Orders known as *Flowering plants* or *Phanerogams*, though there also it is claimed to exist in much modified form. But the evident alternation of generations, which has been described as part of the life-history of ferns proper, is considerably modified even in the case of some of the plants known as *Fern Allies*, and is one evidence of how, in long-past ages, evolution worked its miracles, and gradually produced our now highly diversified flora from one common stock, some of the developing links which have meantime become extinct being known only as fossil remains, while others doubtless remain unknown.

Thus in the Equisetaceae the spores are all alike, but the prothalli unisexual; in Lycopodiaceae the spores are all alike and the prothalli monoecious, while in the otherwise very similar Selaginellaceae the spores are of two kinds—one producing spermatozoids and the other archegonia on germination, with only very rudimentary prothalli. Thus the sexual differentiation which shows only on the prothallus in ferns begins in the spores of *Selaginella*, and though the alternation of generations is still present, it is in a highly modified form.

CHAPTER IV¹

CULTIVATION

THERE can be no more fascinating hobby than the cultivation of our native ferns. This is not because their cultivation is so simple and easy, but rather because there are so many kinds, and each species has its own requirements, which require attention if success is to be attained. Almost every picnic or holiday party carries home a heavy load of fern roots, and it is in order to make the disappointment over these less frequent that this article is written. In this connection, my first advice is, plant them when you get home, instead of a few days afterwards.

But there are other general considerations which require attention, and apply to all ferns. Every species has a resting period—usually during winter—in which transplanting may be done with little injury. Many are more or less leafless at that season, but whether leafless or not, it is good policy, when removing a fern from its native locality into cultivation, to cut off every frond and begin with a healthy crown and a good root system, unencumbered with the remains of former fronds, for however pretty these may be when lifted, the chances are all against their being so good a month afterwards.

If, through unavoidable circumstances, the transplanting is done at other than the resting period, then one has to be much more careful to protect the fronds already formed, since

¹ (This Chapter was re-written by me and appeared nearly in its present form in *South African Gardening and Agriculture* and by the kind permission of the Editor of that paper is now reproduced with only such alterations as changes of name introduced in this edition require.)

in some kinds the young growth is all made in spring, and if that is destroyed the beauty of the plant is lost till next year, and even then perfection can hardly be expected.

Another important point is to collect only what can be carefully handled, rather than a large quantity to be abused. It is unfortunately too often the case that every pretty plant is grubbed out and taken away, carelessly handled in transit, and either left unplanted or huddled in anyhow, the number of plants being in excess of the number of pots or tins available. In this way pretty forest streams are denuded of their ferns, without satisfaction to those who do it.

There are about two hundred species of ferns known to occur wild in South Africa, taking as South Africa all south of the Zambesi. A few of these are more or less tropical in their natures, and require separate treatment, but by far the larger number are equally hardy wherever frost is absent, and a good many can stand several degrees of frost without injury, while others stand frost in so far as the crown is concerned, but are deciduous under that condition.

In the cultivation of any fern it is well to give it conditions as nearly as possible the same as those in which it grows well, and to do this a close study has to be made of the different kinds in their native habitats. These habitats may be grouped as follows, and the means of copying these conditions are also indicated, viz.:

1. *Tropical or sub-tropical Forest Ferns.*—These require both heat and moisture. A sunny greenhouse, shaded against bright sunshine, and including some spots where the sun never shines, best meets the requirements of this class. A night temperature not lower than 60° Fahr. is preferred, and if this can be obtained by retaining sun-heat the climate is better than where artificial heating has to be resorted to. At the same time, abundant shade and ventilation are necessary by day to prevent scorching.

2. *Forest Ferns.*—These are kinds which may be found in shady spots, quite irrespective of moisture, though usually moist during summer and autumn, and with a reasonably

moist cool atmosphere surrounding them. Such conditions are most easily reproduced if one has a bush-clad stream passing through his property, but even a bare donga can in a year or two be made into an excellent fernery by planting trees in and around it, especially if it has a stream. But as these conditions often do not exist, an equally successful fernery may be fitted up under almost any other condition. A verandah facing east or south may with trellis or screens be converted into an excellent substitute, or a shady corner under a tree or trees, if it can be protected from wind, as it usually can by erecting rockery, answers the purpose well. Frost must be excluded, hot winds must be excluded, and bright sunshine should be tempered by branches or artificially; if these conditions are complied with, and moisture is maintained, most forest ferns will succeed. This is the largest class, and consequently requires most room, but in the absence of a satisfactory tree for cover, a bamboo shade-house or a Bankian Rose covering answers the purpose well. Drip is to be avoided if possible, and the soil should never be saturated.

3. *Forest Stream Ferns*.—These require conditions almost identical with the above, but in addition should have a stream flowing among their roots. Stagnant water is objectionable, and soon causes bad health, but flowing water suits all forest ferns, together with moist atmosphere and protection from wind and cold. Most forest ferns will stand sunshine, especially if somewhat diffused by foliage, provided sufficient moisture exists in the atmosphere. When in pots these ferns require abundant drainage and to have the pots placed in saucers of water frequently refilled.

4. *Mountain Ferns*.—These naturally have cool moist habitats, usually with a south aspect, and often they grow in spots which keep naturally moist without being wet, such as steep slopes, or deep holes or dongas. Although they stand the sunshine prevalent in these cool habitats, they are somewhat tender under the hot winds they have to face in cultivation, and with such kinds protection against wind, and a slight amount of shade, is an advantage. Most of them are

used to grass fires and recover in one season. The kinds differ in their individual requirements, and will be referred to separately further on.

5. *Rock Ferns*. There are many such, which growing on rock *débris* or in cracks in rocks, are not easily supplied with similar conditions under culture. Usually they stand sun well, and are accustomed to be burned off annually or occasionally, without injury to the crown and roots. In cultivation, a sunny rockery with more stone than soil meets their case, if attention is given to keep the stones moist.

6. *Soil Ferns, standing exposure*.—There are a good many of this class, mostly easy of culture, but some are fastidious and require constantly moist spots, while one requires almost saline conditions, and then is not pretty.

7. *Epiphytes*.—Several species usually occur as epiphytes, and seldom are happy elsewhere. These are rather difficult to cultivate, since they do better on a living tree than on a dead one, but if established among living moss or on a mossy brick they do reasonably well. All these enjoy forest moisture, but like epiphytal orchids, they frequently occur on high bare tree-trunks where sunshine is abundant.

The different habitats and conditions of growth already indicated give a guide to the cultural conditions most likely to produce health and vigour in any one species, still as each has its own peculiarities these will now be taken more in detail.

GLEICHENIA.—There are three species, viz., *G. polypodioides*, *G. umbraculifera*, and *G. linearis*, more or less similar in nature, and requiring the same conditions. *G. polypodioides* usually occupies the moist banks of running streams or waterfalls; the other two occupy steep slopes facing away from the sun, but are usually fully exposed to light, and enjoy cool moist conditions, usually on stiff moist soil, but where water cannot become stagnant. In Europe, under artificial conditions, these *Gleichenias* are considered the most difficult ferns to keep permanently in good health, and healthy

specimens are usually prize-takers in fern exhibitions, as they are most graceful as well as rather difficult. They have very long wiry rhizomes, trailing on or under the surface, and are often spoken of as climbing ferns, the rhizomes being trained over wirework, etc. Success is best attained there with them by using large shallow pans, say two feet wide and six inches deep, filled almost full of broken bricks, on the top of which a peaty or loamy mixture is used as soil, and, of course, they are there grown under glass. Here one seldom sees them in cultivation, for the simple reason that the cut rhizomes do not readily root again, and take so long to do it that the foliage is painfully wretched, if present at all, and the plant is usually discarded. But if, instead of beginning with cut rhizomes, one begins with a seedling plantlet, success is more assured, and nice specimens have been secured in this way, especially on shady rockery. Constant moisture in soil and air is the secret of success, but must be combined with abundant drainage and no condition of stagnant saturation.

HYMENOPHYLLUM and TRICHOMANES.—These pretty little ferns, usually known as Filmy Ferns, are of most delicate cellular structure, and grow naturally on moist tree-trunks or on rock-faces surrounding waterfalls. Soil is of no importance to them, but moist atmosphere and constant trickling water are what suits them best, though it is wonderful what dry conditions they can endure for a time in their native habitats. The species are *H. fumarioides*, *H. inaequale*, *H. Marlothii*, *H. lineare*, *H. ciliatum*, *H. Tunbridgense*, *H. uncinatum*, *Tr. erosum*, *T. digitatum*, *T. montanum* var. *quercifolium*, *T. pyxidiferum*, and *T. rigidum*, and all agree in requiring the above conditions. They are not difficult subjects under cultivation, but require such moist conditions that a cool shady conservatory, or even a glass case inside that, is necessary to obtain best development. A stone or trunk covered with filmy ferns may be removed bodily to this secluded spot, but if that is not practicable, remove a large patch with as much soil and moss as can be secured, and wire this tightly on to a brick or stone and then keep moist, and it will fix itself eventually to

the support. Filmy ferns are seldom used as show ferns as they are not conspicuous enough, though delicately pretty. Two to three inches is the usual height of frond, and only one of the species exceeds six inches.

CYATHEA.—This is the best known tree fern throughout South Africa, having stems up to one foot in diameter and often up to ten feet in height, surmounted by a crown of graceful arching fronds varying from three to eight feet in length, in accordance with the size and vigour of the specimen. It usually grows in mountain kloofs, fully exposed to the sun, and standing erect, unprotected from wind and weather, when mature, though usually starting life in an antbear hole or a stream or other somewhat sheltered situation. It occurs in abundance in the midlands of Kaffraria and Natal, and also in many parts of the Eastern Transvaal, but is curious in its distribution, since it extends from about 7000 feet altitude down to the coast, wherever conditions suit it, but missing very considerable areas altogether and never present in large dense bush. It is usually present in the misty upland kloofs and mountain slopes, but absent from flat, dry and exposed high veld; it is usually absent from the thornveld, but present occasionally along rapid streams even there, and it is abundant near Pinetown, as well as in Eastern Pondoland, in the coast belt. Frost kills the fronds, if severe, but seldom hurts the crown; grass fires do it little damage during winter when it is dormant; but a bright hot day occasionally scorches young fronds, especially in cultivation. When taken into cultivation it is well to lift a dormant stem during winter, taking the mass of roots also, and cutting off all fronds, leaving the crown to develop young fronds as spring advances. The soil is of little importance, but as roots are produced all up the stem, and hug the stem closely making a somewhat rooted mass all down its side, it is well to water the stem daily as well as the root, taking care, however, to put no water into the crown, as such must stand there till evaporated off, and sometimes rots the young fronds. Even if a stem is cut off at the ground surface and planted, it usually has enough

adventitious roots along the stem to allow it to start life again, but in such case it is not an uncommon occurrence for a stem to throw out its first set of new fronds and stand through the summer from the vitality left in the stem, but to die thereafter through having formed an insufficient new root-system to keep it going on.

As with other ferns, a sporeling plant with fronds not more than six inches high is the best foundation to start from, but that takes time to make an eight foot stem. This fern does beautifully in cultivation, especially if planted out in a moist shady border, away from hot winds; it is usually one of the prize plants in collections of native ferns at shows, and it is sometimes exported, the stems fetching a fair price in Europe, and standing the journey well while dormant.

C. Drègei is the only South African species, but very considerable variations occur in batches of sporelings in one stream, apparently all from one parentage, probably due to individual variation only.

HEMITELIA CAPENSIS.—This is another tree fern, with slender stems three to four inches diameter and up to eight feet in height, surmounted by a most graceful crown of long arching fronds. Unlike *Cyathea*, this species is confined to the moist, damp situations along streams inside dense forest, and is never found out in the open. This, of course, gives a clue to treatment, for unless a moist atmosphere is constantly maintained it is seldom a success in culture. And still, under greenhouse or shadehouse treatment very beautiful specimens are occasionally met with, especially if planted out beside a trickling stream. This species should not be removed from the forest except when dormant during winter; the roots should be taken along with the stem, and the fronds may be cut off at once as they hardly ever remain good.

Though this fern occurs in the moister forests throughout South Africa, it is much less abundant than *Cyathea*, and in cultivation it is less common and usually less successful, through absence of moisture. Hot wind kills it, frost kills it, bright sunshine is fatal, and even moderately dry conditions

are unsatisfactory. And, still, in its forest home it is one of the prettiest ferns, and occasionally it is so in cultivation.

WOODSIA BURGESSIANA is a small alpine fern, more or less regularly deciduous, usually found among loose boulder rocks, and seldom below 5000 feet altitude. It is not difficult to cultivate, however, if given a cool spot among stones, plenty of drainage, and a half-decomposed leaf mould soil.

DAVALLIA is a genus containing many species of very diverse appearance and habit, and is represented in South Africa by one species only—*D. chaerophylloides*—which is one of the so-called Haresfoot ferns, the scaly rhizome having a considerable resemblance to a hare's foot. Its natural habitat is in cracks in rocks, or between fixed stones, or in moss on tree-trunks, and in cultivation it is usually most successful when given more bricks or stones than soil. It enjoys sunshine, in a moist atmosphere, it is not difficult to keep healthy, and is often cultivated in Europe. The fronds are firm, and useful with cut flowers, but too few fronds are produced to make it a profitable fern to grow for cut-flower work.

MICROLEPIA SPELUNCAE is a vigorous softly herbaceous fern found in moist glades in woods, the rhizomes long, and the fronds abundant and sometimes two yards high. No fern is more easy of cultivation, and it is often a prize-taker at shows as the best specimen native fern. It enjoys a soil mostly leaf mould, with abundant drainage and abundant water-supply. Like most softly herbaceous ferns, it flags off entirely if allowed to get dry, but fresh fronds come again with remarkable rapidity. It is easily transplanted from its native habitat, and takes possession of a pot as if it enjoyed being there.

CYSTOPTERIS FRAGILIS is a well known British fern, native also in South Africa, growing here beside streams under thick bush, or in deep upland ravines. It is easily cultivated, in ordinary loam, but dislikes hot winds, or bright sunshine. It is almost deciduous and loses its old fronds as soon as the young ones appear.

SCHIZOLOMA ENSIFOLIA is another stream fern, but belongs to the warmer districts. It resembles *Pteris cretica*, but is much less satisfactory in cultivation and worth a place in collections only as a variety.

ADIANTUM.—This is without doubt the favourite fern genus in South Africa, as well as in every other country. This happens through the beautiful and delicate cutting of the fronds, their useful shape, the vigorous constitution of most species, and the graceful habits which they assume. Many species are in cultivation, gathered from many countries, and South Africa supplies several of these.

The best known group of these is that which includes *A. capillus veneris*, *A. Poiretii*, *A. aethiopicum*, and *A. sulphureum*.

A. capillus veneris is to be found in nearly every stream, surrounding waterfalls or wet rocky banks, and many natives make a living by collecting tin-falls and hawking them round the nearest town. It enjoys loam, or even stiff soil if given drainage; decomposed manure makes it more vigorous, and sandy soil makes it dwarf and compact. In its native state I have never seen scale upon it, but in cultivation it is more subject to it than most of the other *Adiantums*. It stands bright sunshine if the atmosphere is humid, and prefers rocky nooks in open streams rather than shady localities. *A. aethiopicum* is more usually found in shaded forest slopes, often quite away from a stream, and though not common, it often forms quite a mass where it is present. It is much more vigorous than any other S.A. *Adiantum*, and often grows fronds three feet high, and in cultivation it makes a grand specimen of such fronds. Good loam, leaf mould or decomposed manure suit it, and good drainage, moist atmosphere, and partial shade give best growth. It makes a splendid specimen, especially in a large pot, and it also makes a most graceful basket. *A. Poiretii* is a very similar fern, but smaller in habit and more difficult to cultivate satisfactorily.

A. sulphureum is very similar to *A. aethiopicum*, but dusted on the under surface with yellow powder. It is vigorous, and

enjoys more sunshine than *aethiopicum*, and makes a beautiful specimen when well cultivated.

A. reniforme is a distinct little fern with a simply reniform frond; it produces few fronds, and is only worth growing as a curio.

Another group includes simply pinnate species, *A. caudatum*, and *A. lunulatum*, both interesting species but not showy. They are rather difficult to cultivate, requiring close, moist, warm conditions, with shade and sufficient drainage, and when prolific from the long caudate frond-tip, they produce pretty little young plants there.

A. hispidulum, a Rhodesian species, is often cultivated in Europe, requiring airy, moist conditions, firm soil, and good drainage.

A. Oatesii, a somewhat similar Rhodesian species, has not been seen in cultivation.

LONCHITIS PUBESCENS is a vigorous and pretty forest swamp fern, growing fronds six feet long occasionally, though more usually only three or four. It is easily cultivated if given drainage, water and shade with a moist atmosphere, but is somewhat fragile and requires room. It is exceedingly variable in its cutting and pubescence.

HYPOLEPIS, like many other fern genera, contains species having little resemblance among themselves. *H. sparsisora* is the most vigorous fern of wet sunny forest glades, the long rhizomes throwing up fronds a foot or more apart, which fronds grow four to six feet high and are softly herbaceous, and at first hairy. This fern grows bracken-like in large masses, the fronds die down in winter, and in early spring the young fronds come up in abundance. It is easily cultivated, especially if one begins with a young plant, and a large tub full of this makes a fine specimen. Though in nature it grows in swampy localities, it enjoys drainage in cultivation, together with regular watering and good fresh loam.

H. Bergiana is a smaller plant, seldom more than a foot high, without creeping rhizome, but producing adventitious buds on the roots, especially where the roots come to the surface at the edge of a pot. This fern likes well drained

leaf mould, and, unlike most other ferns, it does better in cultivation than it usually does in its forest home. It requires shade, and is very fragile.

H. Schimperi is a compact little fern, exactly a *Cheilanthes* in habit, but with *Hypolepis* fructification. It is a Rhodesian species, and we have not seen it in cultivation.

CHEILANTHES.—These are small herbaceous or subcoriaceous ferns of xerophytic nature, usually growing on or among stones, but enduring very long periods of drought. They are more interesting than showy; they enjoy fresh air, are more or less deciduous, and though they like the constant moisture obtainable from a rock, they are more easily damaged in cultivation by overwatering and want of drainage than by any other cause. *C. hirta*, *C. depauperata* and *C. parviloba* are usually under stones in open or shrubby localities, and *C. multifida*, *C. induta* and *C. Bolusii* occur mostly among loose stone heaps.

C. farinosa, abundant in some parts of Rhodesia, is coated on the under surface with white or yellowish powder. A healthy and pretty plant of this was shown by Mr Sams at last Maritzburg Show, in a six-inch pot.

Adiantopsis capensis enjoys rather wet banks in dry or high districts.

PELLAEA is another genus mostly xerophytic, having firm leathery texture, wiry stipes and in most species a natural inclination to occupy hot sunny spots on or among rocks. The dry conditions endured by some of these species are surprising, and though it is usual to think of a small fern in a rock crack as being well supplied with moisture by the rock, an instance occurred in which I picked a frondless and practically rootless crown of *P. auriculata* about the size of a pea, put it in my pocket and forgot all about it for over a month, then as it seemed to be still alive I planted it, and it grew well. Like *Cheilanthes*, the species of *Pellaea* are more easily damaged by saturation than by any other cause; they like fresh air, sunshine, rock surroundings, sufficient drainage, loamy soil, and to be never quite dry.

They are interesting rather than showy species, always healthy and happy in nature; often not so in cultivation. *P. viridis* is normally an open forest fern, but has also two small rock forms, but all the other species avoid forest shade. These include *P. auriculata*, *P. Goudotii*, *P. lancifolia*, *P. quadripinna*, *P. Boivini*, *P. namaquensis*, *P. involuta*, *P. Doniana*, *P. viridis* variety *glauca*, *P. hastata*, and *P. dura*. Of these, *P. quadripinna* gives the best result under cultivation; the others usually do better planted out than cultivated in tins or pots.

DORYOPTERIS are of very similar habit to Pellaea. *D. concolor* prefers some shrub shelter and open shade, and is easily cultivated; *D. deltoidea* and *D. robusta* are from dry Namaqualand, and unknown in cultivation.

PTERIS.—Though closely allied to Pellaea, and usually more or less leathery in texture, the species of Pteris are all forest ferns and enjoy at least partial shade.

P. longifolia always grows near a stream, and usually in shade, though it sometimes thrives well on a wet sunny bank. It is easily cultivated, in well drained loam, and has long been a favourite as a greenhouse and house decorative plant.

P. cretica is common in woods, often away from streams, and this also has long been in cultivation as a table or greenhouse decorative plant. A variegated form and a tassellated form are also in cultivation. It enjoys light shade, a loamy soil, and free drainage.

P. biaurita, *P. dentata*, and *P. Buchanani* are robust forest ferns, easy of cultivation, and making nice specimens. The young plants make pretty table plants in small pots, but soon outgrow these and require large pots or even tubs for their full development.

Histiopteris incisa has a long rhizome, and grows naturally in damp forest glades. It is easily cultivated, but is almost deciduous, and seldom very pretty.

Pteridium aquilinum is the bracken, cosmopolitan in its range, usually growing in rather moist grassy glades, and seldom inside bush, though often at its margin. The long underground rhizomes with long nodes make it difficult to

transplant, but if begun as a sporeling—and sporelings are usually available—there is no difficulty in getting this fern firmly established. It is not well adapted for pot culture, and is seldom grown so, but planted out in a rockery it takes possession.

BLECHNUM is a genus of hard leathery ferns, having the fertile frond different from the barren. They are all easily cultivated in loamy soil with good drainage and ample water supply. *B. inflexa* grows beside open streams; *B. capense* and *B. tabulare* grow on moist banks or glades, usually above the yellowwood forests, or in mountain streams, and fully exposed to sunshine; *B. attenuatum* is always in deep wooded gorges and growing in swamp or stream at the bottom; while *B. punctulatum* is usually in forest streams. *B. tabulare* has a short erect tree stem, 12 to 24 inches high and 4 to 9 inches diameter, and these stems often suffer from forest fires without injury to the crown.

In *B. attenuatum* the young barren fronds are usually bright pink in colour, though sometimes green. The sporeling plants of this species have very different fronds from those on the mature plants, and look like different species. Several of the species occur crested, and more or less bipinnate.

B. australe and *B. auriculatum* occur in open localities usually near or above the yellowwood forests. The requirements are sunshine, moisture and drainage; with these they are easily cultivated.

ASPLENIUM is one of the largest and prettiest of South African genera. The species are almost all bush ferns, usually delicate in texture, easily damaged by drought or hot wind, and consequently more or less confined to moist spots or stream banks. None of them stand soil saturation, for though some, such as *protensum*, often occur in running streams, they promptly die if the water is stagnant. *A. trichomanes* and *A. adiantum-nigrum* often occur on rocky banks in full sunlight, but only in positions where there is constant moisture without an over-supply. *A. solidum* occurs usually on the constantly moist sand of the sea-dunes. One group (*Darea*)

including *A. Dregeanum*, *A. auriculatum*, *A. bipinnatum* and others, are of firm leathery texture and grow on the moss surrounding tree trunks, or on half-decayed tree-roots, and many other species of *Asplenium* also enjoy this class of habitat. The genus includes some of our finest native ferns, often cultivated elsewhere, including *A. praemorsum*, *A. abyssinicum*, *A. cuneatum*, *A. gemmiferum*, *A. serra*, *A. prionitis*, *A. anisophyllum*, *A. protensum*, *A. lunulatum* and *A. bipinnatum*, any one of which is suitable for a show specimen.

Besides those already mentioned, the genus includes *A. Kraussii*, *A. Sandersoni*, *A. platyneuron*, *A. monanthes*, *A. varians*, *A. pumilum*, *A. Rawsoni*, and *A. Mannii*—all pretty little ferns.

A constantly moist atmosphere and constantly moist open soil, with reasonable shade, may be taken as the requirement of all except *A. trichomanes*, *A. adiantum-nigrum*, and *A. solidum*; these three enjoy sunlight combined with moist soil and air.

A. theciferum is a leathery, epiphytic fern, usually growing in moss either on tree trunks or on stones; it is very like *Asplenium bipinnatum*, but less satisfactory in cultivation, suffers more under drought, and is never particularly pretty.

A. Hollandii, a Rhodesian species, is one of the most beautiful ferns I have seen, but I have no information as to its cultural requirements.

ATHYRIUM is exactly similar in its requirements to the forest-stream species of *Asplenium*.

ACTINIOPTERIS RADIATA is one of the curiosities of fern life. It grows only a few inches high, with firm fan-shaped little fronds; it occurs usually in rock-cracks in full sunshine in the drier northern portions of South Africa. It is cultivated in Europe among broken bricks, under glass, but is never showy.

DIDYMOCHLAENA TRUNCATULA is a fine fern, well worth cultivation. It somewhat resembles one of the larger two-pinnate *Adiantums*, with fronds up to five feet in height,

several such fronds rising from a woody crown. It usually grows in moist spots in small bushes, where it gets abundant root-moisture and still is not in heavy shade. In cultivation it enjoys abundant drainage and good water-supply; with these conditions and partial shade it does well. Planted out it likes a good fresh border or rockery, but hates stagnant saturation.

DRYOPTERIS is a large and hardy genus, easily cultivated, and seldom requiring shade. Most of the species grow in the open, along streams or under banks, or in ant-bear holes or similar localities, and as they have to endure annual grass fires, creeping rhizomes covered with scales, or short crowns, are usual. *D. parasitica* (= *Nephrodium molle*) is a market favourite in London, especially its crested forms; *D. lanuginosa* (= *N. catopterion*) often makes beautiful specimen plants in English conservatories, and *D. Buchananii* is equally pretty though more rare. The pretty little *D. thelypteris*, which is British as well as South African, always grows naturally in wet grassy swamp, but is not difficult of cultivation in well-drained pots. *D. gongylodes* is also a swamp fern, but of much larger size and often found in partial shade, and easily cultivated. *D. elongata* has been classed as a variety of the British male fern, but is exceedingly different in cutting though its cultivation is equally simple. *D. inaequalis* and *D. athamantica* belong to the same group, and though regarded as rough wild ferns are very easily cultivated and stand any amount of abuse, as also is the case with the group which includes *D. Bergiana*, *D. mauritiana* and *D. parasitica*.

D. prolifera and *D. silvatica* having much resemblance to *D. gongylodes*, grow naturally in similar somewhat swampy localities, but in cultivation can be successfully grown in well drained fresh soil which is never allowed to become quite dry. *D. prolifera* is a lovely drooping fern, and most effective in hanging baskets.

D. africana is like *D. Bergiana* and grows in wet places in forests, usually along the streams. It consequently requires moist atmosphere in shade, together with good drainage.

Good loamy soil, reasonable attention, and full exposure or only partial shade are what the Dryopterids like.

POLYSTICHUM is closely allied to Dryopteris botanically as well as in habit and habitat, though more usually under bush cover than are the ferns of that genus. *P. luctuosum* makes a fine specimen plant of a beautiful fern when well treated; *P. adiantiforme* is often cultivated in Europe, and it also makes a fine specimen; *P. aristatum*, *P. Macleanii*, *P. aculeatum*, and *P. pungens* have the same general habit as *P. luctuosum*; while *Cyrtomium falcatum*, often cultivated in Europe, is also a specimen plant. All they require is good drainage, good loam, light shade and regular attention. These species are, however, more subject to scale than most other ferns.

NEPHROLEPIS is so well known in cultivation as the most hardy and vigorous fern genus we have that I need only name the respective South African species as their cultural requirements are identical, viz. fresh loam, little frost, regular watering, and either sunshine or shade. The South African species are *N. cordifolia* (*N. tuberosa*), *N. exaltata* and *N. biserrata*.

OLEANDRA ARTICULATA.—This fern occurs in shady localities among rocks—usually perpendicular rocks—where moisture is never absent and seldom in excess. The long slender rhizomes do not root readily, and it is therefore one of the difficult ferns to cultivate. A suspended basket or bracket, filled with broken bricks and charcoal, and lined with moss, suits it best, if it can be arranged so as never to get quite dry. Even at its best it is not a showy fern, being curious rather than pretty.

POLYPODIUM.—This immense genus, though rather sparingly represented in South Africa, has, even here, types very different in habit and habitat.

P. vulgare (also a British fern) enjoys sunshine on well-drained leaf mould or a turfy bank; *P. phymatodes* likes similar or more sandy soil, or even pure sand, either in sunshine or shade; *P. punctatum* likes to occupy a fork

in a tree, or to grow in mossy leaf mould; *P. lineare* and *P. Pappi* are more distinctly epiphytal on mossy trunks, or in cracks of rocks; while *P. polypodioides*, *P. ensiforme*, *P. lanceolatum* and *P. lycopodioides* are usually quite epiphytic, and often without moss, all having long rooting rhizomes. For such kinds the best culture is to wire them on to a stem, living if possible, with or without a little moss, and keep them constantly moist but not saturated, until they form new roots which adhere to the stem, and produce new growth if the atmosphere is reasonably moist. These epiphytal Polypodiums are curious rather than pretty, and *P. polypodioides* has the additional feature of rolling its fronds up, as if dead, during drought, and expanding them again in full vigour as soon as the atmosphere is moist. *P. parvulum* is not known in cultivation, but is presumably epiphytal. *P. loxogramme* is an epiphyte, growing on mossy trunks in dense shade. It resembles *Polypodium lineare*, flags easily, and has no particularly attractive features.

Cyclophorus africanus is also epiphytal, usually on the stems of tree ferns.

NOTHOLAENA (= *Nothochlaena*).—This little group belongs normally to hot dry rocky country, where *N. inaequalis* and *N. Eckloniana* are often found on almost bare rock, or occupying little cracks in the rocks, and fully exposed to sunshine. They are prepared for heat and drought by having the upper surface of the frond leathery and the under surface densely clothed with scales; they curl up and look withered during drought and expand fresh again when moistened. *N. Buchananii* prefers the moist and shady side of a rock, but otherwise its habitat is similar. These are difficult ferns to keep in good health in cultivation, but their natural habitats indicate their requirements. *N. Rawsoni* has only once been found, the locality being in Namaqualand.

Anogramma leptophylla is probably the only true annual among South African ferns; it is a pretty but delicate little plant, three inches high, growing on waterfall banks or *débris*, and requiring the same conditions as filmy ferns in cultivation.

Ceterach cordatum, on the contrary, is often found on hot dry rocks, when it is indistinguishable from the British *Ceterach officinarum*, and densely scaly, but it also grows on soil under thorn trees, etc., and in cultivation is not difficult. Like the *Notholaenas*, it rolls up when dry.

Ceropteris calomelanos, *Gymnogramma argentea* and *G. aurea* are horticultural favourites, difficult to transplant from the wild state, but not difficult to raise as sporelings in any moist greenhouse. The two former are silver-dusted and known as Silver Ferns, the latter is yellow-dusted. When well grown they make pretty specimen plants, but almost require warm greenhouse conditions and well-drained turfy loam.

VITTARIA ISOETIFOLIA requires the same conditions as *P. loxogramme*, and resembles a hanging tuft of grass. It is easily cultivated in moist shade, but is not attractive.

ELAPHOGLOSSUM is another large genus of varied aspect and habit. Those with simple fronds—*E. conforme*, *E. petiolatum*, *E. hybridum*, *E. Aubertii*, *E. spathulatum* and *E. lineare*—all belong to moist banks or rocks in dense shade, though they also sometimes occur on mossy stumps. They are not difficult to grow, but as they produce few fronds, and only one at a time, they are never very attractive. *E. petiolatum* var. *rupestre*, a small rigid form, grows in cracks of rocks in sunshine, and produces numerous small fronds. *Stenochlaena tenuifolia* is a rampant epiphytal creeper, which often takes possession of large trunks in moist shady places in the frostless parts of Natal and Zululand. In cultivation a large hanging basket is its best place, or a large trunk on which it can climb, but it is better to be either in dense bush or in a warm greenhouse. It is a pretty fern, the fertile and barren fronds being very distinct, but it is so large and unwieldy that it does not lend itself well to usual cultural conditions. *Acrostichum aureum* is never pretty; it is a stiff rough fern, growing in tidal mud or close to that, and never cultivated here, while in Europe I have never seen it looking happy. Unless for a botanical collector, it has no attraction.

PLATYCERIUM.—These Stag's-horn ferns, frequent in cultivation in Europe under stove treatment, are seldom seen here. They are distinctly epiphytal, and huge masses four feet across, of the thalloid barren fronds, surmounted by the fertile stag's-horn fronds, are occasionally to be seen far up a tree in the forests of tropical South Africa, in Rhodesia and Portuguese East Africa; *P. bifurcatum* and *P. angolense* occur. In cultivation they require warm greenhouse treatment and much patience, and are best treated when wired on to a living stem and exposed to a good deal of sunshine and moisture.

TODEA BARBARA is a robust, somewhat rigid fern which makes a short stout tree-stem, and often forms a nice specimen in cultivation. It grows usually in moist, swampy, open bushland, or even in dry open country, many stems together, and frequently has to endure grass fires, which it does without sustaining serious injury. In cultivation, well-drained leaf mould or loam suits it; it stands a good deal of sunshine, and likes a constant supply of water, and a fairly high temperature.

OSMUNDA REGALIS is what is known in Britain as the Flowering Fern, on account of the fertile pinnae being very distinct from the barren. It grows on the banks of streams, fully exposed, but quite above the water-level, and loses its fronds during winter. Open turfy loam, well drained, is what it likes, and no fern is more easily grown into a nice specimen, but it is at its best only for a month or two every year.

SCHIZAEA *tenella* and *S. pectinata* are small grass-like ferns, found among grasses and rushes in swampy streams; they have no attractive feature as ferns, and are only cultivated as botanical curiosities, in similar swampy sites.

ANEIMIA is another genus of so-called "Flowering Ferns," having distinct fertile pinnae. The species occur in loam in open woodlands and are not difficult to cultivate, though not specially attractive. There are three South African species, *A. tomentosa*, *A. anthriscifolia*, and *A. Dregeana*.

MOHRIA CAFFRORUM is a small fern abundant on steep grassy slopes, near bush. It likes loamy turf, plenty of water, good drainage, and fair sunshine, and if given these it usually does well and is easily cultivated. *M. lepigera* is a Rhodesian fern, untried here.

LYGODIUM.—A genus of scandent ferns well known in cultivation, and often used in Europe as specimen ferns. They do best in large pans, filled with broken bricks covered with turfy soil. Having long black wiry underground stems, somewhat like those of the *Gleichenias*, they cannot conveniently be confined into a small pot, but in a bed or border they are easy of cultivation, and can be trained into any form. The two well known South African species are *L. scandens* and *L. Kerstenii*, the latter being very like the *L. japonicum* common in cultivation.

MARATTIA FRAXINEA.—This is a large fern, growing in swamps or wet banks under trees, and producing fronds up to eight feet long. The fronds are not numerous, but are graceful and pretty, with a somewhat rigid formal aspect. As the crown is very large it requires a large tub to hold it, but does well in well drained turfy loam in a cool and shaded site.

OPHIOGLOSSUM.—These little ferns are seldom thought to be ferns by those who do not know the botanical characters, and may often be passed as grasses or weeds. They are small inconspicuous affairs, without any attractive feature, but are not difficult to cultivate in turfy loam, the fronds being annual from a perennial crown.

Of the Fern Allies, the Selaginellas are the only ones which attract the cultivator. Some of these are very pretty and very easily cultivated, and quite common in cultivation here and in Europe, and with care all can be grown.

The Lycopodiums require the natural habitat of each to be studied. *L. gnidioides*, *L. verticillatum*, *L. saururus*, and *L. dacrydioides*, as also *Psilotum*, are easily grown hung upon trees or logs; *L. carolinianum* and *L. cernuum* are easily grown

in fresh swamp, and *L. clavatum* grows if hot winds are excluded.

Equisetum grows easily in moist ground, *Marsilia* in ponds or wet mud, and *Isoetes* in or close to standing water.

The raising of ferns from spores is an interesting hobby requiring patience and close attention. Although spores will germinate in the most unlikely places on their own account, they require suitable conditions under culture, these conditions usually being a moist site and cool moist atmosphere, or in the case of tropical ferns a warm humid atmosphere. The exclusion of hot wind is necessary, and the required conditions are best met inside a glass frame, and even then it is well to use a pot and to cover that with a piece of glass, wiping the glass daily to prevent drip from condensation falling among the spores. Inside the pot give sufficient drainage of broken bricks, above which the dust made of broken bricks makes a good soil, retaining moisture well and not getting too wet. Never water overhead, but stand the pot in a saucer of water. After germination it is well to admit a little air by raising the covering glass on one side, and gradually to increase the ventilation as young fronds appear showing that fertilisation has been accomplished. After that the plantlets are ready to pot off separately as soon as they are fit to handle.

For soil they are not very particular. Leaf-mould is of course best, but in the absence of that, good loam, loam and sand, loam and well-rotted tan refuse, or well rotted stable litter, brick dust, or almost any other soil which does not contain clay, iron-gravel, or kraal manure will do. For pot culture, earthenware pans, or pots, where procurable, are best, but tins answer the purpose equally well if properly drained. This drainage is managed by driving several holes through the bottom of the tin, above this place a layer two inches deep of broken bricks, then a thin layer of moss or fallen tree leaves, and above that the soil. In English nurseries broken flower pots are used for covering the holes, and they are certainly the best thing, but in S. Africa they are too expensive, and bricks answer nearly as well.

The soil should be as described above, and perhaps the best test of its suitability is that it can dry again quickly after rain, for it is easy to give more water, but most difficult to make a saturated plant dry. The tin or pot should be about the size of the root, but not much larger, or the soil will get sour before the plant can utilise it. The best sign of perfect health is an abundant crop of young growing roots pushing their way through among the broken bricks at the bottom, and this may also be taken as notice that the plant wants a larger tin.

Be careful in watering to give only when required, which may be twice a day with one plant, and once in two weeks with another standing beside it. Knowing when they are dry comes only by practice; but it is seldom that a fern lover, who does not know this, can keep his ferns long in good health.

Watering must, however, be understood as quite a different thing from syringing, or otherwise damping the foliage, which may be done lightly all over two or three times a day with benefit.

Planted out in a natural donga or artificial fernery most ferns do better even than when grown in pots, and with less trouble, but there is a fascination in doing what is difficult which leads many growers to prefer pots, while some kinds are so easy and graceful that they have for years displaced most other kinds for table decoration.

The absence of flowers is no defect, but tends rather to add to the charm of ferns, for it allows them to be in season all the year round, and frequently a good fern, in good hands, will remain in decorative condition for years.

Inside a room is seldom too close for them, but as they always grow towards the light, plants in rooms require to be turned round frequently in order to prevent lop-sidedness.

Just how much closing up some kinds will stand has never been fully demonstrated, but cases are on record (see *S. A. Gardening*, April 1913, page 208) in which ferns have germinated inside sealed bottles and continued to grow for years therein without any additional moisture or fresh air being supplied.

CHAPTER V

IDENTIFICATION AND PRESERVATION

THE student desirous of making himself acquainted with the classification of ferns must begin by thoroughly mastering the chapter on the parts of ferns, and the terms used in describing them. Having done so, the next thing is definitely to understand the differences between the Cohorts, Divisions, Orders and Sub-orders; and in connection with this, it is much to be regretted that no other good character than the opening of the capsule is obtainable. To follow out this character is difficult enough to bring many young students to a stand-still, but in South Africa fortunately there are only a few species in each of the groups, except in the Order Filices which is very large, and rather difficult to subdivide satisfactorily. Besides this, the few species which form these other groups are so distinct in their general appearance that with them the figures are sufficient for identification, and, when once known, he who wishes to study the capsules can easily do so.

In the Order Filices the species are numerous, and often closely related to one another, but the characters of the genera in most cases are easily followed.

When examining a plant, always make sure of the genus first, then compare it with the distinctive characters of each species in that genus, the point most to be noticed being given in the synopsis at the beginning of each genus.

To go by the illustrations without consulting the text is very superficial work, and to attempt to follow descriptions, without first having mastered the alphabet, as the technical terms have been called, can only end in disgust.

A little practice only is required to enable anyone to follow out the distinctions and connections between the different groups, and then the ferns will be found to form one of the most beautiful, interesting, and easily understood orders of our South African flora.

Besides cultivating ferns, a most interesting method of preserving them is, as dried specimens, in the form of an herbarium.

For this purpose perfect plants, nearly mature, should be selected, and placed at once between sheets of paper—sufficient paper being used to absorb all the moisture in the plant. With the larger kinds one frond only, or even part of a frond, can be kept instead of a whole plant, but any peculiarity such as a running rhizome, a scaly crown, or a tree stem, should if possible be shown or noted.

The paper may require to be changed several times before the specimen is dry, and a pressure sufficient to keep the frond flattened is required all along. When dry, the specimen should be mounted on uniform sheets of stiff paper, or in a book, fixed by strips of gummed paper, or by threads sewed through, and furnished with a label stating the name of the fern, where and when found, kind of locality, and any other particulars of interest. Many botanists fix their specimens to the paper with gum, and in whichever manner they are fixed, they ought to be poisoned to keep away insects.

Such a collection is easily formed, and when once in order remains for many years—to its maker an object of interest; to his friend a proof of his perseverance; and not unfrequently to both a reminder of happy holidays spent in one another's company long ago.

CHAPTER VI

THE FERNS OF SOUTH AFRICA

THE number of species of ferns in South Africa is remarkably small compared with the whole flora, and in the south-west portion this is especially the case, and it is probably on this account that while, seventy years ago, Cape heaths, geraniums and bulbs were the leading favourites in English conservatories, Cape ferns were almost unknown.

They had indeed, like other plants, been collected by the earlier travellers, among whom were Burmann, de Chamisso, Sparrman, P. J. Bergius, Krebs, and Lichtenstein, and a few species had been described by Bergius, Linnaeus, and Willdenow, before the beginning of the nineteenth century, but it remained for Thunberg to describe the South African ferns as a group, for the first time, in his *Prodromus Plantarum Capensium* (1800).

It is interesting to compare the species then known, and the names in use in those days, with present ideas on the same subject, and for this purpose his list of ferns is given, and opposite to each species the present name for the same plant.

THUNBERG'S NAME	PRESENT NAME
Onoclea capensis	Blechnum capense.
Ophioglossum lusitanicum ...	Ophioglossum capense.
Osmunda barbara	Todea barbara.
Acrostichum cordatum	Ceterach cordatum.
Pteris cuspidata	Marattia (young).
Pteris tabularis	Blechnum tabulare.
Pteris cretica	Pteris cretica.

THUNBERG'S NAME	PRESENT NAME
<i>Pteris confluens</i>	<i>Pellaea auriculata</i> .
<i>Pteris incisa</i>	<i>Histiopteris incisa</i> .
<i>Pteris auriculata</i>	<i>Pellaea viridis</i> .
<i>Pteris capensis</i>	<i>Pteridium aquilinum</i> .
<i>Pteris flabellulata</i>	<i>Pteris dentata</i> .
<i>Pteris hastata</i>	<i>Pellaea hastata</i> .
<i>Schizaea pectinata</i>	<i>Schizaea pectinata</i> .
<i>Blechnum australe</i>	<i>Blechnum australe</i> .
<i>Caenopteris rutaefolium</i>	<i>Asplenium bipinnatum</i> .
<i>Asplenium falcatum</i>	<i>Asplenium lunulatum</i> .
<i>Asplenium furcatum</i>	<i>Asplenium praemorsum</i> .
<i>Polypodium ensiforme</i>	<i>Polypodium ensiforme</i> .
<i>Polypodium tottum</i>	<i>Dryopteris africana</i> .
<i>Polypodium aculeatum</i>	<i>Polystichum pungens</i> .
<i>Polypodium capense</i>	<i>Hemitelia capensis</i> .
<i>Adiantum auriculatum</i>	<i>Pellaea auriculata</i> .
<i>Adiantum capense</i>	<i>Adiantopsis capensis</i> .
<i>Adiantum caffrorum</i>	<i>Mohria caffrorum</i> .
<i>Adiantum pteroides</i>	<i>Pellaea pteroides</i> .
<i>Adiantum aethiopicum</i>	<i>Adiantum aethiopicum</i> .
<i>Gleichenia polypodioides</i>	<i>Gleichenia polypodioides</i> .
<i>Hymenophyllum tunbridgense</i>	<i>Hymenophyllum tunbridgense</i> .
<i>Trichomanes incisum</i>	Abnormal pinnae on <i>Hemitelia</i> .

It will be seen from this that the limits of the genera have undergone very considerable alterations since that time, and also that several specific names have been changed. It will also be noticed that every species mentioned is to be found near Cape Town or, at least, between there and Knysna.

About the same date, Swartz was at work on the ferns, and in Schrader's *Journal für die Botanik*, 1800, 1803, he introduced, among others, a good many South African species.

Soon afterwards Breutel, Mund and Maire, Burchell, C. W. Bergius, and Rev. Mr Thom were all collecting, while Rev. Mr Hesse of Cape Town sent to Europe a collection of ferns and lycopods, which were described in Schrader's *Göttinger Gelehrte Anzeigen*, 1818.

Thunberg's *Flora Capensis*, 1823, contains only the same

ferns as his previous *Prodromus*, but in 1825 Prof. de Schlechtendal began to issue his *Adumbrationes Plantarum*, the first volume of which was on Cape ferns, and, though unfinished, it is the most important work ever issued on South African ferns. In its unfinished state it contains excellent figures of 30 species, and descriptions of 70 species of ferns and fern allies, almost all good species, still maintained, though in some cases under different names.

1823 saw the arrival of C. F. Ecklon and K. L. P. Zeyher, while in 1826 J. F. Drège arrived. All three collected plants for sale, and from their collections the whole flora of South Africa as far as Natal and Transvaal may be said to have been made known, while, at the same time, Burke travelled in the Transvaal, and Gueinzus made a most complete collection of the ferns of Natal.

Prof. Presl's *Tentamen Pteridographiae* (1836) brought the knowledge of ferns generally well up to date, and Kunze, in the same year, reviewed the ferns of South Africa in *Linnaea*¹, after having examined the collections of all these more recent collectors.

He made out 33 genera and 111 species, many of which were new, but have since been sunk as varieties only. Subsequent numbers of *Linnaea* contain Kunze's further investigations, especially those of the year 1844, and some African species are figured by Kunze in *Die Farnkräuter in colorirten Abbildungen* (Leipzig, 1840).

Harvey in his *Genera of South African Plants*, 1838 (1st edition), describes 31 genera, but does not definitely indicate the number of species.

Sir Wm Hooker's *Genera Filicum* (1838) and his *Species Filicum* (1846-64) considerably altered the nomenclature, but Hooker's classification was not followed by Pappe and Rawson, in whose *Synopsis Filicum Africae Australis* (1858) descriptions are given as a united group of all the South African ferns then known². Kunze's nomenclature and descriptions are very

¹ *Plantarum acotyledonearum Africae Australioris recensio nova*, I. Filices, *Linnaea*, 1836.

² This first appeared in the *Cape Monthly Magazine*, Nov. and Dec. 1857, and then as a pamphlet in 1858.

closely followed, and, though many new species were described, only a few of them have been upheld by the more recent authorities on ferns, the great majority having sunk into the position of varieties. Altogether, 161 ferns and fern allies are described, beside 16 species described by former authors, on which Pappe and Rawson had doubts.

Lowe's *Ferns, British and Exotic* (1860), and Hooker's *Filices Exoticae* (1859), include descriptions and figures of a few South African species.

Mettenius' *Re-arrangement of Ferns* (*Ueber einige Farn-gattungen*, 1851-9) is followed by Kuhn, whose *Filices Africanae* (1868) gives a complete list of the ferns and fern allies of Africa and the African islands, with descriptions of new species, and the most complete and accurate synonymy that materials would allow.

In this remarkable book, 59 genera and 683 species (including fern allies) are credited to Africa. So far as South Africa is represented in it, the materials were drawn, in great part, from Pappe and Rawson's synopsis, with the result that a few species, which had evidently not been compared, are maintained on insufficient grounds.

Moore's *Index*, about the same date, gives splendid illustrations of the generic distinctions, and also a complete synonymy so far as it goes, but it was never completed, and only goes, alphabetically, to G.

Hooker and Baker's *Synopsis Filicum* (1868) again brought fern knowledge up to date, and put the systematic work in such form that the identification became easier, and consequently the study became more popular. This splendid book contains descriptions of 2401 species.

In Harvey's *Genera of South African Plants*, 2nd edition (1868), the genera of Cape ferns are set down by Mr Baker at 37, and the species at 132.

McKen, immediately after the issue of Hooker and Baker's *Synopsis Filicum*, prepared a small *Ferns of Natal* (1869), in which the descriptions of genera and species are transcribed verbatim from the *Synopsis Filicum*, but with the addition of

a good many Natal localities. He gives 120 species, but included several which were mistakes.

Up to and about this date, the principal collectors, not already mentioned, were, in Cape Colony, Dr Pappe, Hon. R. W. Rawson, Dr Harvey, Dr Alexander, Sir Henry and Lady Barkly, Dr Atherstone, Capt. Espinasse, Col. Blagrove, Mrs Barber, Mrs Kitton, Mrs Holland, Dr Shaw, Rev. R. Baur, Dr H. Bolus, and Messrs Burke, McGibbon, Forbes, and Browning; and in Natal, Dr Krauss, Dr Cattell, Rev. J. Buchanan, and Messrs Plant, W. T. Gerrard, and M. J. McKen; while Messrs Ayres, J. Sanderson, J. Todd, McLea, and F. Oates, collected in Natal and the Transvaal.

The issue of the second edition of Hooker and Baker's *Synopsis Filicum* (1874) gave a renewed interest in Pteridology, and has stood the test of time well, being still the standard descriptive work on the subject. It contains descriptions of 2235 species, so a good many names contained in the first edition must have lost specific rank. In the Cape, a further impetus was bestowed by the attention given to the subject by His Excellency the Governor, Sir Henry Barkly, and by Lady Barkly, who in 1875 prepared a revised list of South African ferns, giving localities or distribution, so far as given in the *Synopsis Filicum* or shown by specimens in the Cape Government Herbarium, along with the results of their own travels, and with Natal notes supplied by Rev. J. Buchanan. This list appeared in the *Cape Monthly Magazine*, April, 1875.

In this list, so great a number of Pappe and Rawson's species are merged into others that, including additions made in the meantime, the total number of species is reduced to 153.

Corresponding with this, and in the same year, came Rev. J. Buchanan's revised list of Natal ferns in the *Natal Colonist*, with numerous notes upon the rarer or more confused species—a most useful list, in which 132 ferns and 13 fern allies are enumerated, and Natal localities given. In 1877, Wood's *Ferns of Natal* was issued, in which good popular descriptions are given of 119 species, along with distribution, Natal localities, etc.

Kuhn's list in Diekens' *Reisen in Ost-Africa, Botanik*, III. pages 7—71 (1879), contains various South African species.

In Hooker's *Icones Plantarum* (1886), three parts are devoted to the new ferns, and include several South African species (with figures).

Oates' *Matabeleland* (1881), describing a journey from Durban to the Victoria Falls on the Zambesi, includes a list by Baker of plants collected, numbering 67 species, of which 10 are ferns; and one new species, *Adiantum Oatesii* Bkr, is described and figured.

Dr Hans Schinz' *Observations on a collection of Transvaal Plants, collected mostly near Elim*, includes only two ferns, *Nephrodium Bergianum* and *Cheilanthes hirta* Sw., but that is very evidently not representative of the Transvaal mountain forests.

My own *Handbook of Kaffrarian Ferns* (1891) contained descriptions and illustrations of the 68 ferns and 7 fern allies found by me in what was formerly the Colony of Kaffraria, which however does not quite correspond with the Kaffrarian district, as understood in the present work, in which all the Transkeian territories as well as the old Colony of Kaffraria are included.

In 1892 the first edition of the present work appeared, in which 157 species of ferns and 22 species of fern allies were described, and 159 plates used to illustrate all the species of which specimens had been obtained or seen.

The geographical area dealt with in that edition was nominally that part of continental Africa lying south of the tropic of Capricorn. This included the Transvaal but only part of Rhodesia, and the latter was only represented by bare lists of about 30 species.

Railway communication with the Transvaal had only recently been opened, and pioneers were more bent on money-making than on scientific study.

In the preparation of the book I carefully examined practically all the herbarium material available in South Africa, and with some assurance ended the Preface with these words: "I do not anticipate that many more species of ferns

will ever be found in Cape Colony, but the whole region north of the Orange, Vaal, and Umfolozi Rivers is still, botanically, almost a *terra incognita*, and doubtless contains many still unrecorded species."

The twenty-two years which have elapsed since then have seen a complete transformation of the means of transport, as also of the safety and comfort with which the northern regions up to and beyond the Zambesi may be toured and their floras studied, and the above prediction has been found correct throughout. Many collectors have been at work in the Orange Free State, Transvaal and Rhodesia, and their collections have been rich in ferns; in Namaqualand and Damaraland, Dr H. H. W. Pearson and Dr Marloth have proved that ferns are by no means absent, and in Zululand and Portuguese East Africa I have explored most of the lower levels, while Mr C. F. M. Swynnerton, F.L.S., has collected in the dividing range between Portuguese East Africa and Rhodesia, and his fern collections have been reported on by Mr A. Gepp, F.L.S., of the British Museum Herbarium, in the *Linnean Society's Journal*, Botany, Oct. 1911, where localities are given for 66 species of ferns and fern allies, and his specimens have since been examined by me and used herein.

The result of all these collections (which have mostly passed through my hands) is that the number of South African species has been very considerably increased and the known distribution of nearly every species much extended, the only exceptions to this being the few absolutely local species.

At the Johannesburg meeting of the British Association, Aug. 1905, I submitted a paper entitled "Recent Information concerning South African Ferns and their Distribution," which was published by the South African Philosophical Society (Vol. XVI. Part 3, Aug. 1906), in which the number of species of ferns and fern allies is brought up to 212—South Africa being there taken to include Southern Rhodesia and part of Portuguese East Africa, viz. all the sub-continent south of the Zambesi, which also is the area adopted in the present work.

About the same time Mr F. Eyles published a list of the

flora of Southern Rhodesia, including many ferns, and this has been recently revised for republication.

In 1907, Dr J. Medley Wood published his *Handbook to the Flora of Natal*, which in so far as ferns and allied plants are concerned includes synoptical descriptions and general distribution of 139 species. In 1912 Mr J. Burt-Davy, F.L.S., and Mrs R. Pott-Leendertz published their "First Checklist of the Flowering Plants and Ferns of the Transvaal and Swaziland" in the *Annals of the Transvaal Museum* (May, 1912), in which 112 species of ferns and fern allies are enumerated.

Dr Marloth has a work on hand on the Flora of South Africa¹, in which ferns as well as other plants will be treated, and of which the first volume has recently been published.

In Europe various botanists have been at work on ferns, including South African ferns, among whom may be mentioned Professors Engler, Christ, Hieronymus, Bower, Prince Roland Bonaparte, etc., but European investigation has interested itself more in the life-history of ferns than in their systematic classification. It is probable that some smaller foreign publications in Europe have not come to my notice, and it is to be regretted that one such which I have seen (Krasser, *Ann. Hofmus. Wien*, 15, 1900) illustrates two so-called new species, *Asplenium multifforme* Krasser and *Nephrodium Pentheri* Krasser, which are evidently identical with old and well known kinds.

In the *Journal of the Linnean Society* (Botany), No 262, Vol. 37, Nov. 1, 1906, is included "A Contribution to the Botany of Southern Rhodesia," by Miss L. S. Gibbs, F.L.S., in which 20 ferns and 4 fern allies are named.

New species have been described in various journals, including *Journal of Botany* (July, 1874) and *Gardeners' Chronicle* (Nov. 16, 1889), and all additions to, or alterations of, the second edition of Hooker and Baker's *Synopsis Filicum* up to that date were brought together by Baker in *Annals of Botany* (1891)². Another new species is described by him in *Kew Bulletin*, 1901, page 138.

¹ *The Flora of South Africa*, by Dr R. Marloth. Part I. issued 1914.

² Reprinted as *A Summary of the new Ferns which have been discovered or described since 1874*, by J. G. Baker, F.R.S. (1892).

But if fern study received a sound systematic foundation in Hooker and Baker's *Synopsis Filicum*, already referred to, it has received further most valuable assistance in Carl Christensen's *Index Filicum* (1906), which does the same for ferns as the *Index Kewensis* does for flowering plants. It is a most patient, industrious and accurate undertaking, investigating synonymy and priority of nomenclature in accordance with the laws of priority now adopted, and has been accepted as the authority for fern nomenclature (Brussels Congress, 1910).

The frequent changes of generic name may therefore be considered to have reached finality in so far as ancient record is concerned, and this brings us to the point where, in order to keep up with added information on distribution and to adopt the now recognised nomenclature, a second edition of the present work is called for.

It is unfortunate that many of the generic names used in Hooker and Baker's *Synopsis Filicum*, and from them used in the first edition of this work, have had to be set aside in favour of generic names now proved to have had priority of claim; but as Christensen's work is now in use in all leading herbaria it is advisable at once to use its nomenclature, even at the expense of using unfamiliar names instead of well-known ones now relegated to synonymy; and this has been done, with very few exceptions, in the present work.

Christensen follows mostly the nomenclature and arrangement adopted in Engler und Prantl, *Die natürlichen Pflanzenfamilien*, but has also carefully studied Hooker and Baker's *Synopsis Filicum*, 2nd ed., 1874, and Dr H. Christ's *Die Farnkräuter der Erde*, 1897, and has in most cases given the specific names used in all these three works, either as retained species or as synonyms.

Christensen has further enhanced his work by the publication of a *Supplementum*, 1906—1912 (1913), to his *Index Filicum*, in which reference is made to several South African species.

In Brause, *Fedde Repert.* II. 1912, *Hymenophyllum Marlothii* is described.

The South African fern allies are included in most of the South African books already mentioned, and were described, along with those from other parts of the world, by Spring, in Vols. 15 and 24 of *Mémoires de l'Académie royale de Belgique* (1842 and 1849), and again carefully monographed by Baker in his *Handbook of Fern Allies* (1887), in which 562 species are described, separated into 11 genera, and 5 orders. Of these, only 22 species are known to be South African, and 10 are found nowhere else. Christensen's *Index Filicum* includes the Salviniaceae and Marsileaceae.

In the preparation of the following pages, almost all the above works have been consulted, and collated with live plants or with dried specimens. The collection in the Cape Government Herbarium is almost complete, including many collected by Ecklon and Zeyher, Drège, Dr Pappe, Rawson, and Lady Barkly, as well as numerous additions from most recent collectors.

The Bolus Herbarium has also a very complete set, and the collections in the Natal Government Herbarium, Albany Herbarium, Transvaal Museum Herbarium, and my own, as well as several other private herbaria, are almost complete as local collections. These have been examined as opportunity occurred, and through the kindness of those in charge I have been able to examine later additions recently.

Several large collections of South African plants have been numbered and distributed, most of which contain some ferns.

Among these, Burchell's is about the earliest, and as they were distributed with numbers corresponding to his *Geographical Catalogue*, which were later arranged in MS. by the late Dr Bolus, the locality for any specimen can still be traced.

Drège's collections were also distributed, as were the collections of Ecklon and Zeyher, which had the localities numbered corresponding with a list of localities in *Linnaea*, Vol. 19.

The collections of Krauss and Dr Rehmann (1875—1880) were distributed with localities on the labels, as also have

been the few ferns sent out in *Herbarium Normale Austro-Africanum*, by Messrs MacOwan and Bolus.

In recent years many numbered collections have been formed and distributed to a small extent, but that distributed by Mr R. Schlechter was so large and was supplied to so many leading herbaria that it is necessary to call attention to the unfortunately numerous errors of nomenclature among the ferns.

A most interesting collection of plants was made by the Percy Sladen Memorial Expeditions under Dr Pearson into the north-west region, Namaqualand and Damaraland, which included a considerable number of ferns, mostly characteristic of sheltered crevices in arid country.

The ferns of the Waterberg district of the Transvaal were studied and specimens collected some years ago by Rev. H. Junod, and in other parts of the Transvaal extensive collections have been made by Mrs R. Pott, Curator of the Transvaal Museum Herbarium (formerly Miss R. Leendertz), and by her assistant Miss M. Collins, and also by Mr J. B. Pole-Evans and Miss E. Doidge, who have formed a good collection in connection with the Agricultural Department, Division of Botany.

In 1909 Mr G. Duthie, Supt of Education, Rhodesia, submitted to me 25 species collected in the Mazoe district by a school pupil, Mr Eric Eyles, including one new species (*Asplenium Eylesii*) and several previously unrecorded from Rhodesia, and Mr Eyles and his father (Mr F. Eyles) have since then sent many additional species from Southern Rhodesia.

In 1910 Mr James Sim inspected the forest districts of S. Rhodesia, and collected a good many ferns mostly on the Zambesi near the Victoria Falls, and on the Gwaai River, and in sending them to me he states: "most of the Rhodesian ferns, like the rest of the vegetation, are deciduous, so only a few were available in winter." Mr H. Ffolliott-Darling had previously sent me many specimens from Rhodesia, as also had Mr H. Marshall Hole, C.C., Mrs Bennett, Mr B. H. Holland, and Mr G. Richards (M.L.A., Natal), while Oates

Waller and Sir John Kirk had also collected there and on the Zambesi.

Mrs Doig Young, of Main, Tembuland, has for many years sent interesting collections from that neighbourhood, and Mr A. G. MacLoughlin has also collected largely in the same district.

Mr W. A. Quail sent a collection from Ficksburg, Orange Free State.

Mr Wm Leighton and Mr W. E. Marriott have collected in the Karkloof district of Natal, and Dr J. W. Bews in the neighbourhood of Van Reenen in the Orange Free State and Natal.

Among other recent collectors besides those mentioned above, and whose specimens I have seen, are: Mr T. H. Rex, Mr Pehrsson, Mr T. J. Jenkins, Miss L. Collins, Miss F. Thorncroft, Miss Williams, Dr F. Wilms, Rev. F. A. Rogers, Mr W. Nelson, Mrs S. Burger, Mr C. Wilde, Mr P. Krantz, Prof. G. Potts, Mr A. Roberts, Miss L. C. de Beer, Miss S. Viljoen, Mr V. G. Crawley, Mr A. J. T. Janse, Miss M. Knobel, Mr H. A. Bailly, Mr Allen (formerly of Victoria Falls), Mr Eastwood, and Mr John M. Sim.

Constant diversity of opinion has been at work during the past century as to the claims to specific rank of some of the more closely related of our ferns, and numerous such species named as new by the various writers have come to be discarded later as their relationship and liability to variation became better understood. On this account the number of South African species, which was unduly raised by early writers, has been increasing slowly of late, as the deletion of bad species has almost equalled the discovery of new good species. The extension of area in the present work has, however, allowed a considerable increase in the number of species enumerated, which is 220 species of ferns and fern allies in the present edition as against 179 species in the first edition.

We still include a few which have been found only once, and which may later on come to be regarded as conditional varieties of other species when better understood. But we

have deleted a good many species which are still maintained by Christensen, and which our opportunities of studying the living plants under natural conditions lead us to think are not specifically distinct. Christensen's work is most thorough and accurate, and as it is always difficult to reduce a species except where it is well known in natural growth, he has refrained from doing so and thereby rather inflated the total number of fern species. Our endeavour here has been to put that right, so far as South Africa is concerned. But as an instance of how careful one has to be in expunging a name, may be mentioned the case of *Ceropteris calomelanos*, collected in Natal by Gerrard about forty-five years ago, and of which the only other known South African specimen on record is a frond labelled 'Transvaal' in the Bolus Herbarium. Suspicion was natural that these unsupported records were either from cultivated plants, or that the localities were given in error. But recently we have found this fern near Durban in profusion and long established, but in a deep railway cutting which did not exist in Gerrard's time. If not indigenous it is fully naturalised, and Gerrard's ancient record still raises a doubt as to whether or not it is really indigenous. Being an attractive 'Golden Fern' it is surprising that the present locality should have escaped notice for so many years, as it is passed by hundreds of railway passengers daily, and there may be other localities still undetected.

CHAPTER VII

THE NATURAL HOME OF THE FERNS

THE area dealt with in our first edition was nominally that part of continental Africa lying south of the Tropic of Capricorn. As explained elsewhere, the present edition deals with South Africa up to the Zambesi and that parallel, thereby including the whole Union of South Africa, Southern Rhodesia, part of Portuguese East Africa and part of German West Africa. The whole of this area is now much more accessible than it was 22 years ago when our first edition was published, and most of it has been more or less carefully examined by botanists or botanical collectors, and the physical features of the country are now well known.

The distribution of ferns usually accompanies the presence of suitable conditions. Presumably the exceedingly small and light spores are carried immense distances by the wind without their vitality being destroyed. At least we have the fact that wherever conditions are just right ferns abound, often many miles away from the nearest similar locality where the same kinds also occur, but these ferns do not appear between.

Thus at Broughton, Molteno, on the high Stormberg plateau, an isolated kloof contains many species of ferns. So also at Wellington, Rosetta, a sheltered hillside has a small patch of scrub bush containing many fern species, though the whole neighbourhood except that patch is subject to intense frost and has almost no ferns. And even in the Karroo certain species seem to have sufficient drought-resisting power to find a satisfactory habitat among the rocks of the kopjes. Of course each kind selects its own class of habitat, or to put this in another form, a species

does not appear unless its requirements are met. But some ferns (such as the Bracken) are cosmopolitan if their requirements are met, and it is surprising how many South African species are not endemic and not even confined to Africa, but represented frequently in one or more of the other continents or ocean islands. In this connection it is interesting to read in the late Sir George King's *Sketch of the Flora of Rajputana* (1878), a carroid¹ province in north-west India corresponding somewhat with the frostless portions of South African *thorn-veld*, that the richest part in cryptogamic vegetation is the isolated mountain mass Aboo, "but even there only about a dozen species of ferns occur, and of this small number only *Adiantum caudatum*, *Adiantum lunulatum*, *Cheilanthes farinosa*, *Nephrodium molle*, *Nephrodium cicutarium*, and *Actiniopteris radiata* can be said to be abundant. *Adiantum capillus-veneris* is found in a few spots, and *Botrychium virginianum* is very rare.....In the eastern tract, the only ferns ever seen are *Adiantum lunulatum* and *caudatum*, *Nephrodium molle*, and *Actiniopteris radiata*. These species occur very sparingly indeed in the western tract, and only in shady crevices of rocks, or on old moist walls. In wells, the maiden-hair, *Adiantum capillus-veneris*, is occasionally met with on both sides of the Arvalis."

Strangely, every species mentioned except *Botrychium* occurs also in Rhodesia, though it must be admitted each has a fairly wide distribution.

But if these and other species can cross continents and oceans, and germinate wherever they find conditions suitable, then it is not surprising that the distribution of ferns in this sub-continent is regulated mostly by the physical features.

Speaking generally, ferns enjoy a humid atmosphere and a certain amount of shade. There are of course exceptions, but apart from these the somewhat delicate texture of the fronds indicates that association. Such conditions also favour the growth of trees, consequently trees and ferns are often

¹ For "carroid" see General Index and Glossary.

found together, and some species of ferns enjoy even the deepest shade.

The distribution of forests and forest patches is almost confined to the eastern slopes leading from the edge of the high central tableland of South Africa to the Indian Ocean. The distribution of ferns follows these same lines and every forest has its ferns, and some species appear in every forest, from Capetown to the Zambesi. But other species, either through insufficient or excessive humidity, or excessive or insufficient shade, are not so general in their distribution, and some are quite local, or endemic to a very limited area.

There is the further factor of temperature, for many of ours are temperate ferns, enduring any temperature in which frost is absent, or even in some cases where frost does occur. But others are tropical ferns, and only occur under tropical conditions.

The forests of South Africa, though present more or less along the whole eastern slope and seaboard, are at their best on the steep mountain faces having an eastern aspect, and follow more or less the range which begins near the coast about Knysna, and is further inland further north, including the Amatolas, the Zuurberg and the Drakensberg, the latter range being on the boundary between the Cape and Basutoland, between Natal and Basutoland, the Orange Free State and Transvaal, between Portuguese East Africa and the Transvaal, and between Portuguese East Africa and Rhodesia.

The range thus indicated, varying in altitude from the coast at Knysna to 10,000 feet or more further north, is the home of ferns in South Africa as well as the site of most of the forests and forest patches, and the distribution of ferns within that range depends mostly on the humidity, except that in the northern portion tropical conditions exist, and consequently outlying stragglers of species belonging further north begin to appear. In no part of the forest area does frost penetrate into the forest, though in some parts hard frosts occur in proximity to or even in the forest

margin. But quite a large number of our ferns are not damaged by drought, and are regularly subject to it, growing not only in the outskirts of the forests but also along rocky banks, or in ditches, and others even in swamps. A few species occur only in swamps; many prefer to be close to waterfalls or running streams, and one species (*Acrostichum aureum*) has a partiality for being just above floodmark in tidal lagoons.

The flat sandy country between the mountain range and the sea in Northern Zululand and throughout much of Portuguese East Africa has very few ferns, those present being either of the hardiest nature and common kinds, or else of peculiar requirement such as *Acrostichum aureum* on the lagoon mud, *Dryopteris thelypteris* and *D. gongylodes* in swamps, *Ophioglossum* in sandy grass-land, *Stenochlaena* as a climbing epiphyte, or *Platynerium* as an epiphyte high up on the trees, or *Ceratopteris* floating on pond water.

Equally peculiar are those xerophytic species which belong to or extend into the dry regions, including *Cheilanthes hirta*, *Pellaea hastata*, *P. viridis* and the various western species, some of which are little known and seldom seen in perfect condition through being brittle and easily damaged, and also through growing where collectors seldom visit and where those who do so do not have the best conveniences for drying good specimens. Notable among collections from this dry class of country is the collection made by the Percy Sladen Memorial Expedition under Dr H. H. W. Pearson in the dry regions of Namaqualand and beyond, the ferns then collected including *Mohria caffrorum*, *Cheilanthes multifida*, *C. hirta*, *C. induta*, *Adiantopsis capensis*, *Asplenium adiantum-nigrum*, *Ophioglossum capense*, *Pellaea auriculata*, *Pteridium aquilinum*, *Blechnum australe*, *Adiantum capillus-veneris*, *Osunda regalis*, and *Todea barbara*. This group is representative of the ferns of carroid districts, the last three being present only where there is regular soil-moisture but withstanding the other conditions.

Some of these carroid ferns have amazing vitality; one small plant of *Pellaea auriculata* collected by myself was left

in my pocket dry for a month and when found resembled a small bulb, but when placed in moist conditions it at once started into growth, and soon developed into a nice healthy plant.

Most of the carroid kinds are also specially adapted for their conditions, either by being clothed in scales or hairs, or by being thick and leathery.

Many ferns are subject to being burned in annual grass-fires without being seriously damaged. All the kinds that grow in the forest outskirts are included among these, such as *Mohria caffrorum*, *Pteridium aquilinum*, *Dryopteris elongata*, *Pellaea viridis*, and *Blechnum tabulare*. The latter species has its crown protected by a dense clothing of scales, and the undeveloped fronds are protected while the mature fronds are burned off. This is the case frequently also with the large tree fern, *Cyathea Drègei*.

All ferns growing among exposed rocks, mostly *Pellaea*, *Cheilanthes* and *Mohria*, are very subject to fire, but seem to be able to survive.

A good many ferns are epiphytal, and many grow on soil collected into decayed tree stumps, or such localities. The epiphytal condition gives the most perfect moisture and drainage arrangement—always moisture available, seldom too much, and then not for long!

Moisture and drainage is the secret also of the existence of the rock ferns; none are more difficult to cultivate than these, because excess water supply is seldom provided against, whereas in nature it does not occur.

With most other ferns light open soil conditions suit them best, but there are a few swamp ferns which demand wet, stiff clay and seldom succeed without it.

The filmy ferns are among the most beautiful, but require conditions specially adapted to their delicate texture. Damp rocks below a waterfall, damp stones in dense forest, or humus on an old stump, are the sites in which they do best.

The fern allies have each its own requirement, which will be noted in connection with the species.

In trying to allocate each species to certain known areas,

it has been found convenient to divide South Africa as follows :—

- (1) West, including the Cape Peninsula, the Karroo, the north-western dry country, and the Knysna forests which agree generally with the neighbourhood of Capetown.
- (2) East, including the country along the two railways from Port Elizabeth to Rosmead.
- (3) Kaffraria, from the Fish River to the Natal Border.
- (4) Natal.
- (5) Orange Free State.
- (6) Transvaal, including Swaziland.
- (7) Rhodesia.
- (8) Portuguese East Africa.

These last five are political boundaries and easily defined, but are not very satisfactory as plant-distribution areas, since the dividing line is along the mountain range and, as in the case of the Orange Free State, the whole Province may be nearly destitute of ferns, but still it has a long list from the few kloofs on the boundary.

So also the first division is unsatisfactory as a plant-distribution area, since it includes exceedingly dry country, and also moist forests, but these are inseparably mixed, and, as elsewhere, each species selects its own habitat.

CHAPTER VIII

CLASSIFICATION

THE plants described in this work come under the *CLASS Pteridophyta*, which Class consists of all the ferns and fern allies, associated and yet differentiated by their respective methods of reproduction. The Pteridophyta are also spoken of as *Vascular Cryptogams* as distinct from the *Cryptogams* which include Mosses and Liverworts (*Bryophyta*), Algae and Fungi. The differences between the Pteridophyta and Bryophyta are as under :

Pteridophyta. The alternation of generations takes the form of :

(1) A vegetative prothallus, more or less developed, either monoecious or dioecious, on which sexual organs produce fertilisation resulting in

(2) the more complex plant, which is recognised as the fern or fern-ally species, and on which spores are produced, which after falling from the parent produce prothalli similar to those of the first stage, and repeat the process.

Bryophyta. The alternation of generations takes the form of :

(1) the complex plant which is recognised as the species, either monoecious or dioecious, on which sexual organs produce fertilisation resulting in the production on the plant of

(2) a capsule, containing numerous asexual spores, each of which may grow into a plant of the first stage, and repeat the process.

Although the Pteridophyta are thus scientifically distinguished from all other plants (see also first chapter), its component groups differ from one another to a considerable degree, both in general appearance and in specific characters, and the student may find difficulty in recognising the common characters by which they are grouped together, and may also find difficulty in seeing a satisfactory basis of separation. This has been the experience of every botanist, and even now the highest authorities on systematic Pteridology approach the subject from very different standpoints, some working from the lower forms of plant-formation to the higher, and others *vice versa*. This alone merely involves simple inversion of the arrangement, but different conceptions of the homology and uses of certain organs lead to further differences of opinion.

Prof. Bower's scheme of arrangement (in so far as South African species are concerned) is :

COHORT I. LYCOPODIALES. Sporangia arranged singly in the axils of subtending sporophylls.

A. *Eligulatae*. Without a ligule, and homosporous.

Lycopodium.

B. *Ligulatae*. With a ligule on upper surface of leaf, and heterosporous.

Selaginella and *Isoetes*.

COHORT II. EQUISETALES. Sporangia borne on sporangiophores which are inserted directly upon the axis. Leaves in whorls.

Equisetum.

COHORT III. SPHENOPHYLLALES. Sporangia borne on sporangiophores. Leaves alternate.

Psilotum.

COHORT IV. OPHIOGLOSSALES. Sporangia sunk in the tissues of a fertile spike.

Ophioglossum.

COHORT V. FILICALES. Sporangia in sori distributed over the under-surface of the leaves.

A. Homosporous. (Sporangia and spores all alike.)

1. *Simplices*. Sporangia of a sorus produced simultaneously.
Marattiaceae, *Osmundaceae*, *Schizaeaceae*, *Gleicheniaceae*.

2. *Gradatae*. (A definite succession of time and space in the production of sporangia.)

Hymenophyllaceae, *Cyatheaceae*.

3. *Mixtae*. (A definite succession of time only in the production of sporangia.)
Pterideae, sori marginal.
Aspidiae, *Aspleniae* and *Polypodiaceae*, sori superficial.
- B. Heterosporous. (Spores and sporangia differ in size and form.)
Salviniaceae (*Azolla*) and *Marsiliaceae* (*Marsilia*).

The arrangement adopted by Christensen and which is followed in the present work deals with Cohorts IV. and V. of the above in a somewhat different manner, as will be seen later, but as Christensen does not include Cohorts I., II. and III. of the above I now follow Bower in regard to these, in preference to the arrangement used in my first edition, which was :

- ORDER 1. Filices, including Cohorts IV. and V., A, of the above.
2. Equisetaceae, equal to Cohort II. of the above.
 3. Lycopodiaceae, sporangia uniform. *Lycopodium* and *Psilotum*.
 4. Selaginellaceae, sporangia of two kinds. *Selaginella* and *Isoetes*.
 5. Rhizocarpeae, equal to Cohort V., B, of the above. *Azolla* and *Marsilia*.

It will be seen from the above that each group has characters of its own, which, as referred to in a previous chapter (Reproduction and Propagation), appear not only in the plant which we describe as the species but also in the alternate generation of spore and sporeling; and as connecting links between some of the groups are known only as fossils (*Lepidodendraceae*, *Sigillariaceae*, etc.) and others are very probably extinct, the gradual evolution through long ages, and the consequent relationship of existing groups, can never be fully determined, and consequently any scheme of arrangement is simply the expression of an individual opinion on the most natural relationship, and may or may not obtain general support, while further investigations into the early life-history may lead to still further developments.

CLASSIFICATION OF FERNS AND FERN ALLIES

Key to the Cohorts.

PTERIDOPHYTA.

Vascular cryptogamic plants, having in the higher forms a distinct and evident alternation of generations consisting of (1) a vegetative prothallus, more or less developed, either monoecious or dioecious, on which sexual organs produce fertilisation, resulting in (2) the more complex plant which is recognised as the Fern and Fern-ally species, and on which unfertilised spores are produced, which after falling from the parent produce prothalli similar to those of the first stage, and repeat the process. In certain of the lower forms the vegetative prothallus is less evident, or has to be assumed, but the sexual fertilisation occurs at that stage.

COHORT I. FILICALES. Sporangia in sori, mostly in lines or dots or scattered, on the under-surface of the frond ; vernation circinate.

(1) FILICALES LEPTOSPORANGIATAE. Sporangia small, superficial or specialised, free or eventually free.

A. *Filices*. Sporangia free, in sori on the under-surface or margin of the frond ; sporangia and spores all alike. (All ordinary ferns.)

B. *Salviniaceae* and *Marsiliaceae*¹. Sporangia and spores of two kinds, specialised, eventually free. (*Azolla* and *Marsilia*.)

(2) MARATTIALES. Sporangia large, without rings, permanently united, opening by slits down their inner faces ; vernation circinate. (*Marattia*.)

(3) OPHIOGLOSSALES. Sporangia large, 2-valved, without rings, sunk into a fertile frond, and opening by a slit ; vernation erect. (*Ophioglossum*.)

¹ = *Hydropteridineae*, = *Rhizocarpeae* of our first edition.

COHORT II. LYCOPODIALES. Sporangia arranged singly in the axils of leaves or bracts. (*Lycopodium*, *Selaginella* and *Isoetes*.)

COHORT III. SPHENOPHYLLALES. Sporangia united 3 together to form a 3-lobed 3-celled sporangiophore. Leaves scattered. (*Psilotum*.)

COHORT IV. EQUISETALES. Sporangia united 6 to 9 together under a stalked peltate receptacle, these receptacles forming a cone terminal to the stem. Leaves (or teeth of sheath) whorled. (*Equisetum*.)

Key to the Orders and Genera.

COHORT I. FILICALES.

DIVISION I. FILICALES LEPTOSPORANGIATAE.

ORDER I. FILICES. Ferns. Foliaceous plants having distinct crowns or stems, roots, and leafy fronds with circinate vernation. Capsules in groups (sori), mostly in lines or dots or scattered, on the under-surface of the frond, either with or without indusia. Capsules very small, all alike in one species, one-celled, and containing minute uniform spores without filaments. Vernation of plant circinate. This Order includes all the plants usually regarded as ferns. These differ immensely among themselves in the form, cutting and texture of the fronds, and in the arrangement and protection of the sori.

Sub-Order I. HYMENOPHYLLACEAE. Filmy ferns. Rhizome extending, often branched. Fronds delicate, pellucid, usually much cut. Capsules roundish or flattened, surrounded by an obliquely transverse entire ring. Capsules enclosed in a foliaceous cup, and surrounding an elongated receptacle, which is terminal on a vein, and marginal on the frond. Sori abundant, either sunk into or extending beyond the lamina of the frond.

Genus 1. *Trichomanes*. Involucre a deep cup, not much compressed, and with an entire mouth, or slightly two-lipped when young.

Genus 2. *Hymenophyllum*. Involucre a cup of same texture as the frond, and placed on its margin, more or less compressed, and distinctly two-lipped, or cut into two valves.

Sub-Order II. CYATHEACEAE. Tree-ferns. Trunk arborescent and woody. Sori globose or shortly conical, situated on the back of the frond, and contained in a cup-like or more or less imperfect involucre. Capsules sessile or nearly so, and having a broad nearly vertical ring.

Genus 3. *Cyathea*. Involucre at first completely enclosing the sorus, afterwards bursting at the top, and remaining as a cup under and around the capsules, which surround a raised receptacle. Stem tree-like.

Genus 4. *Hemitelia*. Involucre only a scale placed under the capsules which surround a raised receptacle. Involucre sometimes absent. Stem tree-like.

Sub-Order III. POLYPODIACEAE. Habit various. Capsules many in a sorus, small, often stalked, having a jointed elastic band passing up one side, over the top, and partly down the other side, and opening horizontally at the part where the band is absent. Sori on the back of the frond, with or without indusia.

* **Woodsieae**. Sori scattered on the back of the frond; involucre cup-like or scale-like, inferior, and enclosing or folding over the sorus.

Genus 5. *Woodsia*. Involucre cup-like, at first enclosing the sorus, afterwards bursting at the top into several lobes. Plant small, herbaceous.

Genus 6. *Cystopteris*. Involucre like a scale attached under the sorus by its wide end, and at first having the other end turned hood-like over the sorus.

** **Aspidieae**. Fronds not articulated to the rhizome; sori roundish, placed on the back of the frond, not marginal; indusium usually present and reniform or peltate, absent in some species.

Genus 7. *Dryopteris*. Sori kidney-shaped or elongated, indusium kidney-shaped, attached by its sinus, absent in some species. Pinnæ not articulated.

Genus 8. *Didymochlaena*. Sori reniform on the intra-marginal raised end of a vein, and covered by a reniform or elliptical indusium, attached along its length to the vein, and free all round the edges and upper end.

Genus 9. *Aspidium*. Sori round, indusium round, fixed by its centre, peltate. Veins anastomosing copiously.

Genus 10. *Polystichum*. Fertile and barren fronds alike. Sori round; indusium round, fixed by its centre, peltate; veins free.

Genus 11. *Cyrtomium*. Veins anastomosing somewhat; other characters as in *Polystichum*.

Genus 12. *Leptochilus*. Fertile and barren fronds different; veins anastomosing; sori abundant, produced in a dense mass, without indusium.

*** **Oleandreae**. Fronds articulated to the long woody rhizome, simple; sori in an irregular line near the midrib, roundish, covered by a reniform indusium.

Genus 13. *Oleandra*. Characters as above.

**** **Davallieae**. Sori terminal to certain veins, marginal or submarginal; indusium opening outward.

Genus 14. *Nephrolepis*. Pinnae simple, articulated to the rachis; involucre reniform or suborbicular, submarginal, terminal on the inner branch of a forked vein.

Genus 15. *Davallia*. Frond firm, decompound, jointed to the rhizome. Sorus marginal, almost cup-like, involucre coriaceous.

Genus 16. *Microlepia*. Stipe continuous with the rhizome; involucre membranaceous, intramarginal; sorus at the base of a sinus.

Genus 17. *Schizoloma*. Sori united in a continuous linear marginal line, covered by a linear indusium, opening outward. Veins anastomosing.

***** **Asplenieae**. Sori not marginal, but (except in *Ceterach* and *Stenochlaena*) covered by a linear or oblong indusium, opening toward the midrib.

Genus 18. *Athyrium*. Sori short, more or less curved, often horse-shoe shaped. Indusium present.

Genus 19. *Asplenium*. Sori linear or oblong, placed obliquely between the midrib and the margin; indusium present.

Genus 20. *Ceterach*. Sori linear, without true indusium, but hidden among closely imbricated brown chaffy scales.

Genus 21. *Blechnum*. Fronds dimorphous. Sori linear, parallel with the midrib, and intramarginal or occupying the whole under-surface of the fertile pinnae (variable in some species). Indusium present.

Genus 22. *Stenochlaena*. Fronds dimorphous. Sori occupying the whole under-surface of the fertile frond, without indusium.

***** **Pterideae**. Sori terminal on the veins or linear on the outer veins. Except in *Gymnogramminae* and *Notholaena* indusium is present, formed of the reflexed margin. Sori separate or more or less continuous.

A. GYMNOGRAMMINAE. Indusium absent; sori linear on the outer veins.

Genus 23. *Anogramma*. Plant small, annual.

Genus 24. *Gymnogramma*. Veins free; plant perennial; frond 3-pinnatifid.

Genus 25. *Ceropteris*. Under-surface coated with white or yellow powder; frond 4-pinnatifid.

B. CHEILANTHINAE. Sori on the frond close to the margin, separate or more or less confluent, covered by the reflexed margin (except in *Notholaena*).

Genus 26. *Pellaea*. Indusium continuous or sometimes imperfectly continuous, interrupted or roundish. Capsules produced on the frond, under the indusium, in a wide line.

Genus 27. *Doryopteris*. Sori as in *Pellaea*. Fronds small, deltoid.

Genus 28. *Adiantopsis*. Involucre distinct, roundish, confined to the apex of a single veinlet.

Genus 29. *Notholaena*. Sori marginal, linear; indusium absent.

Genus 30. *Cheilanthes*. Indusium roundish, not continuous but more or less confluent, formed of the edge of the frond which is only partly turned back. Sori abundant—often crowded all round the edge of the frond except at the sinus.

Genus 31. *Hypolepis*. Indusium membranous in texture, small, round, equal. Sori in the hollow between two lobes, or on the opposite edge of the frond; sometimes also scattered along the edge. Veins free.

C. ADIANTINAE. Capsules produced on the under-side of the indusium, which varies from kidney-shaped to long, and is produced on the points of the pinnules.

Genus 32. *Adiantum*. Characters as above.

D. PTERIDINAE. Sori in the axil of the reflexed margin which forms the indusium.

Genus 33. *Actiniopteris*. Frond flabellate, with linear segments.

Genus 34. *Pteris*. Indusium continuous. Veins free or nearly so.

Genus 35. *Lonchitis*. Sori in the hollow between two lobes, reniform, or oblong, covered by the indusium; veins anastomosing.

Genus 36. *Histiopteris*. Indusium continuous; veins anastomosing freely, without free included veinlets.

Genus 37. *Pteridium*. Indusium sometimes double; veins free.

***** **Vittarieae**. Fronds simple and grass-like; veins and sori parallel to the midrib.

Genus 38. *Monogramma*. Sori linear, near the midrib; frond simple, with one vein only.

Genus 39. *Vittaria*. Sori in long lines near the margin; fronds simple, grass-like, with several veins.

***** **Polypodieae**. Fronds usually jointed to the rhizome; sori round or oblong, scattered, without indusium.

Genus 40. *Polypodium*. Sori separate, scattered or regular.

Genus 41. *Cyclophorus*. Sori numerous, densely placed all over the upper part of the frond, and nearly covered by the stellate tomentum.

***** **Acrosticheae.** Sori congested in a mass on the back of distinct fertile fronds.

Genus 42. *Elaphoglossum*. Fronds simple, veins free.

Genus 43. *Acrostichum*. Fronds pinnate; veins anastomosing freely.

Genus 44. *Platynerium*. Fertile fronds dichotomous or cuneate; barren frond thalloid.

Sub-Order IV. PARKERIACEAE. Capsules sessile, subglobose, with an irregular ring. Sori round, scattered on veins parallel to the midrib, and covered by the reflexed margin.

Genus 45. *Ceratopteris*. Characters as above. A floating fern.

Sub-Order V. GLEICHENIACEAE. Capsules few in a sorus, without indusium, large, composed almost entirely of a broad, elastic, jointed, complete ring, which crosses the top, and opens vertically by the separation of two joints of the ring. Fronds dichotomously branched. Pinnæ pinnate. Sori on the back of the frond. Vernation circinate.

Genus 46. *Gleichenia*. Characters as above.

Sub-Order VI. SCHIZAEACEAE. Ring of capsule horizontal, confined to the upper portion. Capsule opening down the side. Vernation circinate.

Genus 47. *Schizaea*. Fertile segment pinnate, at the top of a grass-like frond. Barren frond grass-like.

Genus 48. *Lygodium*. Stems scandent; fronds dichotomous at the base; capsules solitary in the axils of imbricating scales, arranged in spikes on the margin of ordinary fronds, or forming distinct fertile fronds.

Genus 49. *Mohria*. Capsules marginal or nearly marginal on ordinary fronds. A small herbaceous fern.

Genus 50. *Aneimia*. Fertile part of frond distinct, without lamina, much branched, rising from the base of a pinnate, leafy, barren frond.

Sub-Order VII. OSMUNDACEAE. Capsules stalked, opening at the top, and having an incomplete ring horizontally round one side. Vernation circinate.

Genus 51. *Todea*. Sori on the back of ordinary pinnæ.

Genus 52. *Osmunda*. Fertile pinnæ with almost no lamina.

ORDER II. SALVINIACEAE. Capsules free in the axils of the leaves, of two kinds, the larger round, containing numerous minute spores, the smaller ovoid, containing one large spore.

(Included in Order V., *Rhizocarpeae* in our first edition.)

Genus 53. *Azolla*. A small floating Waterweed.

ORDER III. MARSILIACEAE. Sporangia of large and small spores, both attached together in groups, which are fastened to a mucilaginous connecting cord, and enclosed in the two-valved stalked capsule, which ultimately opens.

(Included in *Rhizocarpeae* in our first edition.)

Genus 54. *Marsilia*. A semi-aquatic plant; leaves often floating.

DIVISION II. MARATTIALES.

ORDER IV. MARATTIACEAE. Capsules united in a double line into a concrete sorus; sori on the back of ordinary pinnae; vernation circinate.

Genus 55. *Marattia*. Characters as above.

DIVISION III. OPHIOGLOSSALES.

ORDER V. OPHIOGLOSSACEAE. Capsules without a ring, permanent, and united into a line on each side of the spike, which is separate from the barren pinna. Vernation erect.

Genus 56. *Ophioglossum*. Characters as above.

COHORT II. LYCOPODIALES.

ORDER VI. LYCOPODIACEAE. Capsules uniform, reniform, one-celled, opening lengthways along the top. Spores uniform. Capsules placed singly in the axils of ordinary leaves or of bracts arranged in terminal spikes.

Genus 57. *Lycopodium*. Characters as above.

ORDER VII. SELAGINELLACEAE. Spores of two kinds, produced in separate sporangia which are placed in the axils of leaves or bracts.

Genus 58. *Selaginella*. Capsules of two kinds arranged in the axils of bracts in a terminal spike, the smaller kind toward the apex and the larger kind toward the base of the spike. Leaves dimorphous.

Genus 59. *Isoetes*. Capsules placed in the axils of the ordinary rush-like leaves, those with large spores in the outer leaves, and those with small spores in the inner. Aquatic herbs.

COHORT III. SPHENOPHYLLALES.

ORDER VIII. PSILOTACEAE. Characters of the Cohort.

Genus 60. *Psilotum*. Epiphytal, rigid, almost leafless plants, with much-twisted stems, repeatedly branched dichotomously, and bearing the sporangiophores in the axils of the few small scattered leaves.

COHORT IV. EQUISETALES.

ORDER IX. EQUISETACEAE. Fertile cone terminal on the stem, and formed of numerous peltate receptacles, under the margin of which are placed the capsules, containing uniform spores, each with four hygro-metric filaments attached.

Genus 61. *Equisetum*. Characters as above.

CHAPTER IX

DESCRIPTIONS OF THE SPECIES

(Technical terms and contractions for the names of botanists or books are explained in the Glossary at the end.)

COHORT I. FILICALES.

DIVISION I. FILICALES LEPTOSPORANGIATAE.

ORDER I. FILICES. FERNS.

SUB-ORDER I. HYMENOPHYLLACEAE.

Genus I. *TRICHOMANES* Linn.

Rhizome creeping, slender, matted or branched, and bearing pellucid tender fronds, similar in habit and texture to the Hymenophylla. Sori terminal on a pinnule, or sunk into its apex. Involucre tubular with a rim, or two-lipped at the mouth, but not deeply divided, and having the end of the vein prolonged as a central receptacle, bearing capsules as far as enclosed in the involucre, but often having a filiform point without capsules extending beyond. The Trichomanes are delicate little plants, requiring abundant moisture but easily cultivated where that is obtainable.

The genus is closely allied to *Hymenophyllum*, and has about 227 species; widely distributed in the warmer regions, and some extending into the temperate zone.

Key to the species :

1. *T. rigidum*. Frond three to four-pinnatifid, three to eight inches long; rachis not winged, or winged only at the summit.
2. *T. pyxidiferum*. Frond three-pinnatifid, one to four inches long; rachis winged above.
(*T. digitatum*. Frond stalked, pinnatifid into long linear ciliated segments; involucre sunk in the frond.)

3. *T. montanum*. Fronds almost sessile, irregularly pinnatifid, slightly ciliated; involucre not sunk.
4. *T. erosum*. Fronds shortly stalked, nearly entire, or bluntly lobed; involucre sunk in the frond.

1. TRICHOMANES RIGIDUM Sw.

Plate 1. Nat. size. b Pinnule, enlarged. c Involucre, enlarged.
d Var. *Drègei*, one pinna.

Rhizome short, stout, set with lanceolate dark scales, and with the fronds more or less tufted, three-pinnate or four-pinnatifid, dark green, and leathery in texture. Stalk three to six inches long, black, wiry, slender. Frond three to eight inches long, three to five inches broad at the base, and tapering to the point. Main rachis and rachis of pinnae wiry, and winged only toward the point. Lower pinnae two inches long, one inch broad at the base, with five to six pairs of secondary pinnae a half to one inch long, a half inch broad, and cut to a winged mid-rib in lobed or pinnate pinnules, with narrow linear segments. Sori small, one or more on each secondary pinna, axillary on the inner base of a pinnule. Involucre free from lamina, cylindrical, slightly widened at the mouth, but not two-lipped. Receptacle twice as long as involucre, but bearing capsules only inside it.

A specimen in the Albany Museum Herbarium named *T. Drègei* (Baker) differs in having the fronds widest at the middle, eighteen inches long, three inches wide; rachis hardly winged; pinnae alternate, one and a half inches long, one and a half inches wide, not cut to the rachis; secondary pinnae one-third inch long, five to seven lobed. Sori one to three on the inner side of each secondary pinna, free; receptacle two to three lines long, wiry, bearing capsules only inside the involucre. It appears worthy to be kept up as a sub-species, but this is the only specimen known, and unfortunately no locality is recorded. (See Plate 1, d.) Christensen puts *T. Drègei*, v. d. B. as a synonym under *T. rigidum*.

T. rigidum Swartz, *Prod.* 137, 1788; Kunze, *Linnaea*, 10, 553; Pappe and Rawson, 45; Kuhn, *Fil. Afr.* 37; Hk. and Bkr., *Syn. Fil.* 86 (in part); Sim, *Ferns of S. Africa*, 1st ed., 56; C. Chr. *Index Filicum*, 649. *T. Harveyi* Carruthers.

Widely distributed in the tropics and sub-tropics, including tropical Africa and its islands, in damp close places near streams. Stated in *Syn. Fil.* to belong to Cape Colony, but I have heard of no locality there for it.

Natal.—Inanda (Dr Rehmann, 8193), Kranzkloof, Great Noodsberg, Umhlatine, Attercliffe (McKen), Umpumulo (Buchanan), Omsamcaba (Drège), Ngoya Forest, Zululand (Stayner).

Transvaal.—Drakensberg near Macamac (J. H. McLea). Mamotsinri, common (Burt-Davy, 210).

2. TRICHOMANES PYXIDIFERUM Linn.

Plate 3. Fig. 3. Nat. size. b Pinnule and Involucre, enlarged.

Rhizome slender, branching, set with black shag. Frond one to four inches long, one inch broad, tripinnatifid, ovate-oblong, rounded at the point, and set on a slender wiry stalk, half-inch or more long. Rachis narrowly winged down to near the lowest pinnæ. Pinnæ longest at or above the middle of the frond, a half to three-quarter inch long, half inch broad at the base, cut in a pinnate or flabellate manner to the winged mid-rib, into narrow, linear, pinnatifid, dichotomous or forked membranaceous pinnules, having one vein in each segment. Margin not toothed. Sori terminal on the inner segments of the larger pinnæ or axillary. Involucre cup-shaped, with a slightly expanded rim, generally more or less two-lipped, not toothed. Receptacle central, often much longer than the involucre, but bearing capsules only on the lower part.

In general appearance this is very much like *Hymenophyllum tunbridgense*, from which it is distinguished by the involucre as well as by having the margin of the pinnules quite destitute of teeth. It also has a narrow green edging or wing down the side of the rachis, though this disappears in the lower part, and the slender rhizomes are matted with short black shag. It is seldom in such dense masses as the *Hymenophyllum*, has more widely spreading rhizomes, and grows among moss, on stones, trees, and on the ground in every damp part of the forest. When young the involucre is often compressed and the edges folded together so as to be two-lipped, and this is occasionally seen in older specimens

when it appears as *T. filicula* Bory, but these specimens are otherwise identical with *T. pyxidiferum*. In the *Synopsis Filicum*, where the two are maintained as distinct species, both widely distributed, the Cape is given as a locality for each. Pappe and Rawson find *T. filicula* the common plant, and *T. pyxidiferum* from Natal only. In other countries they may be distinct, but I agree with Lady Barkly and Buchanan in recognising only one species, and not even two good varieties, in South Africa. Kuhn also does so, but considers it distinct from *T. pyxidiferum* Linn., and calls it *T. melanotrichum* Schl.

Christensen maintains *T. pyxidiferum* Linn. from the tropics and *T. melanotrichum* Schl. from "Africa, tropical and South, with islands; ? Asia tropical," and he places *T. filicula* Bory under the widely distributed *T. bipunctatum* Poir., giving "East and South Africa and its islands" among other localities.

T. pyxidiferum Linn. Pappe and Rawson, 45; Hk. and Bkr. *Syn. Fil.* 81; Sim, *Ferns of S. Africa*, 1st ed., 55; C. Chr. *Index Filicum*, 648.

T. melanotrichum Schl. *Adum.* 56; Kunze, *Linnaea*, 10, 74; Pappe and Rawson, 45; C. Chr. *Index Fil.* 644.

In moist close places, on trees and rocks throughout most tropical and sub-tropical countries, abundant in Natal and Eastern District, more rare West.

West.—Genadendal (P. and R.), Plattenberg Bay (Mund).

East.—Abundant at Grahamstown, Bedford, etc.

Kaff.—Plentiful throughout the forest region, Transkei (Bowker), Umtata (Flanagan, 2647).

Natal.—Inanda (Dr Rehmann, 8194), Umpumulo (Buchanan), common in the Midland and Upper district (McKen), Buccleuch (Leighton), Lidgetton (A. Roberts, 971).

Transvaal.—Macamac, and Pilgrim's Rest (McLea and Herb. Bolus, 3019), Mamotsinri (Burt-Davy, 212), Houtboschberg (W. Nelson, 453), Sabie-hoek forest, 4200 ft (Burt-Davy, 1525).

Orange Free State.—Van Reenen (Prof. Bews, and R. Schlechter, 6976).

(TRICHOMANES DIGITATUM Swartz.)

Plate 4. Fig. 3. Nat. size. d Margin magnified.

Rhizome very slender, wiry. Frond one to two inches

long, one inch broad, on a wiry stipe one inch long or less; very irregular as to cutting, but generally flabellate or sub-pinnate in general outline; cut throughout into simple or forked linear pinnules, a half to one inch long, one line broad, and with one central vein in each; the main rachis when present winged like the other segments. Margin slightly toothed, with a hair point on each tooth. Involucre terminal on the upper pinnules, and quite sunk into the lamina, with short round spreading lobes.

This species is a native of the Mascarene and Polynesian islands, and is given in *Synopsis Filicum* as a Cape plant on Dr Brown's authority; but it has not been found by any collector since, and no Cape specimen exists in the Colonial Herbaria, nor is it in Kew Herbarium from the Cape, and Christensen excludes it.

Can it have originated from small barren plants of *Hymenophyllum Marlothii* Brause?

My description and figure are from Samoan specimens kindly forwarded to me from Kew.

3. TRICHOMANES MONTANUM Hk.

Plate 2. Fig. 1. Nat. size. b Margin and hairs, magnified;
c Involucre magnified.

Rhizomes long, slender, and coated with short black shag. Fronds sessile or almost so, glaucous green, membranaceous, very irregular in outline, sometimes linear-oblong and sinuate, more frequently obovate from a cuneate base, deeply pinnatifid into rounded, irregular pinnules, more or less wavy at the margin, and with frequent blunt lobes or teeth, crowned by two or more sessile hairs arranged stellate fashion. Fronds a half to one and a half inches long, a quarter to three-quarter inch broad, and bearing the sori terminal on the veins in the upper part. Involucre quite exserted, tubular from a contracted base, and having two large semi-circular lobes at the mouth. Receptacle twice as long as the tube, but bearing capsules only on its lower half. The veins are pinnately arranged, but numerous; spurious venules exist, generally leading up to the tufts of hairs.

Var. *QUERCIFOLIUM* Hk. and Gr. (Plate 2, Fig. 2) is larger, with upper pinnae three-quarter inch long, and more or less pinnatifid again, but grows among the other, and seems only to consist of more luxuriant specimens.

In our first edition *T. montanum* was named *T. pusillum* Sw.

Our *T. montanum* and *T. erosum* are evidently very closely related, and may possibly, when known in growth, be passable as forms of one species; Kuhn considers our present plant distinct from the South American *T. pusillum* Sw., and places it in another South American species, *T. reptans* Mett., var. *major* Mett. Christensen maintains both these as South American but places our plant in *T. montanum*, which he considers also tropical American as well as Natalian.

T. montanum. Hk. *Ic. pl.* t. 187, 1837; C. Chr. *Index Filicum*, 645.

T. pusillum Swartz. Hk. and Bkr, *Syn. Fil.* 77; Wood's *Natal Ferns*, p. 6; Sim, *Ferns of S. Africa*, 1st ed., p. 54; Wood's *Hand-book of the Flora of Natal*, 166.

T. quercifolium. Hk. and Gr. *Ic. Fil.* tab. 115; Hk. and Bkr, *Syn. Fil.* 465.

T. Robinsoni Hk. Bak. *Jour. Linn. Soc.* 9, 339.

T. reptans Mett. Var. *major* Mett.; Kuhn, 37.

Natal.—On damp rocks in the up-country districts. Inanda (Wood), Krantzkop, Zwaartkop, Maritzburg, Noodsberg, Nottingham (McKen), Krantzklouf, Umpumulo (Buchanan).

Transvaal.—Sabie-hoek forest (Burt-Davy, 1525 a).

4. *TRICHOMANES EROSUM* Willd.

Plate 2. Fig. 3. Nat. size. b Involucre, enlarged. c Part of frond, enlarged.

Mr J. M. Wood writes me—"In 1887 I gathered a *Trichomanes*, which I at the time took for *T. quercifolium*, plants of which I wanted for a correspondent at home. It was put into a small tin and posted without examination, reached home in good order, and was found not to be *quercifolium*. I much regret I have no specimen. My correspondent wrote me, July 28, 1887—"It is exactly like some which were sent me from Singapore as *T. muscoides*, so I sent a bit to Kew. Mr Baker says it is certainly not *quercifolium*, nor is it typical *muscoides*, so he calls it a variety of the latter'." Consequently in my first edition this was named *T. muscoides* Sw., var.

Christensen does not maintain *T. muscoides*, and finds Baker's description in *Syn. Fil.* to include three species, the African plants being placed in *T. erosum* Willd., which he quotes from West tropical Africa only. Dr J. Medley Wood in his *Handbook of the Flora of Natal*, 1907, includes *T. muscoides* Sw., which he describes "Frond simple, entire or bluntly lobed," and adds "A variety of this species was found by the writer on wet rocks, Ungoya forest, Zululand. Not seen since." This is evidently the locality referred to in the letter quoted above.

T. erosum is distinguished from *T. montanum* by having the involucre sunk into the frond with only the mouth free, and that surrounded by a rim, but hardly two-lipped. The frond, like that of *T. montanum*, varies considerably in outline; sometimes lanceolate lobed; more frequently when full sized obovate or oblong, with a cuneate base; a half to one inch long, a quarter to half inch broad, with a slender stipe a half inch or more long, and is either entire or divided along the margin into several short rounded lobes. Sori terminal on the veins in the upper lobes, sunk entirely into the lamina with a free spreading rim, hardly two-lipped. When young the fronds are set with simple or stellate hairs which soon disappear. The stipe is continued through the frond as a strong mid-rib, pinnately forked into the lobes, and the strongest again forked or pinnate. Besides these veins there are numerous parallel venules not connected with these primary veins, but connected along the margin by a more or less distinct marginal vein. The above description and figure are from specimens from Fernando Po, kindly forwarded to me from Kew.

In the absence of South African specimens this species is included here with doubt, the difference between it and *T. montanum* being not greater than the variation which occurs within one tuft of *T. montanum*.

Genus 2. *HYMENOPHYLLUM* Smith.

Very delicate little plants, with creeping, and generally matted, slender rhizomes, growing in tufts on stones or trees,

where there is constantly a saturated atmosphere. Fronds pellucid, consisting mostly of winged veins. Involucre terminal on some of the pinnules, composed of two flattened or concave valves, connected at the base, and containing between them the prolonged apex of the vein, which becomes an elongated receptacle, surrounded by capsules on all sides, and often with a point extending beyond them. Capsules flattened, surrounded by an obliquely transverse entire ring, and bursting irregularly. The genus contains about 235 species, mostly tropical or subtropical.

Key to the species :

- § Frond glabrous, not toothed.
 - 5. *H. fumarioides*, rachis winged, frond bipinnatifid, pinnules wide.
 - 6. *H. inaequale*, rachis not winged, frond tripinnatifid, pinnules narrowly linear.
- §§ Frond ciliated and hairy.
 - 7. *H. Marlothii*, rachis winged, frond ovate-triangular, clothed with stellate hairs.
 - 8. *H. ciliatum*, rachis winged above, frond oblong-acuminate, ciliated.
 - 9. *H. lineare*, rachis not winged, frond linear lanceolate.
- §§§ Fronds toothed at the margin. (*Leptocionium*, Presl.; and v. d. Bosch.)
 - 10. *H. tunbridgense*, frond triangular, tripinnatifid, rachis winged upward.
 - 11. *H. uncinatum*, frond linear lanceolate, 2—3-pinnate, rachis not winged.

5. HYMENOPHYLLUM FUMARIOIDES Willd.

Plate 3. Fig. 2. Nat. size. b Pinnule and involucre, enlarged.

Rhizome very slender, black. Stalk one inch long, slender. Frond pinnate, one to four inches long, four to eight lines broad at the base, tapering upward, pendent from the top of the stalk. Rachis winged for most of its length, pinnae neither toothed nor hairy at the edge, lower side undivided, upper side with three to five blunt pinnules, each one to three lines long, one line broad; upper pinnae simple or forked, involucre inflated, wider and shorter than in the other species, lobes often one line broad, a half line long, divided to the lamina, and light coloured.

Sori terminal on the upper pinnae, or on the pinnules nearest the rachis lower down.

Some of the Table Mountain specimens are much larger than usual, four inches long, a half inch wide, and tapering below; others one inch wide, and deltoid, but all having the involucre as wide as, or wider than, the segments.

H. fumarioides Willd. *Sp.* 5, 526, 1810; Schl. *Adum.* 56 (tab. 35, ined.); Kunze, No. 114; Kuhn, *Fil. Afr.* 39; C. Chr. *Index Filicum*, 361.

H. rarum. (R. Brown in *Prod. Flor. Nov. Holl.* 159); Hk. and Bkr, *Syn. Fil.* 58; Pappe and Rawson, 137; Sim, *Ferns of S. Africa*, 1st ed., p. 47.

H. Thunbergii. *Pr.* 1843; Ecklon (teste Kuhn, but not Schl. nor Kunze).

H. natalense. V. d. Bosch, *Syn. Hym.* 46.

H. Zeyheri. V. d. Bosch, 1859.

H. tabulare. V. d. Bosch.

H. flabellatum. Kaulf.

H. capense. Schrader, *Gött. Gel. Anz.*, 1818, p. 919.

South Africa and its islands.

This was formerly included in *H. rarum* R. Br., but Christensen confines *H. rarum* to Australasia and revives the name *H. fumarioides* for specimens from South Africa and African islands only.

West.—Table Mountain and Devil's Mountain, 2300 feet (Bolos), Genadendal, Hottentots' Holland (Lady Barkly), Sir Lowry's Pass (Schlechter, 7838); Worcester (Miss Doidge).

East.—Van Staden's River (Ecklon, Drège), Howison's Poort, Blockhouse Kloof, and Dassie's Kranz, Grahamstown (Dr Atherstone).

Kaff.—Above Perie Mission Station.

Natal.—Collected by Gueinzus, but not found by Buchanan or McKen, though the latter gives as recorded localities, Fort Buckingham, Kranz Kloof.

Transvaal.—Houtbosch, 6800 ft (Schlechter, mixed in his 4758, *Lycopodium gnidioides*).

6. HYMENOPHYLLUM INAEQUALE (Poir.) Desv.

Plate 4. Fig. 2. Nat. size. b Part of frond, enlarged.

Rhizome slender, wide creeping, wiry. Frond three pinnatifid, deltoid, three inches long, one to two inches broad, on a wiry stipe one to two inches long. Rachis zigzag, slightly

winged upward, entirely without wing in the lower half, and bearing alternate pinnae a third to half-inch apart. Pinnae deltoid; the lower, which are largest, one inch long, and a half-inch broad at the base; cut to the slightly-winged rachis into three to four pairs of pinnatifid pinnules with four to five linear segments, those above gradually less divided, and with the pinnules linear and undivided. Pinnules (or segments) half a line broad, one to two lines long, distant, blunt, and with entire margins. Sori terminal on the pinnules of the upper pinnae, about as broad as the pinnule, hardly longer than broad, with roundish triangular valves cut about halfway down. Not unlike *H. tunbridgense*, but with entire margins and terminal sori.

H. inaequale (Poir.). Desv. *Prod.* 335, 1827; Kuhn, *Fil. Afr.* 40; C. Chr. *Index Filicum*, 362.

H. gracile Bory. Hk. and Bkr, *Syn. Fil.* 58; Sim, *Ferns of S. Africa*, 1st ed., 48.

Bourbon, Mauritius, Madagascar, and Natal.

This species was till recently only known from South Africa by specimens at Kew in the Rawson Herbarium, from Pietermaritzburg, Natal (Sanderson, 1863), which I have been unable to see, but it is included in Swynnerton's list from Mt Pene, Rhodesia (7000 ft), as his 6016, and a small frond, not fertile but apparently of this species, was sent me from Mazoe, Rhodesia, by Eyles as his 359, from 5200 ft alt.; description and figure are from Mauritius specimens kindly forwarded to me from Kew.

7. HYMENOPHYLLUM MARLOTHII Brause.

Plate 4. Fig. 1. Nat. size. B Stellate hair, magnified.

Rhizome long, running, slender. Stipe one inch or more, hairy above. Frond two to three pinnatifid, one to six inches long, three-quarters to two inches broad at the base, ovate triangular, and set all over with numerous brown, stellate, stalked hairs. Rachis winged throughout; upper pinnae simple or forked, often one inch long and undivided; lower pinnae pinnately cut nearly to the mid-rib, into three to five linear-oblong pinnules, two to four lines long, one line broad.

Sori not seen by us, but Col. Brause states that they are quite distinct from those of *H. obtusum*. Some of the Table Mountain specimens are four to six inches long (including stipe), two inches broad, and with lower pinnae two-pinnatifid, and as large as the whole frond usual size. A barren specimen from Knysna collected by Miss Rex, and marked in Herb. Gub. *H. lineare*, is evidently this species, but is hairy on one side only, while the Table Mountain plant is hairy on both sides. A further specimen from Knysna (T. H. Rex, 834, Sept. 1909) is hairy on both sides.

The Table Mountain locality is mentioned in first edition of *Syn. Fil.* under the name of *H. obtusum* Hk. and Arn., but omitted in the second edition, where Sandwich Islands is the only locality given. It is also omitted by Kuhn, but he credits to the Cape the very closely allied *H. aeruginosum* Carm.

Lady Barkly distributed many specimens from Table Mountain, and the exact localities in Skeleton Ravine and Disa Gorge are well known to several Cape Town botanists. Marloth also records it from Jonkershoek.

In Mr Marquardt's fern grotto, plants of this species originally from Table Mountain grew well. From Mrs Young I received a few fronds of this, mixed among *H. tunbridgense*, but without locality. Her specimens are mostly from Kaffraria and Natal.

Christensen maintains *H. obtusum* from Hawaii and New Guinea, but includes the Cape plant in *H. ciliatum* Sw.

H. Marlothii Brause, *Fedde Repert.* II. 112 (1912).

H. obtusum (Hk. and Arn.). Lady Barkly's List, 195; Sim, *Ferns of S. Africa*, 1st ed., 49.

8. HYMENOPHYLLUM CILIATUM Swartz.

Baker's description in *Syn. Fil.* is: "Stem 1—2 in. long, ciliated and decurrently winged above; frond oblong acuminate, tripinnatifid, 2—6 in. long, 1—2 in. broad at the centre; main rachis broadly winged throughout and ciliated; lower pinnae oblong or rhomboidal, with a broad central undivided portion, and numerous erecto-patent simple or forked

ciliated linear segments 2—3 lines long; sori 2—12 on a pinna, placed at the end of the lateral segments on both sides; involucre immersed, sub-orbicular; valves divided about half-way down, and conspicuously ciliated." He gives the distribution as tropical America, East Himalayas, New Zealand, West tropical Africa, and in the east in the Zambesi district and the islands, and adds: "The African plant well known under the name of *Boryanum* seems quite to coincide with the American *ciliatum*," and he also refers to a form with fronds a foot long from West tropical Africa under the name *H. splendidum*.

Christensen gives "tropical and South Africa and islands" among other localities for it.

The difference between this and *H. Marlothii* appears to be that this is *ciliated* whereas *H. Marlothii* is densely clothed with stellate hairs. It also differs in having a broad central undivided portion in the lower pinnae. I have seen no specimen answering to this, but a somewhat modified description might make it include *H. Marlothii*; in any case, further knowledge of the two is required before their connection or difference can be definitely settled.

9. HYMENOPHYLLUM LINEARE Sw.

Plate 5. Fig. 2. Nat. size.

Frond pinnate, elongating from the point, each season's growth lanceolate in outline, widest at the middle, and tapering to both ends; about three inches in length, and a half to one inch broad. Three to six of these season's growths or fronds, placed one above another, are sometimes to be found, and, as they are very slender, wavy, and flaccid, they form a tangled mass in growth. Rachis not winged, but ciliated like the rest of the frond. Pinnae five to eight lines long, three lines broad, cut to a winged mid-rib, into three to seven simple, or forked, pinnules, which are oblong, one line broad, one to one and a half lines long. Pinnae closely set, more or less overlapping. Sori terminal on lower pinnules, with ciliated lobes.

H. lineare Swartz. Schrad. *Jour.* 1800; Hk. and Bkr, *Syn. Fil.* 66; Sim, *Ferns of S. Africa*, 1st ed., 50.

H. elegans Spr. Hk. *Sp.* 1, 91.

H. trifidum. Hk. and Gr. *Ic. Fil.* t. 196.

Found in the West Indies only. The closely allied *H. capillare* Desv. (Kuhn, *Fil. Afr.* 38) is from African islands. I have seen no South African specimen, but Lady Barkly and Buchanan give "Macamac, Transvaal Gold Fields, specimens recently sent by Mr Ayres." No further record has arrived. My description and figure are from imported specimens.

10. HYMENOPHYLLUM TUNBRIDGENSE Smith.

Plate 3. Fig. 1. Nat. size. c Do., grown in shade. b Pinnule and involucre, enlarged.

Rhizome slender, black, short-jointed. Frond tripinnatifid, little more than a series of winged veins, very irregular in outline, often triangular, six to eight lines long, four to six lines broad, but frequently lanceolate or ovate-lanceolate, with the lower pinnae more or less reduced, and ranging up to four inches in length, one to one and a half inches broad. Stem not winged; rachis narrowly winged in the upper half; pinnae bipinnatifid, with a winged rachis, or in dwarf-grown specimens flabellate. Pinnules linear, one-third of a line broad, strongly toothed. Sori on the lower pinnules of the mid-pinnae, solitary, terminal on side pinnules. Involucre cut to the base into two flattened, circular, semi-divergent, strongly toothed lobes; between which is the globular mass of capsules on a short receptacle.

This is a little beauty, growing in dense masses several feet square, on or near the solid rock in the Forest region. During dry weather the masses of this look like carpets of nearly black shrivelled moss, but when transferred to a moist, close position, and kept constantly damp (as in Mr Marquardt's fern grotto, Cape Town), it develops into a much larger and more delicate plant, of a pellucid light green colour, quite unlike its former self, and unequalled, in fragile beauty, by any other fern we have.

In the Government Herbarium are specimens with fronds three inches long, one inch wide, on top of leafless stalks six inches long; more divided than the ordinary form, and with very large involucre. Kunze mentions a form which he calls var. *β. pedunculatum*, having fertile segments attenuate to the point, and the involucre smaller and oval. All these forms appear to be dependent on conditions of growth, and can hardly rank as varieties.

H. tunbridgense. Smith in Sowerby, *Engl. Bot.* t. 162, 1794; Thunb. *Flora Cap.* 737; Schl. *Ad.* 55; Schk. *Fil.* 134, tab. 135 d; Kunze, *Linnaea*, 10, 554; Pappe and Rawson, 44; Wood's *Natal Ferns*, 5; Hk. and Bkr, *Syn. Fil.* 67; Kuhn, *Fil. Afr.* 42; Sim, *Ferns of S. Africa*, 1st ed., 50. C. Chr. *Index Filicum*, 369.

H. Dregeanum. Presl. 1843.

Leptocionium. V. d. Bosch.

Found in most parts of the world, from the tropics to Norway. In South Africa widely distributed, and not uncommon in the forest, but often overlooked, or passed as *Trichomanes pyxidiferum*, which eastward is the more common plant, though in the west *H. tunbridgense* takes its place.

West.—Table Mountain, Hottentots' Holland, etc. (P. and R.), Kirstenbosch, 1500 feet (Bolus), Tulbagh (Ecklon), Knysna, Koratra (Drège).

East.—Bedford (Holland).

Kaff.—Perie Mountain, and Frankfort Hill, toward the top.

Orange Free State.—Without locality (T. Cooper, 1862).

Natal.—Kranzkloof, Maritzburg, Noodsberg, Karkloof (McKen); Um-pumulo (Buch.); Midland and upper districts, plentiful (Wood).

H. WILSONI Hk. differs from *H. tunbridgense* in having pinnules on the upper side only of the pinnae, and in the involucre being entire. The two generally grow in company, and intermediate forms occur connecting them. In Europe they are regarded as distinct varieties, but I have seen nothing here answering to *H. Wilsoni*; nor is it included by Pappe and Rawson, Lady Barkly, or McKen, though Kuhn includes it from the Cape and Natal under the name of *H. peltatum* Desv.; and Buchanan finds it mixed with *H. tunbridgense* in Natal, while the South African *H. Meyeri* Presl. is founded on it. Our illustrations are both of typical *H. tunbridgense*.

11. HYMENOPHYLLUM UNCINATUM Sim. (New species.)¹

Plate 5. Fig. 1. Nat. size. B Pinna, enlarged. C Involucre, enlarged.

Frond six to nine inches long, three-quarter to one inch wide, linear lanceolate, tapering somewhat to both ends, mostly 2-pinnate, firm in texture, rather coriaceous, glabrous, and with a short wiry stipe. Rachis rigid, wiry, glabrous, not winged. Pinnæ alternate, two to four lines apart, simply pinnate or with some pinnules simply forked. Pinnules four to eight, two to four lines long, half line wide, strongly nerved and sharply toothed, rounded at the apex, and free or slightly winged at the base; pinnæ somewhat secund, each pinnule recurved, giving a densely hooked appearance to the frond. Sori replacing the inner pinnules of upper pinnæ, deeply 2-valved, free from lamina, oblong, rounded and slightly ciliated at the apex; receptacle not exserted. A distinct and beautiful species.

Table Mountain, Cape Town. Theo. Kässner, 1007. Dec. 1891 (in the Transvaal Museum Herbarium).

In my first edition (page 51) reference is made to a barren specimen of this in the Government Herbarium, Cape Town, which in the absence of more complete material was placed under *H. tunbridgense*, but the specimens now seen show it to be quite distinct.

¹ 11. HYMENOPHYLLUM UNCINATUM Sim. (Species Nova.)

Tab. 5. Fig. 1. Mag. Nat. B Pinna, amplific. C Involucre, amplific.

Folia 6—9" longa, $\frac{3}{4}$ —1" lata, linearia-lanceolata, sursum deorsum paullum attenuata, plerumque bipinnata, textu firma, subcoriacea, glabra, stipiti brevi, rigidulo imposita; rachis rigidula, glabra, non alata; pinnæ alternantes, $\frac{1}{2}$ — $\frac{1}{3}$ " distantes, simpliciter pinnatæ sive pinnulis nonnullis simpliciter furcatis; pinnulæ 4—8, $\frac{1}{8}$ — $\frac{1}{4}$ " longæ, $\frac{1}{2}$ — $\frac{1}{4}$ " latae, fortiter nervatæ atque argute dentatæ, apice rotundatæ, basi liberae seu tenuiter alatæ; pinnæ subsecundæ, pinnulis singulis recurvatis, frondi speciem dense uncatam præbentibus; sori pinnulas interiores pinnarum superiorum loco moventes, alte bivalvi, liberi a lamina, oblongi, apice rotundati ac tenuiter ciliati; receptaculum non exsertum.

Species distincta et pulchra. Cape Town, in Mont. Tab. Theo. Kässner, 1007. Dec. 1891.

SUB-ORDER II. CYATHEACEAE.

Genus 3. *CYATHEA* Smith.

Tree ferns with stout erect stems several feet in height, and mostly with three—to four—pinnate fronds. Sori several on a pinnule, at first completely enclosed in the involucre, which bursts at the top, and remains under and around the capsules. Capsules surround a raised globose receptacle. This genus is credited with about 180 species, mostly of similar habit, distributed through the tropics and a short distance beyond them. When better known, the number will be much reduced. Several are African, but I believe only one extends to South Africa.

12. *CYATHEA* DRÈGEI Kunze.

Plate 6. A Plant much reduced. B Part of frond, natural size. C Part of frond of young plant. D Pinnule of tripinnate frond. E Sorus, with capsules. F Involucre after capsules are gone.

Stem erect, tree-like, generally six to seven feet high, but often ten and sometimes fifteen feet in height, and eight to twelve inches in diameter. Fronds three to five feet long, one to two feet broad, arranged in a crown at the top of the stem, more or less arching, and with the points turned upward. Fronds usually three-pinnate, firm in texture, dark green above, lighter on the under surface. Crown densely set with narrowly lanceolate shining brown scales, one to one and a half inches long, one line broad. Base of the stipe set with short soft prickles, which become harder and more apparent when the frond withers. Rachis and underside of pinnules more or less densely covered with brown woolly tomentum, which often disappears from old barren fronds but is more abundant when fertile, and then mostly among the sori. Stipe also paleaceous at first. Pinnae twelve to twenty pairs, pointed, from a base three inches broad; lower pinnae reduced, and frequently a pair of small pinnae similar to the others occur close to the crown. Pinnules lanceolate, widest at the base, pointed, cut to or near to the rachis into oblong subfalcate segments, which are bluntly pointed and

either entire or toothed. Sori at the base of the segments, one to three pairs on each. Capsules numerous from a globular receptacle, involucre remaining saucer-like, with an irregular margin, under the mass of capsules. Stem usually single, but sometimes branched into two or more.

This splendid tree fern grows generally on exposed and bare hillsides, but is sometimes found among small bushes, when the stems are longer and more slender. The young plants require the shelter obtainable at the rise of a water-course, but when fully grown they stand erect, exposed to the full sun, and not unlike Cycads at a distance. When in this kind of situation they exhibit the stout stem and short arching tomentose fronds shown in our figure, but when in a deep hollow or in shelter the fronds are more upright in habit and nearly glabrous. Many stems of this fern have been exported to Europe and travel well, but it requires very careful treatment to keep an old stem healthy for many years after it is transplanted from its native damp uplands down to the drier country below. It is easily cultivated if begun small, but if lifted when fully grown generally lives but one year. The small seedling plants very much resemble the ordinary British form of *Nephrodium filix-mas*, and the fronds are much less cut than in mature plants. Age and exposure continue to make much variation in the cutting of the frond and amount of tomentum present. I feel satisfied that this has led to too many species being described, and that if *C. Manniana* Hk. and *C. Thomsoni* (Baker, *Jour. Bot.* 1881, 180) are distinct from *C. Drègei*, they have not yet been found south of the Zambesi. Swynnerton's list includes all three, as also does Eyles' list (from the same specimens), but I have examined these specimens, and cannot agree that they differ from the usual forms. The description in *Syn. Fil.* of *C. Drègei* "frond bipinnate, pinnules deeply pinnatifid" is misleading, though it does occur under certain conditions, for the more usual condition is 3-pinnate. Forms of *C. Drègei* occur together in Natal which are evidently but indescribably different, probably through age or food supply.

Cyathea Burkei Hk. seems to be the same thing grown

under shade, and consequently of less firm texture, and with the lamina of the frond more expanded, less fertile, and less woolly. Christensen maintains *C. Manniana* Hk. from West tropical Africa, and *C. Thomsoni* from Nyassaland.

Cyathea Drègei. Kunze, *Linnaea*, 10, 551; Pappe and Rawson, 11; Kuhn, *Fil. Afr.* 164; Hk. and Bkr, *Syn. Fil.* 21; Sim, *Ferns of S. Africa*, 1st ed., 57; C. Chr. *Index Filicum*, 191.

C. Burkei. Hk. *Sp.* 1. 23.

C. Drègei. Kze, var. *Burkei*, Pappe and Rawson, 11.

Known only in Africa, and extending from Kaffraria to or beyond the Equator, from 1000 feet alt. upward; native names "Isihihi" and "M'panga."

East.—Knysna, T. H. Rex, 836.

Kaff.—Katberg (Holland); Bazija, 2500 ft (Baur, 161); Pondoland (Drège); Magua Falls, East Pondoland (Sim); Toise River, Thomas River, Dohne Hill, Hogsback, Cathcart, etc. (Sim); Engcoba (McLoughlin).

Natal.—Umzimkulu (Wood); Thabamhlope (Sim); Shafton, Howick (Mrs H. Hutton, 134); Buccleuch (W. Leighton); Pinetown, Murcheson Flats, Hill Crest, Greytown, and abundant from Westville and Umbilo Falls to the Drakensberg, always on sour-veld.

Transvaal.—Magalisbergen (Zeyher, 1862), Macamac (McLea), Houtboschberg, 6700 ft (Schlechter, 4460), Barberton Mountains (Burt-Davy, 329), Belfast (R. Leendertz, 2776), Kloofs everywhere (Burt-Davy, 220); Woodbush (Mrs R. Pott, 4628).

Rhodesia.—Penhalango (Mrs Bennett); Umtali (Holland); Mt Pene, 6500—7000 ft (Swynnerton, 816); Mt Pene, 7000 ft (Swynnerton, 6030; named *C. Manniana* Hk.); Chirinda, 3800 ft (Swynnerton, 817; named *C. Thomsoni* Bkr); Moramballa Mountains (Waller, Livingstone, Kirk); Matopo Hills, near American Mission, by streams (Miss Gibbs, 292). "Not uncommon in ravines and by streams with high protecting banks. Matopo Hills, 5000 ft; Eyles, No. 72." (Eyles' list.)

Genus 4. *HEMITELIA* R. Brown.

Tree ferns with long stems, and large spreading fronds in a crown at the top. Capsules surrounding a conical receptacle, and subtended by the small involucre, which is like a scale under the under side of the sorus, with an irregular broken margin. A small genus of about 58 species, of which two are African, and other two have been found in Madagascar. The other species are distributed through the tropics.

13. *HEMITELIA CAPENSIS* (Linn. fl.) Klf.

Plate 7. Plant much reduced. b Pinnule, nat. size. d Capsule, magnified. c Abnormal pinna, nat. size. e Sorus. f Section of same. g Involucre.

Stem erect, tree-like, five to fifteen feet in height, three to six inches in diameter, surmounted by a crown of most gracefully arching sub-membranaceous fronds, six to nine feet long, two to three feet broad, 3-pinnate or 3-pinnatifid, and tapering to both ends. When young the stipe and rachis are thickly set with short lanceolate, dark brown spreading scales, and the mid-rib of the pinnules and segments with shorter ovate pointed concave scales. As the frond gets older, these partially disappear. Pinnæ twelve to eighteen inches long, four to six inches broad at the base; pinnules sessile, two to four inches long, half to three-quarter inch broad, cut almost to the mid-rib into strongly toothed, pointed, narrowly oblong segments, which bear one sorus each, placed on the lowest veinlet on the upper side.

Fronds have a bare stipe of two feet or thereby, at the base of which arise a pair of abortive or skeletonised pinnæ (fig. c), generally without any lamina, or with only a very little, but green and flaccid when young, and not resembling in the slightest degree the pinnæ above. These abortive pinnæ were mistaken by early botanists for distinct epiphytal ferns, and are believed to have been the *Trichomanes incisum* of Thunberg, though he distinguishes by the fructification the genus *Trichomanes*, of which this, which bears no sori, was his only species; while *Hemitelia* is not included at all in his flora, unless his *Polypodium capense* be intended for it, and, if so, it is rather strange that the tree-like *caudex* should not be mentioned. *Trichomanes cormophyllum* Klfs is another name for the abnormal pinnæ.

Sori one line long, on a conical receptacle, and subtended on the side next the mid-rib by a small ovate or lobed scale, or involucre, hardly large enough to show from under the capsules, and frequently absent or falling off early, in consequence of which this species was formerly placed in the genus *Alsophila*, in which there is no involucre. Specimens from

Bazija have sori much larger than usual, and sometimes two to a segment, but are otherwise the same as the ordinary form.

- Hemitelia capensis* R. Br. (Linn. fil.). Klf., *Enum.* 253, 1824; Schl. *Adum.* 55; Kunze, *Linnaea*, 10, 552: 23, 257; Pappe and Rawson, 11; Kuhn, *Fil. Afr.* 162; Hk. and Bkr., *Syn. Fil.* 29; Sim., *Ferns of S. Africa*, 1st ed., 59; C. Chr. *Index Filicum*, 348.
Alsophila capensis J. Smith. Hk. *Sp. Fil.* 1, 36, 1842.
Amphicosmia riparia. Gardner, *Lond. Jour. Bot.* 1, t. 12.
Polypodium capense Linn. Thunb. *Prod.* 172; Thunb. *Flora Cap.* 735 (teste Kuhn).

In moist ravines in shade all through the upper part of the forest region, especially by waterfalls or perennial dashing streamlets, more common inland than on the coast. In Natal in midland districts only, at 2000 to 3000 feet altitude. Found also in Mascarenes and S. America.

West.—Table Mtn, Kerstenbosch, Paradise (Ecklon), Dutoitskloof (Drège), Swellendam (Zeyher), Knysna.

East.—Krakakamma; Fern Kloof, Grahamstown (Atherstone); Bedford, etc.

Kaff.—Bazija (Baur), Katberg (Smith), Perie, Chumie, Dohne Hill.

Natal.—From Inanda to Umpumulo (Buch.), Noodsberg (McKen), Benvie (Marriott), Buccleuch (W. Leighton).

Transvaal.—Barberton, 5000 ft. (G. Thorncroft, 371 and Burt-Davy, 4559.)

Letters from Rhodesia speak of a tree fern with tall, slender stems, but no fertile specimen has come to hand.

SUB-ORDER III. POLYPODIACEAE.

**Woodsieae*.

Genus 5. *WOODSIA* R. Brown.

Small herbaceous ferns, with the sorus at first enclosed in the round involucre, which bursts at the top into several irregular more or less ciliated lobes. A small genus of about 25 species, of which only one species is African.

14. *WOODSIA BURGESSIANA* Gerr.

Plate 44. Fig. 2. Nat. size. b Pinnule of large frond. c Involucre and capsules, enlarged. d Lobe of involucre, magnified.

Crown tufted; fronds lanceolate, pinnate, four to eight

inches long, one to one and a half inches broad, thinly herbaceous in texture, with longish glandular hairs on the rachis, and shorter hairs on both sides of the pinnae, but most abundant on the under surface. Pinnae sessile, bluntly oblong from a wide base, cut halfway to the mid-rib into rounded or oblong toothed lobes, generally bearing two to four sori each, and sometimes with the margin infolded over the sori. Sori of a few capsules, enclosed in a thin globular involucre, which bursts from the top irregularly into three to five lobes. This species is placed in the *Syn. Fil.* in the division *Physematium*, distinguished by having a large involucre, and not ciliated at the edges. In the former character it agrees, but I find the lobes ciliated more or less as in fig. d. Several larger and more deeply cut specimens have been seen, and one frond sent by Mr Wood is fifteen inches long, three inches broad, with pinnae largest at the middle, there one and a half inch long, tapering from a base three-quarter inch broad, with about eight pairs of pinnules (fig. b) cut to the rachis a quarter to three-eighths inch long, one-eighth inch broad, and having about five pairs of lobes, each toothed, and bearing a sorus; whole plant shortly and thinly villose.

W. Burgessiana Gerrard. Hk. and Bkr, *Syn. Fil.* 48, 1866; Kuhn, *Fil. Afr.* 209; Sim, *Ferns of S. Africa*, 1st ed., 61; C. Chr. *Index Filicum*, 656.

Under rocks, in South Africa only, and always at high altitudes.

Kaffraria.—Eastern Provinces (Lady Barkly); Windvogelberg, Cathcart, 5000 ft, 1897 (T. R. Sim); near Ugie, 5100 ft (Flanagan, 2672); Insiswa, 6000 ft (R. Schlechter, 6526); Pot-River-Berg, Maclear, 5500 ft, Mch 1904 (E. E. Galpin, 6932).

Natal.—Tugela River; Lynedoch Farm, Nottingham (McKen); Lidesdale, Karkloof, Mount West, Drakensberg at Cathkin (Buchanan); Wellington, Rosetta, and in many places along the Berg (T. R. Sim). Orange Free State.—Near Van Reenen's (Prof. Bews).

Transvaal.—(Lady Barkly); Houtboschberg, 6500 ft (R. Schlechter, 4705).

Under the name *Woodsia mollis* J. Sm., McKen gives the description from *Syn. Fil.* of that species, and quotes as localities Bushman's River (Gerrard) and Drakensberg. This

seems to have been a mistake as it is not included by Buchanan, nor in *Syn. Fil.*; while Lady Barkly assumes it to be *W. Burgessiana*, and Christensen confines *W. mollis* to America. It may also possibly have been some cut form of *Ceterach cordatum* which occasionally approaches some of the Woodsias in appearance.

Genus 6. *CYSTOPTERIS* Bernh.

Small delicate ferns, having the sori covered by a scale-like indusium attached under the capsules on the lower side, and at first swollen, and turned hood-like over them, but afterwards burst at the point into several irregular lobes, and soon almost hid by the capsules. A small genus of 12 species belonging to the temperate zones, and represented in S. Africa by only one species.

15. *CYSTOPTERIS FRAGILIS* (Linn.) Bernh.

Plate 8. Nat. size. b Pinnule, slightly enlarged. c Do., much enlarged. d Indusium, much enlarged.

Crown tufted, or rhizome shortly creeping; stalks very tender and fragile, green and shining, and with a few scales at the base only. Frond lanceolate, three-pinnatifid, six to twelve inches long, two to three inches broad, glabrous, shining green, herbaceous, and very tender. Pinnae shortly stalked, widest at the base, more or less united toward the point, but at the base having several pairs of oblong pinnules, which are again pinnately divided into toothed lobes, each bearing one or more sori near the middle of the veinlets, subtended on the lower side by the scale-like, irregularly-lobed indusium, which is connected to the receptacle under the capsules by its wide base. Rachis slightly winged in the upper half. Occasional specimens (as R. Schlechter's 6638) get two feet long and six inches broad, and resemble in general appearance *Asplenium filix-femina*. The smaller size is more like *Asplenium Zeyheri*, but it is easily distinguished from both these by the shape of the indusium. This is known as the Bladder Fern, on account of the swollen and bladder-like appearance of the indusium in its younger stages. The

indusium being torn is not mentioned in *Syn. Fil.*, and the figure (tab. II. fig. 19) shows it ovate pointed; but it is similar to ours in the British plant as described in Sir J. E. Smith's *English Flora*, though in Sir W. J. Hooker's *British Flora*, 5th edition, and several later works, it is described differently.

Cystopteris fragilis (Linn.) Bernh. Schrad. *Neu. Jour.* 1806; Pappe and Rawson, 16; Kuhn, *Fil. Afr.* 144; Hk. and Bkr, *Syn. Fil.* 103; Sim, *Ferns of S. Africa*, 1st ed., 66; C. Chr. *Index Filicum*, 203.
Aspidium fragile Sw. Schk. *Ic. Fil.* tab. 54—56.

Almost throughout the temperate zones, and on high mountains between; growing in very close damp deep ravines, or by streams under thick bush, or under drip in open waterfalls.

East.—Bedford and Katberg (Holland), Kat River Mountains (Ecklon), Boschberg (MacOwan).

Kaff.—Above Perie Mission Station, and abundant in a rocky stream at Poutz' Forest, Izeli, 4000 feet alt.; Broughton, Molteno, 6300 ft (Flanagan, 1676); Engcoba (Flanagan, 2715).

Natal.—Greytown to Drakensberg (Wood), not under 3000 feet alt. (Buchanan); Umzinkulu, 4000 ft (R. Schlechter, 6638); Buccleuch (W. Leighton); Benvie, Karkloof (Marriott); Sweetwaters (Prof. Bews); Zwaartkop; Wellington, Rosetta; Giant's Castle, etc. (T. R. Sim).

Rhodesia.—Lo Magundi, near Hanyani River (H. M. Hole).

**** Aspidieae.**

Genus 7. *DRYOPTERIS* Adanson.

Stipe continuous with the rhizome, not jointed; fronds pinnate or decompose; pinnae not articulated; veins free, or those from neighbouring pinnules meeting; sori roundish or reniform (or in *D. africana* elongated); indusium usually present and kidney-shaped, attached by its sinus, but always absent in some species, and occasionally absent in some others.

A large genus of over 700 species, difficult to segregate satisfactorily; it includes what in our first edition were the species of *Nephrodium*, as well as some from *Polypodium* and one from *Gymnogramma*. Formerly *Nephrodium* was distinguished from *Polypodium* by having an indusium present, but in some species that character was found to be fugacious

or not constant, consequently these two genera could be found on the same frond. General habit has therefore been relied upon more in bringing together under *Dryopteris* some species with and others without indusium, as well as some with reniform sori and others with sori elongated. The genus is consequently less artificial but more difficult than formerly. From *Aspidium* it is distinguished by the venation, from *Leptochilus* by the latter having dimorphous fronds, and from *Polystichum* by the indusium when present being reniform, not peltate. The species are widely distributed, and among the most common ferns in South Africa.

Synopsis of the species :

§ Fronds pinnate or 2-pinnatifid, sori round.

16. *D. orientalis*. Rhizome long, slender; sori mostly one to each pinnule; veins free, simple.
17. *D. Bergiana*. Rhizome short, with sub-erect crown; sori numerous in the pinnules; veins free, simple; texture thin; lower pinnae reduced.
18. *D. patens*. Similar to *D. Bergiana*, except lower pinnae not reduced.
19. *D. mauritiana*. Pinnules not close; texture thin; veins simple; two or more pairs of veinlets from neighbouring pinnae meeting. Indusium present.
20. *D. mollis*. Pinnules close or overlapping; texture firmly herbaceous; stipe, rachis and pinnules villose; veins simple, several lower pairs from neighbouring pinnae meeting. Indusium usually present.
21. *D. gongylodes*. Frond pinnate, pinnae lobed; texture coriaceous, nearly glabrous, several pairs of veinlets from neighbouring lobes meeting. Sori near the junction of the veins. Indusium small, fugacious.
22. *D. prolifera*. Frond pinnate, pinnae lobed; veins from neighbouring lobes meeting; sori on the middle of the veinlet, often irregular. Indusium not present.
23. *D. silvatica*. Frond pinnate, pinnae lobed; veins from neighbouring lobes meeting; sori small, close to the mid-rib of the lobe; indusium not present.
24. *D. thelypteris*. Veins free, forked. Rhizome long, slender.

§§ Frond 2-pinnatifid, sori oblong or elongated.

25. *D. africana*. Indusium absent.

§§§ Frond 2-pinnate.

26. *D. zambesiaca*. Veinlets simple, sori medial, indusium fugacious.

§§§§ Frond 3-pinnatifid, or more cut. Veins free.

27. *D. elongata*. Lower pinnae larger than those above, with sharply toothed pinnules. Frond triangular, herbaceous.
28. *D. inaequalis*. Lower pinnae not larger than those above; frond ovate-lanceolate, herbaceous; pinnules sharply toothed.
29. *D. athamantica*. Fronds widest below, sub-coriaceous, and with bluntly toothed pinnules.
30. *D. Buchananii*. Fronds 3-pinnate, deltoid, herbaceous, with the rachis set with spreading hair-like scales.
31. *D. Lastii*. Fronds large, herbaceous, decompound, glabrous, deltoid; pinnules lanceolate, segments quarter-inch wide, cut into oblong toothed lobes.
32. *D. lanuginosa*. Fronds 3-pinnate, very large, villose on both surfaces, and with villose stipe and rachis. Indusium villose.
33. *D. crenata*. Fronds 3-pinnatifid, deltoid, small; crown clothed in red scales. Indusium reniform, but unequal sided.

16. DRYOPTERIS ORIENTALIS (Gmel.) C. Chr.

Plate 9. Nat. size. b Fertile pinnules, enlarged.

Rhizome long, creeping, slender, fibrillose. Frond herbaceous, ovate-lanceolate, two-pinnatifid, strongly and pleasantly scented, minutely pubescent on one or both surfaces, twelve to eighteen inches long, six inches broad, with a short pubescent stipe, which is articulated to the rhizome. Middle pinnae one-half to three-quarter inches broad, and about four inches long; lower pinnae rather shorter, all sessile, lanceolate acuminate, cut to very near the mid-rib into blunt, oblong pinnules, all entire except the lower ones, which are slightly toothed. Sori mostly in the upper part of the frond, one to each pinnule, terminal on the lower veinlet on the upper side. The pinnae have a line of white dots near the margin on the upper surface, from which the name has originated.

Dryopteris orientalis (Gmel.) C. Chr. *Index*, 281, 1905.

Nephrodium albo-punctatum. Desv. *Ann. Linn.* vi. 255; Hooker and Baker, *Syn. Fil.* 264; Wood, *Natal Ferns*, 27; Sim, *Ferns of S. Africa*, 1st ed., 173.

Aspidium albo-punctatum. Bory; Willd.; Kuhn, *Fil. Afr.* 124.

Lastrea albo-punctata. Presl; Moore's *Index*.

Aspidium leucosticton. Kze, *Linnaea*, 23, 301.

Arthropteris. J. Smith.

Polypodium pectinatum. Forsk, *Fl. Aeg.-Arab.* 1775.

Polypodium orientale. Gmel. *Syst. Nat.* 2², 1312. 1791.

Tropical Africa, and African Islands; rare. Old fronds turn yellow; few are fertile.

East.—Zitzikamma (R. Schlechter, 5979).

Natal.—Open rocks about two miles west of the Inanda, and immediately below Insusi Fall, only 2000 feet alt. (Buchanan); (Govt Herb. Cape Town and Natal, and Herb. Bolus, 3974); Noodsberg (Wood).

Rhodesia.—Borrowdale, Salisbury (H. M. Hole); Salisbury (Holland, Darling); Umtali (Mrs Bennett); Sebakwe, 4100 ft (F. Eyles, 390); Mazoe, 5000 ft, common on certain hill-tops (F. Eyles, 337 and E. Eyles, 8); Matopo Hills, Mtchabesi Valley (Miss Gibbs, 210); Chimani-mani Mts, 7000 ft (Swynnerton, 857); Near Victoria Falls (J. Sim).

(*DRYOPTERIS OBTUSILOBA* (Desv.) C. Chr.

A Natal fern, without or almost without indusium, which in Hk. and Bkr, *Syn. Fil.*, stands as *POLYPODIUM OBTUSILOBUM* Desv., had been stated formerly by Baker to belong to one of the forms of *Neph. conterminum*, and on this authority is included in Lady Barkly's list under that name; but it is likely that Mr Baker used that name in the wide sense of the *Conterminum* group, as used in his *Synopsis Filicum*, which includes *N. Bergianum* Baker. At all events, Lady Barkly's specimens from Buchanan, and all the other specimens I have seen so named, or named *Polypodium obtusilobum*, are identical with the larger growing forms of *D. Bergiana*, and do not answer so well to Baker's restricted species *N. conterminum* Desv.; and Mr Baker wrote me that he does not know *N. conterminum* from South Africa. The only difference from *D. Bergiana* is that they have no indusium, and even that is a poor distinction, as in almost every case the specimens are in the advanced condition in which the more or less fugacious indusium is often absent, or can be seen only with difficulty. *D. Bergiana* is however often

without indusium, or almost so, even when young; and Schlechtendal founded thereon his *Polypodium Bergianum* (*Adum.*, p. 20, tab. 9), in which he was followed by Kunze, and by Pappe and Rawson; though Kunze remarks that this and his *N. patens* grow in company.

Though Schlechtendal describes and figures his plant as having no indusium, *Nephrodium Bergianum* Baker, which has generally an indusium, is named from it, with *Polypodium* Schl. as synonym; while the plant without indusium is placed under *P. obtusilobum* Desv. Buchanan, on what he calls a common plant, remarks—"In the last edition of *Syn. Fil.*, *P. obtusilobum* Desv. is retained as a Natal species, and evidently with reason, for the involucre even when visible (which is seldom) is strictly rudimentary, and the sori as a whole show all the irregularity in shape and size of other species of *Phegopteris*."

Kuhn confines *P. obtusilobum* Desv. (*Aspid. Desvauxii* Mett.) to Madagascar, and rejects *N. conterminum* from the African continent; and I have seen no reason why either should be credited to South Africa.

This cannot be regarded even as a permanent variety of *D. Bergiana* Bkr., as sori with and without indusia occur on the same frond, and the same thing happens sometimes with *D. mollis*. Christensen maintains *Dryopteris obtusiloba* (Desv.) C. Chr. from Trop. Africa, Madagascar, and Mascarenes, but not from South Africa.)

17. DRYOPTERIS BERGIANA (Schlecht.) O. Ktze.

Plate 10. Nat. size. b Fertile pinnae. c Sorus, enlarged.

Crown procumbent or sub-erect, or sometimes elongated into a stout rhizome of several inches; slightly scaly. Frond lanceolate, one to five feet long, six to fifteen inches broad, thinly herbaceous, minutely villose, or sometimes nearly glabrous, with a villose rachis, and a round, green, villose stipe six to twelve inches long. Frond widest at the middle, and tapering gradually to both ends. Pinnae lanceolate, cut almost to the rachis, so that veinlets from neighbouring pinnules cannot meet. Pinnules oblong and rounded, or

obliquely blunt pointed, or falcate, sometimes closely set and overlapping, and in others one line apart. In large fronds the pinnules are a quarter inch broad, three-quarter inch long, and the lower one on the upper side sometimes larger, and then pinnatifid. Sori small, placed on the veinlets halfway between the mid-rib and the margin of the pinnules, often many in a pinnule; involucre small, fugacious, thus causing the confusion noted under *D. obtusiloba*. It differs from *D. patens* in having the lower pinnae reduced, and from *D. mauritiana* and *D. mollis* in the pinnae being cut to or below the lowest veinlets. *Aspidium prolixum* Willd., which is included in Burt-Davy's list of Transvaal plants, is presumably a large form of *D. Bergiana*, though *Dry. prolixa* (Willd.) O. Ktze, very closely related to *D. Bergiana*, is credited to Trop. Africa, Madagascar and India.

Dryopteris Bergiana (Schl.) O. Ktze, *Rev. Gen. Pl.* 2, 812. 1891; C. Chr. *Index Filicum*, 254.

Nephrodium Bergianum. Bkr, *Syn. Fil.* 269; Wood, *Natal Ferns*, 27; Sim, *Ferns of S. Africa*, 1st ed. 176.

Polypodium Bergianum. Schl. *Adum.* 20, tab. 9, 1825; Kunze, *Linnaea*, 10, 500; Pappe and Rawson, 39.

Aspidium Bergianum Mett. Kuhn, *Fil. Afr.* 127.

Lastrea Bergiana. Moore's *Index*, 1858.

Aspidium patens. Schl. *Adum.* 22; Kze, *Linnaea*, 10, 547.

Lastrea patens. Pappe and Rawson, 12.

Aspidium Gueintzianum. Mett.; Kuhn, *Fil. Afr.* 134; Buchanan's List (under *N. Bergianum*); Hk. and Bkr, *Syn. Fil.* 269.

Aspidium natalense. Fée, *Mem.* VIII. 102.

South Africa only.

Abundant in all parts of Cape Colony and Natal.

Transvaal.—Elim (Dr Hans Schinz); Shilouvane (Junod, 650); Rietfontein (R. Leendertz, 878); Barberton (P. Orange, 393); Waterval Onder (F. A. Rogers, 94); Waterval Boven (F. A. Rogers, 1006); Rustenburg (M. Collins, 780); Rosehaugh (J. M. Sim).

Rhodesia.—Umtali (J. F. Darling); Penahalonga (Mrs Bennett; Holland); Victoria Falls (Richards; J. Sim); Matopo Hills, 4700 ft (Eyles, 63); Gwaai River (Allen, 229; J. Sim); Mazoe, 5000 ft (E. Eyles; and F. Eyles, 525); also Northern Rhodesia (F. A. Rogers, 8308); Chirinda Forest, 3700—4000 ft (Swynnerton, 866, 870).

Orange Free State.—Van Reenen's (T. R. Sim).

Portuguese East Africa.—Inyamadzi Valley, 2500 ft, Sept. 1906 (Swynnerton, 863); Umbelusi Gorge; Estatuene; Chai-chai; near Inhambane; Beira (T. R. Sim).

18. *DRYOPTERIS PATENS* (Sw.) O. Ktze.

Fronds two to three feet long, eight to twelve inches wide, villose, herbaceous, the lower pinnae not shorter than those above; pinnae three-quarter inch wide, cut more than half-way to the mid-rib into regular, entire, subfalcate lobes; veins all free; veinlets six to twelve pairs, sori near the edge; involucre thin, persistent. Closely resembles *D. Bergiana* and *D. mollis*, but the fronds are not narrowed below.

Included in *Syn. Fil.* from Zambesi-land and Angola, and by Christensen from Tropical Africa, as well as North and South America, Japan, China, and Polynesia, but I have seen no South African specimen. *L. patens* P. and R. belongs to *D. Bergiana*.

19. *DRYOPTERIS MAURITIANA* (Fée) C. Chr.

Plate 12. Nat. size. B Section of pinna, enlarged. C Sorus, enlarged.

Rhizome stout, shortly creeping, paleaceous. Frond two-pinnatifid, two to four feet long, one to two feet broad, widely lanceolate, and tapering to both ends, and with a villose stipe one foot long or more. Texture thinly herbaceous, pinnae as well as the rachis more or less villose on both surfaces, or sometimes nearly glabrous. Pinnae lanceolate, sometimes twelve to fourteen inches long, one inch broad, cut halfway into rather distant falcate pinnules, which are connected below so far as to allow two or more pairs of veinlets from neighbouring pinnules to meet. Veinlets numerous, not forked, with medial sori, and a fugacious indusium. The lower sorus is often where the veins meet, *i.e.* terminal to both.

This fern resembles *D. mollis* in having several pairs of veinlets united; but the texture and habit of the plant are exactly those of large forms of *D. Bergiana*, from which it can only be distinguished by its veins, and with which it is more closely connected than with *D. mollis*.

D. mauritiana (Fée). C. Chr. *Ind.* 277, 1905.

Nephrodium mauritianum. Fée, *Gen.* 308; Sim, *Ferns of South Africa*, 1st ed., 176.

This is *N. elatum* Baker, *Syn. Fil.* 502, but that was evidently a badly chosen name, as *N. elatum* Desv. is our *D. lanuginosa*, a different plant. Mettenius and Bojer have each an *Asp. elatum*, and Baker himself had a previous *Nephrodium* (*Sagenia*) *elatum* Bkr (*Syn. Fil.* 298), also quite a distinct plant. However Mr Baker writes that his *N. elatum* (*Syn. Fil.* 502) proves to be *N. mauritianum* Fée, Mauritius and Natal; so often confused with *N. molle* and *N. Bergianum* that its separate distribution is still doubtful, for though represented in the various herbaria, it is often by specimens without localities.

Kaff.—Pirie Forest, Kologha, Toise River, East London (T. R. Sim); Bazija, Transkei (Rev. R. Baur).

Natal.—Head of Bay of Natal (Buchanan); Buccleuch (W. Leighton); Zwaartkop, Sweetwaters, Bulwer, Nkandhla, Ngomi, Ngoya (T. R. Sim).

Transvaal.—Zoutpansberg (W. Nelson, 358).

Rhodesia.—Lo Magundi (J. F. Darling); Mazoe (Holland); Victoria Falls (Rev. Rogers, 5053).

20. DRYOPTERIS MOLLIS (Jacq.) Hieron.

Plate II. Nat. size. b Fertile pinnules.

Rhizome procumbent, three to six inches long, stout, and with abundant fronds. Fronds one and a half to three feet long, five to seven inches broad, bi-pinnatifid, firmly herbaceous and brittle, deep green, densely villose, or even hairy all over, including the rachis and stipe. Pinnae cut only about halfway down from the margin to the mid-rib into rounded, close or overlapping lobes, sometimes obliquely pointed; lower pinnule on upper side often larger, and with forked veinlets. Lower pinnae smaller than the others, often more distant and deflexed. Veins about six pairs in a pinnule, of which two to four pairs unite with those of the next pinnule. Sori medial, rather large, and with a black indusium which soon disappears.

Kuhn mentions var. *violascens* (Link.) Mett. which has a purplish rachis as found in Natal by Gueinzius, and Eyles includes it as found at Victoria Falls by Engler.

D. mollis is a widely distributed plant, having many varieties in different parts of the world, and found throughout Africa, though evidently rare in Cape Colony.

Kuhn, and P. and R., refer *Asp. patens* Schl. to this species, but there is nothing in either description to indicate that it is not *D. Bergiana*, which is abundant in the locality given (Table Mountain), while I have seen no specimen of this from that part of the colony.

Dryopteris mollis (Jacq.). Hieron. *Hedwigia* 46, 348: 1907; C. Chr. *Index Fil. Suppl.* 1906-1912, 36.

Dryopteris parasitica (Linn.). O. Ktze, *Rev. Gen. Pl.* 2, 811: 1891; C. Chr. *Index Filicum*, 282.

Neph. molle Desv. Hk. and Bkr, *Syn. Fil.* 293; Buchanan's List, No. 92; Sim, *Ferns of South Africa*, 1st ed., 178.

Aspidium molle (Sw.). Kuhn, *Fil. Afr.* 136.

Polypodium molle. Jacq. *Coll.* 3, 188. 1789.

Former collectors mostly gave this name to specimens of *D. mauritiana* Fée, and Kuhn mentions Bergius, Mund and Maire, Ecklon and Zeyher, Drège, and others as collectors of his *Aspidium molle* at the Cape; but I have seen no located specimens from either of these, nor any specimen from the east or west province. *D. Bergiana* and *D. mollis* were also confused by early collectors.

Kaff.—Perie Forest.

Natal.—Moist and shady places on the coast, and common from Inanda to Umpumulo (Buchanan); Sweetwaters, Zwaartkop and Karkloof (T. R. Sim).

Transvaal.—(Buchanan, Lady Barkly); Rosehaugh (J. M. Sim).

Rhodesia.—Matabeleland (Oates); Zambesia (Kirk); near Victoria Falls, 3000 ft (Allen; J. Sim); in rain forest at Victoria Falls (Eyles, 95; Rogers, 5053); Mazoe, common in places (F. Eyles); Umtali (Engler); Chirinda, 3700—4000 ft (Swynnerton, 864, 865, 867, 868, 869, 870).

21. DRYOPTERIS GONGYLODES (Schk.) O. Ktze.

Plate 13. Nat. size.

Rhizome long, creeping underground, black, slender, paleaceous. Frond pinnate, coriaceous, glabrous, or slightly villose on the underside, ovate oblong, one and a half to two feet

long, six to eight inches broad, with a slightly villose rachis, and a brownish, villose or nearly glabrous stipe twelve to fifteen inches long. Pinnae sessile or shortly stalked, three to five inches long, one-half to three-quarter inch broad, lanceolate, pointed, with the margin cut one to two lines deep into roundish obliquely pointed lobes. Lower pinnae as large as, or larger than, those above; upper pinnae more closely placed, and slightly reduced, but at the point of the frond the pinnae are suddenly reduced to a pinnatifid terminal lobe. Veins pinnate, veinlets not forked, but several pairs of veinlets from neighbouring pinnules unite below the sinus, and the abundant sori are situated on the veins near where they meet, or in the lobes near the margin. Indusium small, fugacious.

Var. PROPINQUUM R. Br. (var. *hirsuta* Mett.) differs from the type in having rachis and underside villose or hairy, and is recorded from Zambesi northward, but all our specimens are very slightly villose, or almost glabrous, except those from Swynnerton.

Buchanan finds *N. Plantianum* P. and R., from specimens in the Rawson Herb., to be this, though maintained as a species by Kuhn. It is not mentioned in *Syn. Fil.*, and Christensen places it as doubtful.

Dryopteris gongylodes (Schkuhr). O. Ktze, *Rev. Gen. Pl.* 2, 811. 1891.

Nephrodium unitum R. Br. Hk. and Bkr, *Syn. Fil.* 289 (not Seiber);

Sim, *Ferns of S. Africa*, 1st ed., 179.

Aspidium unitum Mett. Kuhn, *Fil. Afr.* 143.

Aspidium Ecklonii. Kze, *Linnaea*, 10, 546.

Nephrodium Ecklonianum. Pappe and Rawson, 14.

Nephrodium Plantianum. Pappe and Rawson, 14; Kuhn, *Fil. Afr.* 139 (Buchanan, see above).

Tropics of America, Asia, Australia, Africa, and African Islands; growing in exposed swamps, or by streams; local and rather rare in Cape Colony, often along with *N. thelypteris* Desv. and like it taking possession of the swamp.

West.—Hot springs at Brand Valley, Worcester (Rawson), Knysna.

East.—Uitenhage (Holland); Zwaartkops River (Eck.); Van Staaden's River (Browning, Bolus, 1709); Kowie; Despatch, Port Elizabeth (Mrs T. V. Patterson, 952).

Kaff.—Pondoland (Drège), not found or recorded from Kaffraria.

Natal.—Common from the coast to Umpumulo and Maritzburg (Buchanan); Inanda (Wood); Noodsberg (McKen); frequent (T. R. Sim); Buccleuch (W. Leighton).

Transvaal.—Nelspruit, 2350 ft (F. A. Rogers, 58 and 369).

Rhodesia.—Small islands on the Zambesi (Holland); Victoria Falls, banks of river and of islands (Miss Gibbs, 151; Rev. F. A. Rogers, 5318; J. Sim).

Portuguese East Africa.—Matola, 20 ft, 1897 (R. Schlechter, 11687); Zambesi and Luaba Rivers (Kirk); Umbeluzi, Limpopo, Inhambane (T. R. Sim).

Var. PROPINQUUM.

Portuguese East Africa.—Kurumadzi River, Jihu, 2000 ft (Swyn. 861); Mount Maruma, common in swampy ground (Swynnerton, 860); also from the Zambesi northward.

22. DRYOPTERIS PROLIFERA (Retz) C. Chr.

Plate 14. Nat. size.

Rhizome creeping. Frond thinly coriaceous, simply pinnate, lanceolate, two feet long or more, six to eight inches broad, often proliferous by a bud, and with a naked stipe one foot long. Rachis and frond glabrous, or very minutely villose; pinnae lanceolate, acuminate, sessile, from a rounded base, four to five inches long, one-half to three-quarter inch broad, cut along the margin about one line deep into rounded oblique lobes, with four to six pairs of veinlets meeting below the sinus. Veins conspicuous; sori on the middle of the veinlet, often irregular or elongated as in *Gymnogramme*. Indusium absent. Wood remarks—"A coarse-looking fern, having much the appearance of *Nephrodium unitum*, growing in similar places, and often in company with it; it is sometimes erect, and sometimes decumbent and rooting at the point, and is easily recognised by its habit of sending out long branches, which take their rise from an angle between the main rachis and one of the pinnae, no other Natal Polypodium having this peculiarity."

A specimen sent by Mrs Bennett from Umtali has fronds four feet long, six inches wide below, but the upper half with rather distant short alternate pinnules one inch long, half inch wide. Nine axils have buds, some developed into fronds

one foot long. Mrs Bennett writes that it is a lovely drooping fern, and most effective in hanging baskets. Swynnerton, whose specimens also have short pinnae upward, writes: "A straggling fern creeping about amongst the pebbles and boulders at the river's edge, and sending down roots at intervals."

This species appears to be omitted by Kuhn, and resembles small specimens of *Dry. silvatica* P. and R.

Dryopteris prolifera (Retz). C. Chr. *Index*, 286, 1905.

Polypodium (Goniopteris) proliferum Presl. Hk. *Sp.* 5, 13; Hk. and Bkr, *Syn. Fil.* 315; Wood, *Natal Ferns*, 31; Buchanan's List, No. 96; Lady Barkly's List, No. 114; Sim, *Ferns of South Africa*, 1st ed., 192.

Ampelopteris. Kunze.

South Asia, North Australia, Tropical South Africa, and Mauritius, usually in streams or swamps.

Natal.—Coast to 1000 feet, Banks of Umhloti near Todd's Mine, and of the Impisi near Tugela (Buchanan); Umgeni Brickfields (Wood), (Herb. Barkl. 114, Herb. Bolus, 3979); Nkandhla (Marriott); Winter's Kloof and Sweetwaters, Pinetown, Ngoya (T. R. Sim).

Transvaal.—Spelonken, 1910 (T. J. Jenkins); Barberton (Miss Williams, 794).

Rhodesia.—Hunyani River, 1894 (J. F. Darling); Banks of Mazoe (Holland); Umtali (Mrs Bennett); Victoria Falls (J. Sim).

Portuguese East Africa.—Inyamadzi Valley, 2300 ft, Sept. 1906 (Swynnerton, 855); Komati Poort, 600 ft (F. A. Rogers, 409); Limpopo Valley (T. R. Sim).

23. DRYOPTERIS SILVATICA (Pappe and Rawson) C. Chr.

Plate 15. Nat. size.

Crown procumbent or sub-erect. Fronds thinly subcoriaceous, semi-transparent, glabrous or minutely villose, often proliferous, simply pinnate, widely lanceolate, two to four feet long, one to two feet broad at the middle, less below, and with a naked, channelled, herbaceous stipe, one foot or more long. Pinnae sessile, lanceolate, acuminate, from a rounded base, six to twelve inches long, one inch broad, and cut one to three lines deep into obtuse, rounded, oblique, entire, or slightly crenate lobes. Veins conspicuous, five to

six pairs of veinlets meeting below the sinus. Sori small or rather irregular, situated on the veinlets close to the mid-rib of the lobes. Indusium not present.

Dryopteris silvatica (P. and R.). C. Chr. *Index*, 292, 1905.

Polypodium unitum. Hk. *Sp.* 5, 5; Hk. and Bkr, *Syn. Fil.* 317; Wood's *Natal Ferns*, 31; Buchanan's List, 97; Sim, *Ferns of S. Africa*, 1st ed., 193.

Phegopteris unita Mett. Kuhn, *Fil. Afr.* 124.

Gymnogramme unita. Kze, *Linnaea*, 18, 115.

Goniopteris sylvatica. Pappe and Rawson, 39.

Natal and Cameroons only, growing in shady ravines.

Natal.—(Gueinzus, Bolus, 3980), abounds at Inanda inland (Wood); common at Umpumulo, 2000 to 3000 feet (Buchanan); Maritzburg, Zwaartkop, Great Noodsberg, Fort Buckingham (McKen); Buccleuch (W. Leighton); Benvie (Marriott).

Transvaal.—Shilouvane (Junod 884).

Rhodesia.—Umtali (Mrs Bennett).

24. DRYOPTERIS THELYPTERIS (Linn.) A. Gray.

Plate 16. Nat. size, barren. b Fertile, c Barren, pinnules showing venation.

Rhizome long, slender, branching, wide creeping, subterranean. Frond herbaceous, two-pinnatifid, glabrous, ovate-lanceolate or lanceolate, one to two feet long, three to six inches broad, with a slender naked stipe, often one foot long, and a glabrous, slender rachis. Pinnae opposite or alternate, the lower about as long as the others, but more scattered; sessile, bluntly lanceolate, divided to near the mid-rib into close, rounded, entire, rather unequal pinnules; the lower pinnule above and below often rather longer, and crossing the rachis obliquely. Fertile frond, or fertile pinnae, with the margin recurved so that the pinnules look rather narrower and more triangular. Veinlets free, mostly forked in the barren pinnules. Sori small, almost marginal; indusium small, deciduous, ciliated, glandular.

Var. β SQUAMULIGERUM (Schl.) has the mid-rib of the pinnae scaly with short, wide, whitish scales, and to it all the South African specimens I have seen belong. Kuhn credits this variety to South Africa and New Zealand only.

D. thelypteris has a different habit of growth from most of the other species of *Dryopteris*, for owing to its long slender underground rhizomes it takes possession where it gets a hold, and forms a mass of fronds several yards wide. *D. gongylodes*, which often grows intermingled with it, also has this habit.

Dryopteris thelypteris (Linn.), A. Gray, *Man.* ed. 1, 630, 1848; C. Chr. *Ind. Fil.* 297.

Nephrodium thelypteris (Desv.). Hk. and Bkr, *Syn. Fil.* 271; Sim, *Ferns of S. Africa*, 1st ed. 180.

Var. β *SQUAMULIGERUM* Schl.

Nephrodium thelypteris. Desv. β (*N.*) *squamulosum*. Hk., Hk. and Bkr, *Syn. Fil.* 271.

Aspidium thelypteris. Sw. β *squamuligerum*. Schl. *Adum.* 23, tab. II.; Kuhn, *Fil. Afr.* 142.

Aspidium Drègei. Fée.

Aspidium rivulorum. Thunb. ex Eckl. fil. exs.

Polypodium Natalense. Presl, Hb.

Lastrea thelypteris. P. and R. 12.

Polypodium tottum. Thunb. *Fl. Cap.* 735 (?).

West.—Hex River (Mund and Maire); Cape Flats, Table and Devil Mountains, Paarl, Tulbagh (P. and R.); Klip River, Swellendam (Holland).

East.—Uitenhage, Kowie, Howison's Poort, and Brookhuizen's Poort (Dr Atherstone); Somerset East (Guthrie, Bolus, 1705).

Kaff.—Rare, Komgha (Flanagan); Thomas Mountain (Mrs Kitton); Greytown (T. R. Sim); Umtata and Lusikisiki (T. R. Sim); Main (Mrs Young).

Natal.—Very common on the coast, but extending to the far uplands.

Transvaal.—Middelburg (T. J. Jenkins, 1016); Rustenburg (Mrs Pott, 3430); Barberton (G. Williams, 908); Pilgrim's Rest (L. Collins, 901); Krugersdorp (T. J. Jenkins, 916); Bokfontein (T. J. Jenkins, 771).

Rhodesia.—Mazoe and Umtali (J. F. Darling); Penahalonga, Mazoe, 5000 ft, fronds three feet long (E. Eyles, 12; Holland); Umtali (Mrs Bennett); Matopo Hills, 4600 ft (E. Eyles, 69; Rogers, 5197); Rusapi (Engler); Chirinda, 3800 ft (Swynnerton, 858, 859 a).

Portuguese East Africa.—Kurumadzi River, Jihu, 2000 ft (Swyn. 859 and 862 in part); Matola (T. R. Sim).

25. *DRYOPTERIS AFRICANA* (Desv.) C. Chr.

Plate 23. Nat. size, small.

Crown erect, stout, tufted, naked, but the undeveloped young fronds are clothed with green scales. Frond herba-

ceous, ovate-lanceolate, two-pinnatifid, villose in all parts, one to two feet long, three to six inches broad, with a stipe three to twelve inches long, which is villose with short deflexed hairs, and at first slightly paleaceous. Pinnae alternate, lanceolate, two to four inches long, one-half to three-quarter inch broad, the lower slightly reduced, all cut to near the mid-rib into oblong, obtuse, oblique, crenate pinnules, which are widest at the base, or sometimes cut only into rounded lobes along the margin. Sori medial on the veinlets, oblong or elongated along the veinlets sunk into the frond, and without indusia. This has the general habit of *D. Bergiana* but is quite a distinct plant, and not merely an aberrant form of that fern with the fructification of *Gymnogramme*, in which genus it has usually been included.

Dryopteris africana (Desv.). C. Chr. *Index*, 251, 1905.

Gymnogramme totta. Schl. 15, tab. 6; Kunze, *Linnaea*, 10, 495; Hk. and Bkr, *Syn. Fil.* 376; Sim, *Ferns of S. Afr.*, 1st ed., 210.

Gymnogramme Loweii. Hk. and Gr. *lc.* 138.

Phegopteris totta Mett. Kuhn, *Fil. Afr.* 123.

Polypodium tottum Willd. (not Thunberg).

Grammitis totta Presl. Pappe and Rawson, 41.

Polypodium africanum. Desv. 1827.

Asia and Africa; growing by streams in shade. In Africa it occurs in Abyssinia, Guinea Coast, Madeira, Azores, etc.

West.—Table Mountain and Devil's Mountain (Pappe); Koratra (Drège); Knysna (Krauss).

East.—Boschberg (MacOwan); Grahamstown (Guthrie, Bolus, 1729); Bedford (Dr Atherstone); Zuurberg, 5000 ft (R. Schlechter, 6603).

Kaff.—Katberg (Holland); Perie, Frankfort, Dohne, etc., frequent; Engcoba (McLoughlin).

Natal.—Upland bush, not reaching the coast (Wood); 3000 to 4000 feet alt. (Buchanan); Kranzkop, Fort Buckingham, Maritzburg, and Nottingham (McKen).

Transvaal.—Barberton, 1909 (Miss Williams).

26. DRYOPTERIS ZAMBESIACA (Baker) C. Chr.

Baker's description is: "Stipe not seen complete. Frond large, bipinnate, slightly hairy. Lower pinnae lanceolate, a foot long, $1\frac{1}{4}$ inch broad, cut down to the rachis into entire

acute lanceolate segments $\frac{1}{12}$ inch broad. Veinlets simple, 14—15-jugate. Sori medial. Indusium fugacious, membranous, glabrous. Zambesi Highlands, *Buchanan*."

Baker places it next to *D. orientalis* in the group which has the lower pinnae hardly if at all reduced. It is unknown to me, but appears to differ from all other South African species in having the pinnae cut quite to the rachis into long narrow lobes.

D. zambesiaca (Baker). C. Chr. *Ind.* 301, 1905.

Nephrodium zambesiaceum. Baker, *Ann. Bot.* 5, 318, 1891.

Aspidium zambesiaceum, Hier. 1895.

27. DRYOPTERIS ELONGATA (Sw.) Sim.

Plate 17. Pinna, nat. size.

Rhizome short, procumbent or sub-erect, densely paleaceous, with large, ovate, pointed, scarious, yellowish brown scales. Frond deltoid, herbaceous, four-pinnatifid, one to four feet long, one to three feet broad, with a stout rounded stipe one to two feet long, which is abundantly paleaceous toward the base, and with scattered large scales upward, as also on the rachis and secondary rachises. Pinnae widest at the base; lower pinnae much the largest, unequally deltoid, having larger pinnules on the lower side; secondary pinnae lanceolate or ovate-lanceolate; the larger ones cut below into separate, ovate, sharply toothed pinnules, which are closer or confluent above. Smaller pinnae cut only halfway to the mid-rib; pinnules and segments all rounded, and with several sharp-pointed teeth, of which one pointing upward is generally largest. Sori numerous, rather large; indusium not hairy.

This species is much stronger growing than the next, and when fully mature is easily distinguished; but young plants are difficult to separate. The frond is more triangular in outline, the lower pinnae are largest, the colour of the underside is less glaucous, and the rhizomes do not run, but produce four to twelve fronds each. The crown is clothed with large yellowish scales, and this is about the only point in which this plant resembles the well-known male fern, *N. filix-mas*,

of Europe; but in my first edition I adopted that name following Mr Baker, who finds intermediate and connecting forms in other countries. It is included by Buchanan, McKen, and Wood in *N. inaequale* Schl.; and Lady Barkly's specimens of *N. inaequale* all belong to this species.

Schlechtendal's description and figure leave no room for doubt that he also included both, or at least this, in his *A. inaequale*; while Kunze makes this *A. inaequale* Schl., and our next species, *A. inaequale* Schl., var. *montanum*. It appears also to be Pappe and Rawson's *Lastrea pentagona*; while Kuhn makes it a separate species as *Aspidium elongatum* Sw., and also maintains *Lastrea pentagona* Moore (as from Natal). Christensen connects the latter with *D. inaequalis*.

As mentioned above, I find no relationship between this plant and *D. filix-mas*, and in any grouping would place this with other decompound species in the *Spinulosum* group. I have consequently no hesitation in omitting *D. filix-mas* from South Africa, and restoring the name now used for our species. The same plant has been described and illustrated from specimens from Van Reenen, Natal, as *N. Pentheri* Krass. in "Plantae Pentherianae" (*Annalen des K. und K. Naturhistorischen Hofmuseums*, Band 15, Heft 1. Vienna 1900).

Dryopteris elongata (Sw.). Sim, *Ferns of South Africa*, 2nd ed., 104.

Nephrodium filix-mas Rich. γ *elongatum*. Hk. and Bkr, *Syn. Fil.* 272; Sim, *Ferns of S. Afr.*, 1st ed., 181.

Aspidium elongatum Sw. Schrad. *Jour.* 1800, II. 38 (1801); Kuhn, *Fil. Afr.* 132.

Nephrodium elongatum. Hk. and Gr. *Icon.* 234, 1831.

Dryopteris filix-mas (L.) Schott, var. *elongatum*. C. Chr. *Index*, 264.

Lastrea pentagona. P. and R. 13; Kuhn, *Fil. Afr.* 139.

Aspidium inaequale. Schl. *Adum.* 23 (in part); Kunze, *Linnaea*, 10, 549.

Distributed over most of Africa and African Islands; usually the most common fern in forest localities.

West.—Table Mountain (Guthrie, Bolus, 1707); Cape (Pappe).

East.—Fern Kloof, Boschberg (MacOwan); Voorman's Bosch, Van Staaden's River (Browning); Compassberg, 8200 feet alt. (Bolus, 1973); Bedford (Miss Cook).

Kaff.—Main, Transkei (Mrs Young), very common all along the Amatola forests; Katberg (Rogers, 3883); Broughton, Molteno (Flanagan, 1682); Engcoba (McLoughlin, 100).

Natal.—Inanda (Wood); Buccleuch (Leighton); common in every forest (T. R. Sim).

Transvaal.—Macamac (McLea); Marovuni (Burt-Davy, 227); Leydenburg (T. J. Jenkins, 915); Barberton (S. Williams, 822); Belfast (R. Leendertz, 2774); Insiswa, 6000 ft (R. Schlechter, 6200); Houtboschberg (W. Nelson, 469); Woodbush (Mrs R. Pott).

Orange Free State.—Ficksburg (Quail); near Van Reenen (Prof. Bews).

Rhodesia.—Umtali and Lo-Magundi, 9 feet high (Darling); Umtali (Mrs Bennett); Ironmask Hill, Mazoe, 4500 ft (E. Eyles and F. Eyles, 561); Chirinda, 3800 feet (Swynnerton, 874 and 457); Victoria Falls and Gwaai Forest (J. Sim).

Portuguese East Africa.—Swazi border below Estatuene (T. R. Sim).

28. DRYOPTERIS INAEQUALIS (Schl.) O. Ktze.

Plate 18. Nat. size. b Sorus, enlarged.

Main rhizome procumbent even at the crown, and not so scaly as in last species, several inches long, and often with slender rhizomes a foot long proceeding from it. Frond firmly herbaceous, glabrous, three-pinnatifid, ovate-lanceolate, one to one and a half feet long, six to eight inches broad, with a paleaceous stipe one foot long, and with scattered scales along the rachis and mid-rib. Lower pinnae not larger or rather less than those above, and almost equal-sided. Pinnae all pointed from a wide base, divided below to the channelled rachis into ovate-oblong, obtuse, lobed or pinnatifid pinnae, which are sharply serrated, and have a rounded or shortly cuneate base. Sori very abundant; involucre persistent, not hairy.

As stated under *D. elongata*, this species and that are very closely allied, and if really distinct, often confused. It also approaches very closely some of the forms of the European *D. spinulosum* (Müll.) O. Ktze, and all the specimens so named in the Colonial herbaria are this plant. Baker (*Syn. Fil.* 276) mentions *N. spinulosum* Desv. as found "sparingly in Cape Colony," and Kuhn quotes Drège's locality on P. and R.'s authority, but I have seen no specimens which would indicate

more than two species, of which *D. elongata* is one, and the other is the present plant.

If it cannot be separated from *D. spinulosa*, our South African plants might all be included there, and *A. inaequale* Schl. discarded; but meantime I follow Baker and also Christensen in calling this *D. inaequalis*, and omit *A. spinulosum* Sw.

Dryopteris inaequalis (Schl.). O. Ktze, *Rev. Gen. Pl.* 2, 813, 1891; C. Chr. *Index*, 271.

Nephrodium inaequale. Hk. *Sp.* 4, 125; Hk. and Bkr, *Syn. Fil.* 277; Sim, *Ferns of S. Afr.*, 1st ed., 183.

Aspidium inaequale. Schl. *Adum.* 23 (in part); Kuhn, *Fil. Afr.* 134.

Aspidium inaequale, β *montanum*. Kze, *Linnaea*, 10, 549.

Lastrea inaequale Presl. Pappe and Rawson, 12 (in part), (*L. spinulosum*, P. and R., 13).

Known as a South African species only, and evidently rare, most of the localities reported referring to *D. elongata*.

West.—Swellendam (Drège).

East.—Near Grahamstown (Holland); Sneeuwebergen and Wittebergen (Drège); Bedford (Miss Cook).

Kaff.—Perie Forest, rare, Komgha (Flanagan).

Natal.—Buchanan mentions the two forms, but does not state distribution; Zwaartkop, Karkloof, Bulwer, etc. (T. R. Sim).

Transvaal. Woodbush (Mrs R. Pott, 4674).

Rhodesia.—Lo Magundi (Darling); Umtali (Holland).

Portuguese East Africa.—Moramballa Mts (Kirk).

29. DRYOPTERIS ATHAMANTICA (Kze) O. Ktze.

Plate 19. Nat. size.

Rhizome procumbent, one to one and a half inches diameter, naked, except the crown, which has linear brownish scales adpressed to the involuted young fronds. Frond sub-coriaceous, glabrous, widest at the base, and tapering regularly upward, one and a half to two feet long, six to nine inches broad, with a compressed stipe six to twelve inches long, which is thickly paleaceous at the base, and more or less scaly upward, and through the rachis and pinnae-rachises, though sometimes all are naked and shining. Lower pinnae largest, six inches long, three to four inches broad at the base, stalked or sessile, and with lanceolate pinnules,

rather one-sided at the base, of which only the lowest are pinnate, the others being cut halfway to the mid-rib or more into blunt almost entire or crenated lobes, with reflexed edges. Sori abundant, below the sinus or near the mid-rib; indusium persistent. A South African fern only, growing in exposed places, usually in antbear and jackals' holes, and sometimes difficult to distinguish from *D. elongata* when the latter is growing exposed to the sun. The more coriaceous texture, and the absence of sharp teeth, are the best marks. The lower lobe of the pinnule is generally larger on the upper side than the corresponding one on the lower side. This fern is called by the natives "Inkomokomo," and the rhizomes are said to be used as a vermifuge for the cure of tapeworm. A commercial export of roots occasionally takes place from Maritzburg for this purpose.

Dryopteris athamantica (Kze). O. Ktze, *Rev. Gen. Pl.* 2, 812, 1891;
C. Chr. *Index*, 253.

Nephrodium athamanticum. Hk. *Sp.* 4, 125, pl. 258; Hk. and Bkr,
Syn. Fil. 277; Sim, *Ferns of South Africa*, 1st ed., 184.

Aspidium athamanticum. Kunze, *Linnaea*, 18, 123.

Lastrea athamantica. Pappe and Rawson, 13.

Lastrea Plantii. Moore, in Hk. *Jour. Bot.* 5, 227.

Kaff.—Main (Mrs Young); Umzimhlava, 4500 ft (R. Schl., 6556);
Dohne and Kei Road (T. R. Sim); Bazija (Baur); St John's River
(Holland); Umtata (F. Abbott).

Natal.—From Inanda inland (Wood); in most parts of the colony
(Buchanan); Camperdown, Pinetown, Maritzburg (McKen); Mooi
River (Gueinzus).

Transvaal.—Macamac (McLea); Magalisbergen (Sanderson); Shi-
louvane (Junod, 896); Marovuni, rare (Burt-Davy, 219); Belfast,
6400 ft (Burt-Davy, 1287); Bassis, Carolina, 6000 ft (Burt-Davy,
2952); Waterfall Boven (F. A. Rogers, 988); Johannesburg (Mrs
Hutton, 284); Woodbush (Mrs R. Pott).

Rhodesia.—Near the Jumbo Mine (Holland); Umtali (Mrs Bennett);
Mazoe, 4300 ft, 1909 (E. Eyles; and F. Eyles, 562); Chirinda and
Lusitu River, 3000 ft (Swynnerton, 875, 875 a, and 876).

30. DRYOPTERIS BUCHANANI (Baker) O. Ktze.

Plate 20. Nat. size.

Crown sub-erect, paleaceous. Frond firmly herbaceous,
three-pinnate or four-pinnatifid, deltoid, one to three feet

long, one to two feet broad, with a stipe one foot long, which is densely set with reflexed, lanceolate, pointed, dark scales toward the base, while the upper part, as well as the rather rigid rachis and secondary rachises, are set with spreading or reflexed hair-like dark scales, which are smaller upward. Lowest pinnae largest, and with the lower side larger than the upper; other pinnae almost equal sided, tapering slowly from a base three inches broad. Pinnules ovate-lanceolate, obtuse, cut to the mid-rib below into oblique, oblong, obtuse segments, which are entire, or the lower ones pinnately blunt lobed. Sori near the veins in the upper half of pinnules rather large. Indusium small, not hairy, persistent. Veins pinnate with few forked veinlets. Buchanan says—"While growing, the fronds are covered with long hairs, strikingly transparent in the sunlight, but quickly disappearing in the process of drying." In Holland's specimen they show well even on the dried frond.

Dryopteris Buchanani (Baker). O. Ktze, *Rev. Gen. Pl.* 2, 812, 1891; C. Chr. *Index*, 256.

Neph. Buchanani. Bkr, *Icones Plantarum*, pl. 1662; Hk. and Bkr, *Syn. Fil.* ed. 2, 498; Sim, *Ferns of S. Afr.*, 1st ed., 185.

(*Lastrea oppositum*, P. and R. (Appendix No. 2) is doubtfully referred here by Lady Barkly, but their description does not answer to this.)

South Africa, Bourbon, Madagascar, and India; growing in shade near streams.

Kaff.—Griqualand East, Handcock's Drift, Umzimkulu (Buchanan); Chumie (Mrs Young).

Natal.—Nottingham, 4000 feet; Zwaartkop (T. R. Sim); Karkloof (Buchanan).

Transvaal.—Pilgrim's Rest, Drakensberg (J. H. McLea); Haenertsberg (Eastwood).

Rhodesia.—Melsetter (B. H. Holland).

31. DRYOPTERIS LASTII (Baker) C. Chr.

Baker's description is: "Rootstock and stipe not seen. Frond ample, deltoid, decomposed, glabrous; rachis naked, stramineous. Lower pinnae oblong-lanceolate, a foot long; pinnules lanceolate; tertiary segments oblong, obtuse, $\frac{1}{6}$ — $\frac{1}{4}$

inch broad, cut down to the rachis into contiguous oblong quaternary lobes. Sori costular. Indusium firm, glabrous, persistent. Namuli Mukua Country, South-East Tropical Africa. *J. T. Last*. Near *N. scabrosum*." This is unknown to me.

Dryopteris Lastii (Baker). *C. Chr. Index*, 274, 1905.

Nephrodium Lastii. Baker, *Ann. Bot.* 5, 324, 1891.

Aspidium. Hier. 1895.

32. DRYOPTERIS LANUGINOSA (Willd.) C. Chr.

Plate 21. Nat. size.

Crown sub-erect. Fronds scented, herbaceous, villose on both surfaces, three-pinnate or three-pinnatifid, deltoid, or ovate-deltoid, four to five feet long, three feet broad, with a stipe two to four feet long, which like the rachis and frond is finely villose. Pinnæ widely lanceolate, pointed, the lower ones two feet long, unequally deltoid, with longer pinnules on the lower side. Pinnules lanceolate, cut to the mid-rib into oblong segments half-inch long, and three lines broad, which are obliquely connected by the whole base, rounded at the apex, and cut along the margin into three to five pairs of oblique rounded lobes. Veinlets forked or trifid. Sori abundant, medial. Indusium persistent, villose.

Dryopteris lanuginosa (Willd.) *C. Chr. Index*, 273, 1905.

Nephrodium catopterum. Hk. *Sp.* 4, 137; Hk. and Bkr, *Syn. Fil.* 284; Wood's *Natal Ferns*, 28; Sim, *Ferns of S. Afr.*, 1st ed., 185.

Aspidium catopterum. Kze, *Linnaea*, 10, 550, 1836.

Lastrea catoptera. Pappe and Rawson, 12.

Aspidium lanuginosum. Willd. 1824; Kuhn, *Fil. Afr.* 135.

Lastrea lanuginosa. Moore's *Index*, 87, 1858.

Nephrodium elatum. Desv. (not *N. elatum* Baker).

Aspidium odoratum. Sieb., Mett. (not *N. odoratum* Baker).

South Africa and Mascarenes; growing in shade near streams.

West.—George, and Knysna (Lady Barkly); Koratra (Drège).

Kaff.—Near Mission Station, St Augustine, Transkei (Baur, 221);

Bashee (T. R. Sim).

Natal.—From Inanda inland (Wood); Omsamcaba (Drège); Noodsberg, Umpumulo (Buchanan); Buccleuch (W. Leighton); Lidgetton (T. R. Sim).

Transvaal.—Included in Burt-Davy's check-list.

Rhodesia.—Near Umtali, 1904 (Mrs Bennett, Holland); Victoria Falls (J. Sim).

33. DRYOPTERIS CRENATA (Forsk) O. Ktze.

Plate 22. Nat. size. b Pinnule. c Sorus, enlarged.

Crown procumbent, and like the base of the stipe clothed in abundant linear shining brown scales three-quarter inch long. Frond herbaceous, scented, deltoid, three-pinnatifid, six to nine inches long, four to six inches broad, with a channelled stipe which is glabrous below, with a tuft of scales at the base; but upward it is like the rachis and whole frond finely villose on both surfaces. Pinnæ widely lanceolate, the lower largest and deltoid, three inches long, two inches broad, with the pinnules on the lower side larger and more cut. Pinnæ cut to the rachis into oblong, ovate, blunt, pinnatifid pinnules, which are separate below, but connate above; those in the lower pinnæ stalked, and again cut into similar pinnatifid segments, with minutely crenate blunt lobes. Sori numerous, near the mid-rib; indusium large, light coloured, persistent, horse-shoe shaped, but with one side longer; bristly with white hairs.

In form the indusium approaches that of the *Athyrium* section of *Asplenium*.

Baker's description indicates a rather larger plant, but the above is from Mr Bolus' specimens, and confirmed by the living plants at Rosehaugh.

Dryopteris crenata (Forsk). O. Ktze, *Rev. Gen. Pl.* 2, 811, 1891; C. Chr. *Index*, 258.

Polypodium crenatum. Forsk, *Fl. Aeq. Arab.* 185.

Aspidium crenatum Willd. Kuhn, *Fil. Afr.* 129.

Nephrodium odoratum Baker. Hk. and Bkr, *Syn. Fil.* 280 (not *A. odoratum* Sieber).

Nephrodium hirsutum. Don, *Prod. Nep.* 6.

Nephrodium crenatum (Forsk). Sim, *Ferns of S. Afr.*, 1st ed., 186.

South Asia, Mascarenes, and Abyssinia; and collected in the Transvaal by Mr Bolus; at Macamac by Mr Ayres (Buchanan's List, No. 4, p. 30); and on limestone rocks at the Rosehaugh lime quarry, by T. R. Sim (1914).

Genus 8. *DIDYMOCHLAENA* Desvaux.

Sori reniform or elongated, attached along its centre to the intramarginal raised end of a vein, which forms a linear elevated receptacle, and covered by a reniform or elliptical indusium, attached along its length to the vein, and free all round the edges and upper end, but emarginate at the base. This genus consists of only one species, distinguished from *Polystichum* and *Dryopteris* by its elongated receptacle and indusium.

34. *DIDYMOCHLAENA TRUNCATULA* (Sw.) J. Sm.

Plate 24. Nat. size.

Stem erect, sub-arborescent, paleaceous. Frond coriaceous, two-pinnate, three to five feet long, one to two feet broad, with rachis and stipe very paleaceous, with lacinated scales half-inch long. Secondary rachises also scaly. Pinnæ lanceolate, one and a half to two inches broad, with numerous, approximate, one-sided pinnules, three-quarters to one inch long, three to five lines broad at the base, shortly stalked at the lower corner; inner edge parallel with the rachis, entire; upper edge and the rounded end toothed. Pinnules jointed to the rachis; veins sub-flabellate. Sori as described for the genus. A curious plant somewhat resembling some of the *Adiantums* in the form of its pinnules.

D. truncatula (Sw.). J. Smith, *Jour. of Botany*, 4, 196, 1841; C. Chr. *Index*, 225.

D. lunulata. Desv. *Ann. Linn.* 6, 282; Kze, *Fil.* 1, 203; Wood, *Natal Ferns*, 24; Hk. and Bkr, *Syn. Fil.* 248; Sim, *Ferns of S. Afr.*, 1st ed., 164.

D. dimidiata. Kze, *Linnaea*, 18, 122; Pappe and Rawson, 15.

D. lunulata Desv., var. *dimidiata*. Kuhn, *Fil. Afr.* 157.

Aspidium truncatulum Sw. Schrad. *Jour.* 1800², 36. 1801.

Tropical America, East Indies, Africa, and African islands.

Natal.—Nkandhla and Ngoya forests (T. R. Sim); moist places in

bush; midland districts, Inanda inland (Wood); Maritzburg; Umpumulo, 2000 to 3000 feet (Buchanan); near Tugela River (Gueinzius); Buccleuch (W. Leighton); Zwaartkop and Sweetwaters (T. R. Sim).

Rhodesia.—Umtali (Mrs Bennett); Gwaai (J. Sim); Mt Pene Forest, 7000 ft (Swynnerton, 815).

Genus 9. *ASPIDIUM* Swartz.

Sori round with a central stalk supporting the circular peltate indusium, which covers the capsules. Veins anastomosing freely.

Aspidium as restricted by Christensen contains 29 species, widely dispersed, of which only one comes within our district. *Aspidium*, as limited in our first edition, is now placed in *Polystichum*.

35. *ASPIDIUM CICUTARIUM* (Linn.) Sw.

Plate 25. Part of lower pinna, nat. size.

Frond deltoid, three-pinnatifid, glabrous, thinly herbaceous but firm, with three to six pairs of pinnae, and a pinnatifid apex. Lower pinnae opposite, eighteen inches long, twelve inches broad, deltoid, stalked, cut to the rachis below, and to near the rachis above, into numerous, alternate pinnules, of which the upper are lanceolate, increasing from the point downward to six inches in length, one-half to one and a half inches broad, tapering to the acute point, and cut two to three lines deep into rounded oblique lobes three lines broad; while the lower are six to nine inches long, three to four inches broad, and pinnatifid like the upper part of the pinna into rather distant, lanceolate, deeply crenate pinnules half-inch broad, and two to three inches long. Other pinnae gradually smaller upward. Mid-ribs distinct throughout, other veins fine but anastomosing freely into rather irregular areolae. Sori very large, terminal on a free veinlet in the centre of the larger areolae, and forming a straight line near the mid-rib in the simple pinnules, one sorus below each lobe of the margin; in the pinnatifid pinnules the sori occupying a similar position in the segments and absent from near the main mid-rib. Stipe and rachis brownish, shining. A vari-

able species, having several recognised forms. The African form has been separated as *Aspidium coadunatum* Wall., and is placed as a variety by Christensen under that name. Swynnerton's 823 marked on label "var. *gemmiferum* Fée, a common fern," does not appear to differ even as a variety.

Aspidium cicutarium (Linn.) Sw. Schrad. *Jour.* 1800², 36, 1801; C. Chr. *Index*, 68.

Nephrodium cicutarium. Baker, *Syn. Fil.* 299; Sim, *Ferns of South Africa*, 1st ed., 187.

Sagenia. J. Sm.

Tropical America, Asia, Australia and Africa, the African localities including Angola, Guinea Coast, Zambesia and Mascarene Isles.

Transvaal.—Macamac (Ayres, *fide* Buchanan).

Rhodesia.—Umtali (Darling, Holland, Mrs Bennett); Gwaai Forest (J. Sim); Chirinda Forest, 3700—4000 ft (Swyn. 823); Mt Pene, 6500—7000 ft (Swynnerton, 824 a).

Portuguese East Africa.—Moramballa Mountains (Kirk, Waller).

Genus 10. *POLYSTICHUM* Roth.

Sori round, with a central stalk supporting the circular peltate indusium, which covers the capsules. Veins free. Fertile and barren fronds alike, pinnate or decompound. This genus is now credited by Christensen with 112 species, widely distributed; the South African species were all included in *Aspidium* in our first edition, but the limitations of these genera are now altered.

Synopsis of the species :

36. *P. aculeatum.* Two-pinnate or casually three-pinnatifid. Pinnæ lanceolate, lax, not increasing in breadth at the base; scales brown.
37. *P. pungens.* Two-pinnate, erect, stiff; pinnae lanceolate, compact, not increasing in breadth at the base; scales brown.
38. *P. luctuosum.* Two-pinnate or casually three-pinnatifid. Pinnæ lanceolate, increasing in breadth to the base; scales long, nearly black.
39. *P. adiantiforme.* Frond three-pinnate or four-pinnatifid; lower pinnae deltoid; teeth rounded, not bristle-pointed.

40. *P. aristatum*. Frond four-pinnatifid, lower pinnae deltoid; teeth bristle-pointed.
 41. *P. Macleanii*. Frond simply pinnate, coriaceous; sori in regular lines, or somewhat scattered.

36. *POLYSTICHUM ACULEATUM* (Linn.) Schott.

Plate 26. Nat. size.

Plants growing singly, not in mass.

Crown procumbent, abundantly paleaceous, elongating into a thick rhizome several inches long, set all round with the stipes of decayed fronds, from whose bases roots are freely given off. Fronds spreading two-pinnate or casually three-pinnatifid, softly herbaceous, varying from one to four feet long, six to twelve inches broad; rather less or deflexed below, and with a stout stipe six to twelve inches long, which is abundantly paleaceous, with large, pointed, laciniate, brown scales at the base, and set with shorter, brown or red, woolly, scarious scales upward and throughout the rachis and secondary rachises. Pinnae three to six inches long, lanceolate, about an equal breadth (three-quarters to one and a half inches) for half the distance from the base to the point, then tapering. Pinnules sessile or shortly stalked, numerous, lax, one-sided, sharp-pointed, deeply toothed on the upper and outer edges with bristle-pointed teeth, or usually cut more or less into toothed lobes. Sori small, numerous. The pinnules differ very much in form, position, cutting, etc., in different forms, but intermediate varieties are to be found all through. The same plant in shade and in sun, or under a stone and on a stone, shows most of the variations that occur, and they cannot be separated nor perpetuated.

Much confusion has existed between this species and the next.

Buchanan, Wood, and Lady Barkly introduce *A. aculeatum* Sw. as distinct from *A. pungens*; and Pappe and Rawson so introduce *P. angulare*; but I had such strong doubts about their distinctness that in my first edition all

were reduced to one species under the name *Asp. aculeatum* Sw., var. *pungens* Klf.

Much investigation since then has led me to alter this view, and to regard *P. pungens* as specifically distinct from *P. aculeatum*, at least to the extent of each retaining its character under given conditions, but even then I am doubtful as to what any previous S. African writer regarded as the one or the other. I look upon the fern with loose open habit and softly herbaceous drooping or spreading tripinnatifid fronds which usually grows as scattered single plants in the forest as *P. aculeatum*, and the much more rigid plant with erect narrow two-pinnate fronds which grows in masses among stones on open hillsides as *P. pungens*. Knowing how variable this group is in Europe and elsewhere, and how many chance sports from *P. aculeatum* have arisen in horticulture, it is quite likely that *P. pungens* comes within that category, but for the present it seems fixed.

Christensen enumerates 41 named varieties of *P. aculeatum*, our plant being var. *ammifolium* (= *Polypodium ammi-folium*, Poir. *Enc.* 5, 554. 1804).

Polystichum aculeatum (Linn.). Schott, *Gen. Fil.* 1834; Baker, *Syn. Fil.* 252; C. Chr. *Index*, 576.

P. angulare. Pappe and Rawson, 15 (not Willd.).

West.

East. } —Abundant in bush everywhere over 2000 ft alt., and
Kaffraria. } occasionally to the coast.

Natal.

Orange Free State.—Ficksburg (Quail); near Van Reenen (Prof. Bews).

Transvaal.—Pilgrim's Rest (L. Collins); Barberton (J. Thornecroft).

Rhodesia.—Umtali (Holland, Mrs Bennett); Victoria Falls (J. Sim);
Mt Pene Forest, 7000 ft (Swynnerton, 6031, 6032).

37. POLYSTICHUM PUNGENS (Klf.) Presl.

Plate 27. Nat. size.

Plants growing in dense masses, fully exposed on steep banks near the top of the mountains, and often just above the forest. Rhizome long, usually underground, procumbent,

paleaceous with large brown scales. Fronds erect, rather rigid, two to three feet long, six to eight inches wide, somewhat reduced below, two-pinnate, the pinnules close and sharply toothed but seldom much cut, the pinnae of equal width for two-thirds their length. The difference between this and *P. aculeatum* has been explained under that species.

Polystichum pungens (Klf.). Pr. *Tent.* 83, 1836; C. Chr. *Index*, 586.

Aspidium pungens Kaulf. Baker, *Syn. Fil.* 252.

Aspidium aculeatum. Sim, *Kaff. Ferns*, 46 (in part).

Aspidium aculeatum Sw., var. *pungens*. Sim, *Ferns of S. Afr.*, 1st ed., 166 (in part).

Christensen gives the distribution of *P. pungens* as South Africa and Reunion.

West.	} —Abundant everywhere on high rocky slopes, mostly over 4000 ft, and found up to 9550 ft by Galpin at Ben McDhui, Wittebergen, Barkly East.
East.	
Kaffraria.	
Natal.	

Orange Free State.—Near Van Reenen (Prof. Bews).

Transvaal.—Woodbush (T. J. Jenkins).

Rhodesia.—Chirinda, 4000 ft (Swynnerton); Gwaai River (J. Sim).

38. POLYSTICHUM LUCTUOSUM Moore.

Plate 28. Nat. size.

Crown procumbent or sub-erect, very scaly, with large, ovate, pointed, black scales. Frond coriaceous, two-pinnate or three-pinnatifid, two to three feet long, six to ten inches broad at the base, and with a stout stipe nine to fifteen inches long, which is abundantly paleaceous below, and more or less clothed upward, as are also the rachis and frond, with fibrillose black scales or hairs. The fronds, and also the pinnae, taper gradually and regularly from a broad base to the rather attenuated tip. Pinnae sub-opposite, one to one and a half inches broad at the base, lowest pinnule on the upper side larger than the others, parallel with the rachis, and often deeply pinnatifid or pinnate; other pinnules lobed or sharp toothed, and with a bristle-point directed upward. Sori small, very abundant.

This is quite a distinct species, and does not vary at all; always growing beside streams in deep shade, and often in company with *P. aculeatum*, but without any intermediates. In the *Syn. Fil.* Baker places it as a variety of *A. aculeatum*, and in Christensen's *Index* it stands as the African form of *P. lobatum* (Huds.) Pr. *Tent.*, but I consider it quite a good species.

Polystichum luctuosum. Moore's *Index*, 1858; Pappe and Rawson, 14.

Aspidium luctuosum. Kze, *Linnaea*, 10, 548; Buchanan's List, No. 79;

Sim, *Ferns of S. Afr.*, 1st ed., 167.

Aspidium aculeatum Sw., var. *luctuosum*. Hk. and Bkr, *Syn. Fil.* 252; Wood, *Natal Ferns*, 25; Lady Barkly's List, No. 95.

Polystichum lobatum (Huds.). Pr. *Tent.* 83, 1836, variety; C. Chr. *Index*, 583.

South Africa only; nowhere common.

East.—Bedford (Atherstone); Boschberg (MacOwan).

Kaff.—Phillipstown (E. and Z.); Katberg (Holland); Perie Mission Station, Sage's Bush, Frankfort (T. R. Sim); Engcoba (Flanagan, 2781).

Natal.—Maritzburg and Nottingham, 3000 to 4000 feet alt. (Buchanan); upper districts (Wood); Nkandhla (Marriott); Bulwer (T. R. Sim).

Transvaal.—Barberton, 3000 ft (G. Thorncroft).

39. POLYSTICHUM ADIANTIFORME (Forst.) J. Sm.

Plate 29. Lower pinnae, nat. size.

Rhizome creeping, six to eighteen inches long, one inch diameter, often epiphytal on trees, shaggy, with long yellow scales. Fronds deltoid, rather distant, coriaceous, three-pinnate, one to three feet long, one to two feet broad, and with a stout stipe, which is densely paleaceous below, and with scattered ovate scales upward. Lower pinnae largest, deltoid, stalked; with stalked, deltoid, secondary pinnae, which are cut below to the mid-rib into ovate, blunt, bluntly toothed, or lobed, glabrous pinnules, which are confluent above. Sori very large, generally numerous.

Polystichum adiantiforme (Forst.). J. Sm. *Hist. Fil.* 220, 1875; C. Chr. *Index*, 578.

Aspidium capense Willd. Hk. and Bkr, *Syn. Fil.* 254 (not *A. capense* Desv.); Sim, *Ferns of S. Afr.*, 1st ed., 168.

Polypodium adiantiforme. Forst. *Prod.* 82, 1786.

Polypodium capense. Thunb. *Fl. Cap.* 735.

Aspidium coriaceum. Swartz, *Prod.* 133, 1801; Schl. *Adum.* 21; Schk. *Filic.* tab. 50; Kunze, *Linnaea*, 13; Kuhn, *Fil. Afr.* 128.

Polypodium coriaceum. Sw. *Prod.* 133, 1788.

Polystichum coriaceum Schott. Moore's *Index*; Pappe and Rawson, 15.

Tropics and sub-tropics, south of the equator, in America, Africa, Australia and islands; epiphytal on trees, in large clumps, and also growing on the ground about stones, in sunshine.

West.—Swellendam, Genadendal (Kunze); Rondebosch (Bergius); Knysna (Rex); Caledon (S. Viljoen); Zwartberg, near Sandfontein (R. Schl. 10351).

East.—Van Staaden's River, Krakakamma, Grahamstown (Holland); Somerset East (Rogers, 166); Boschberg (MacOwan); Uitenhage, Storms River, 250 ft (R. Schlechter, 5952).

Kaff.—Komgha (Flanagan); Main (Mrs Young); common throughout the forest district.

Natal.—From Inanda inland (Wood); Maritzburg, Noodsberg, Inchanga (McKen); Itafamasi, Umpumulo, rare (Buchanan); Zwaartkop, Karkloof, etc. (T. R. Sim).

40. POLYSTICHUM ARISTATUM (Forst.) Presl.

Plate 30. Nat. size.

Rhizome creeping, paleaceous. Frond sub-coriaceous, or firmly herbaceous, glabrous, deltoid, three-pinnate or four-pinnatifid, one and a half to two feet long, one foot broad, with stipe twelve inches long, set below with narrow scales. Lowest pinnae much the largest, and with pinnae largest on the lower side, unequally deltoid; other pinnae less cut, lanceolate from a wide base. Pinnules ovate-cuneate, sharp pointed, and with pointed teeth, or toothed lobes. Sori small, abundant. This resembles *P. adiantiforme* in outline, but is sharply toothed, with smaller sori, and is less coriaceous. In some herbaria it is confused with *Dryopteris elongata*.

Polystichum aristatum (Forst.). Pr. *Tent.* 83, 1836; C. Chr. *Index*, 578.

Aspidium aristatum Swartz. Hk. and Bkr, *Syn. Fil.* 255; Kuhn, *Fil. Afr.* 209; Buchanan's List, No. 82 (where McKen's *A. frondosum* is said to be a mistake); Sim, *Ferns of S. Afr.*, 1st ed., 170.

Polypodium aristatum. Forst. *Prod.* 82, 1786.

Asia, Australia, and South Africa; beside streamlets in bush.

Kaff.—Katberg (Holland); Bazija (Baur).

Natal.—Maritzburg, and sources of the Umlaas, Nottingham, Karloof (Buchanan); Lidgetton (A. Roberts, 873); Benvie (Marriott); Zwaartkop (T. R. Sim).

Transvaal.—Macamac gold fields (J. H. McLea, No. 7); Pilgrim's Rest (L. Collins); Woodbush (Mrs R. Pott).

Zambesia.—(*Fide* Kuhn, *Filices Africanæ*, 209.)

41. POLYSTICHUM MACLEAI (Baker) Diels.

Plate 31. Nat. size. b Scale from crown.

Crown erect, densely paleaceous, with large, widely lanceolate, laciniated, thin, brown scales. Frond coriaceous, leathery, simply pinnate, widely lanceolate, glabrous on the upper surface, two to three feet long, one foot broad, with a stout stipe one foot long, which is densely set with large scales at the base, and with smaller more fibrillose scales upward. Rachis also fibrillose, and the under side of the pinnae more or less so. Pinnae in thirty to fifty opposite pairs, approximate, almost sessile, lanceolate acuminate, half-inch broad, six inches long; lower ones rather shorter, all deeply and sharply toothed throughout; cut away at the base on the lower side, but with a toothed lobe or auricle on the upper side. Veins free; one group for each tooth. Sori small, in a single line near to the mid-rib, or more frequently scattered in three or four irregular lines, or with scattered sori out on the lobes, the outer ones always smaller.

Baker's figure, especially the magnified one, shows the lobes rounded, with five to six almost equal teeth, but in the fronds I have seen most of the lobes are single large sharp teeth, while toward the base of the pinnae the lobes or auricles are sharp pointed, with a few small teeth along the edges. The auricle is sometimes cut quite to the rachis, and occasionally three to four lobes are so, and then slightly stalked. This is a very distinct plant, known from South Africa only.

Polystichum Macleai (Baker). Diels, *Nat. Pfl.* 1⁴, 190, 1899, where it is misprinted *Macleanii*; C. Chr. *Index*, 584.

Aspidium Macleanii. Baker in Hook. *Ic. Pl.* tab. 1654, 1886 ; Sim, *Ferns of S. Afr.*, 1st ed., 170.

Transkei.—Bazija (Rev. R. Baur ; MacOwan).

Transvaal.—Wet Kloofs, Pilgrim's Rest, Drakensberg (J. H. McLea, No. 34 ; Herb. Bolus, 3030) ; Macamac (Ayres, Buchanan's List, No. 3, page 30).

Genus 11. *CYRTOMIUM* Presl.

Veins anastomosing somewhat ; other characters as in *Polystichum*.

42. *CYRTOMIUM FALCATUM* (L. fil.) Pr.

Plate 32. Frond reduced. b Pinna, nat. size.

Crown erect, abundantly paleaceous, with large, black, pointed scales. Fronds coriaceous, glabrous, shining, dark green, simply pinnate, two feet long, six to eight inches broad, and with a stout stipe six to nine inches long, with numerous large scales at the base. Pinnæ six to ten pairs, sub-opposite, shortly stalked, widely lanceolate, or ovate, with a falcate, acuminate point ; the base often unequal, the lower side being cut away and the upper side rounded. Margin finely toothed, or nearly entire. Veins often anastomosing into a regular network. Sori abundant, irregular, half-line diameter.

With the distinction drawn between *Aspidium* and *Polystichum* that the former has copiously anastomosing veins, while the latter has the veins free or nearly so, this fern holds an intermediate place, being somewhat irregular in this respect, but the network is always present, and usually very considerable.

Cyrtomium falcatum Presl, *Tent.* 86, 1836 ; Pappe and Rawson, 15 ; C. Chr. *Index Filicum*, Suppl. 1906-1912, 101.

Polystichum falcatum (Linn. fil.). Diels, *Nat. Pfl.* 1⁴, 194, 1899 ; C. Chr. *Index*, 581.

Aspidium falcatum. Swartz, 1801 ; Hk. and Bkr, *Syn. Fil.* 257 ; Wood, *Natal Ferns*, 26 ; Sim, *Ferns of S. Afr.*, 1st ed., 171.

Aspidium anomophyllum. Zenk. *Pl. Ind.* ; Kunze, *Linnaea*, 24, 277 ; Kuhn, *Fil. Afr.* 125.

South Asia and South Africa ; growing in deep shade.

East.—Boschberg (Guthrie, MacOwan); Bedford (Dr H. Becker).

Kaff.—Katberg (Holland); near Tyumie (F. H. Ely); Poutz' Bush, Izeli, 3500 ft (T. R. Sim); Chenkwe Mtn, Umtata, 4000 ft (Flanagan, 2648); Cala (H. Royffe, 139); Engcoba (A. G. McLoughlin, 111).

Natal.—Nottingham to Drakensberg (McKen); Umpumulo, rare, Riet Vlei, Cathkin, 3500 feet (Buchanan); Maritzburg (Wood); Zwaartkop (T. R. Sim); Nkandhla (Marriott); Umzimkulu, 4000 ft (R. Schl. 6636).

Transvaal.—Macamac (McLea, No. 6); Lomati Valley, Barberton (Thorncroft); Pilgrim's Rest (L. Collins, 973).

(In the nursery catalogue of W. A. Manda, inc. South Orange, New Jersey, U.S. Amer., a fern is advertised as *Polystichum varium* and said to be introduced from South Africa. *P. varium* (L.) Pr. is from China and Japan, and no fern is known as *P. varium* in South Africa.)

Genus 12. *LEPTOCHILUS* Kaulf.

Fertile and barren fronds different (both pinnate in our species); main veins none or indistinct; veins anastomosing freely; sori abundant, produced in a dense mass without indusium. Over 60 species, formerly included in *Acrostichum*. Only one species is known to us as South African, others occur in tropical America, Asia, and Australia, and in tropical Africa and Madagascar.

43. *LEPTOCHILUS HEUDELOTII* (Bory) C. Chr.

Plate 33. A Barren frond. B Fertile frond.

Rhizome long, creeping. Fronds pinnate, subcoriaceous, glabrous, one and a half to two feet long, six to nine inches wide; pinnae numerous, sessile, lanceolate, entire; three to five inches long, the barren fronds half inch wide or more, the fertile fronds much narrower. Veins anastomosing, indistinct. Sori abundant, matted, without indusium.

L. Heudelotii (Bory). C. Chr. *Ind.* 11, 1905; 385, 1906.

Acrostichum Heudelotii. Hk. 1864; *Syn. Fil.* 422.

Chrysodium Heudelotii (Bory). Kuhn, *Fil. Afr.* 51, 1868.

Gymnopteris Heudelotii Bory. Fée, *Acrost.* 84, t. 45, 1845.

A wandering long-rhizomed fern, growing in or near tropical African streams, Senegambia, Sierra Leone, and Zambesia.

Portuguese East Africa.—Kurumadzi River, Jihu, 2000 ft (Swynnerton, 834); Inyamkawha River, Mafuse, 3000 ft and Chikambogé Valley, 3000 ft, in stream, common, 1906 (Swynnerton, 833); Manganja (Kirk).

(*LEPTOCHILUS AURICULATUS* (Lam.) C. Chr. 184 is a tropical African fern and is recorded from Zambesia, but I have no exact record or locality, and it may or may not occur within our district. Under the name *Acrostichum* (*Gymnopteris*) *punctulatum* Sw., Baker gives the following description of it in *Synopsis Filicum*:

“Rhizome firm, wide creeping; st. of the barren frond 6—12 in. long, slightly scaly, the latter 12—18 in. long, often 1 ft broad, with a terminal pinna and 1 to 8 on each side, which are 4—9 in. long, 1—2 in. broad, lanceolate or oblong, narrowed at both ends, the edge entire or repand; texture papyraceous; rachis and both sides naked; main veins pinnate, with copious hexagonal areolae between them without free veinlets; fertile frond on a longer slender stem with similar but much smaller pinnae. Hk. *Sp.* 5, p. 258. *A. punctatum* Linn.

Hab. Mascarene Isles, Zambesiland, Guinea Coast, Angola.”

He places it in section *Gymnopteris* which has veins anastomosing copiously, main veins distinct nearly or quite to the edge, whereas *L. Heudelotii* is placed in section *Chrysodium* which also has veins anastomosing copiously, but “main veins none or indistinct.”)

*** *Oleandreae*.

Genus 13. *OLEANDRA* Cav.

Fronds simple, articulated to the long woody scandent rhizomes, and having one central costa from which the smaller veins spread to the margin. Veins rising one or two together, simple or dichotomously forked into parallel veinlets, and bearing the sori in an irregular line near the mid-rib, and mostly on unforked veins. Sori covered by a reniform indusium. This genus consists of ten species of similar and very distinct habit, all tropical or almost so, but represented in many countries.

44. *OLEANDRA ARTICULATA* (Sw.) Presl.

Plate 34. Fig. 1. Nat. size. b Portion of frond enlarged showing venation.

Rhizome very long, slender, scandent above ground, with scattered fronds, and abundant, linear, adpressed, shining brown scales. Fronds simple, thinly coriaceous, glabrous, lanceolate, nine to fifteen inches long, one to one and a half inches broad, tapering quickly to an acute point, and rather slowly to a rounded base. Stipe one inch long, jointed close to the rhizome, with numerous involved scales below the joint, and with scattered lanceolate scales above the joint and on the mid-rib. Roots very long and wiry, hanging singly from below each old frond. Margin of frond entire, slightly undulated. Sori rather large, in an irregular line on each side the mid-rib, and one to three lines distant from it. Indusium reniform. Veins numerous, easily seen, and several times forked. When grown in sunshine the fronds are shorter, and the rhizome more scaly. Some specimens in Herb. Gub. have the rhizome scales nearly black, and the frond jointed a half-inch from the rhizome.

Oleandra articulata (Sw.). Pr. *Tent.* 78, 1836; Pappe and Rawson, 13; Kuhn, *Fil. Afr.* 144; Hk. and Bkr, *Syn. Fil.* 302; Sim, *Ferns of S. Africa*, 1st ed., 189; C. Chr. *Index*, 466.

Aspidium articulatum. Sw. 1800; Kunze, *Linnaea*, 18, 123.

Oleandra neriiformis. Hk. *Sp.* 4, p. 156, in part (not *O. neriiformis* Cav.).

Tropical and sub-tropical Africa and islands; among rocks, mostly in shade though sometimes exposed.

Kaffraria.—Port St John, 1896, 100 ft (H. G. Flanagan, 2471).

Natal.—(Gueinzus), Inchanga, Maritzburg, Kranzkloof, Noodsberg, Umpumulo, 2000 to 3000 ft (Buchanan); Midland districts (Wood); Buccleuch (W. Leighton); Table Mtn (T. R. Sim).

Transvaal.—Magalisberg (Zeyher, Burke, 530); Wolhuters Kop, 1909 (V. G. Crawley, 932).

**** **Davallieae.**

Genus 14. *NEPHROLEPIS* Schott.

Fronds simply pinnate, the pinnae lanceolate, articulated to the rachis, and having one central vein from which arise

the spreading side veins each forked into three or four sub-parallel veinlets, the upper one of which is rather shorter than the others, and ends in an intramarginal round sorus, covered by a roundish or emarginate indusium, opening outward. This is a very natural little tropical genus containing 17 species, of which one species extends to Natal, and two others occur in Zambesia. In cultivation many have developed crested or abnormal forms more or less permanent.

45. *NEPHROLEPIS BISERRATA* (Sw.) Schott.

Plate 35. Nat. size.

Crown tufted. Frond pinnate, sub-coriaceous, widely lanceolate, three to four feet long, eight to twelve inches broad, with a short stout stipe, which is slightly scaly at the base. Pinnae sessile, alternate, glabrous, articulated to the rachis, lanceolate-acuminate from a rounded base, four to six inches long, three-quarter inch broad; the lower barren ones finely serrate; the fertile with shallow crenations two lines wide, which are slightly serrated, or with a small tooth between each. Sori in a straight line, one below each sinus, and about a line distant from it. Indusium reniform or nearly round, persistent. Rachis almost glabrous, or with rufous shag about the base of the pinnae.

Nephrolepis biserrata Schott. Kuhn, *Fil. Afr.* 155; Sim, *Ferns of S. Africa*, 1st ed., 188; C. Chr. *Index*, 453.

Nephrolepis acuta Presl. Hk. and Bkr. *Syn. Fil.* 301.

Aspidium biserratum Sw. *Schrad. Jour.* 1800², 32, 1801.

Tropics generally, including in Africa:—Natal, Angola, Guinea Coast, Zambesiland and Mascarene Isles.

Natal.—(Gueinzus); abundant in openings in the bush swamp at head of Bay of Natal, and a few plants on rocks by Palmiet and Nonoti only (Buchanan, Wood).

46. *NEPHROLEPIS EXALTATA* (Linn.) Schott.

Plate 61. Fig. 1. Nat. size. B Vein and sorus, $\times 4$.

Crown erect, stout, with numerous long wiry runners from which new plants arise; frond two to four feet long, three to

five inches wide, glabrous, pinnate ; pinnae separate, not overlapping, one and a half to three inches long, one-quarter to half inch wide, the base wider and auricled on the upper side, the margin entire or slightly crenate, the point more or less acute ; sori sub-marginal. This and the next species are common in cultivation and known as "sword-ferns." They vary somewhat according to conditions of growth, and though extremes differ they approach closely under certain circumstances, and are then difficult to distinguish, especially from dried specimens. In my 1906 paper I doubted if both were South African. Since then I have seen a good many specimens and have changed that view, and I find that Baker includes both among the plants collected by Oates in Matabeleland, and also among the plants collected by Miss Gibbs at the Rain Forest, Victoria Falls.

N. exaltata (Linn.). Schott, *Gen. Fil.* t. 3, 1834 ; C. Chr. *Index*, 454 ; *Syn. Fil.* 301.

Polypodium exaltatum. Linn. *Syst. Nat.* ed. x. 2, 1326. 1759.

Tropics and subtropics of America, Asia, Polynesia, and in Africa from Angola, Guinea Coast, Zambesia, and Mascarene Islands. A specimen in the Natal Government Herbarium, No. 7581, from Lower Umzimkulu, Natal, collected by Dr Dimock Brown in 1897, was presumably an escape, as no one else has found it in Natal, and that district is well known botanically. As the species is common in cultivation and very hardy, escape is easy.

Rhodesia.—Ironmask Hill, Mazoe, 5000 ft (E. Eyles) ; Rain Forest, Victoria Falls (Allen, 1 ; Eyles, 116 ; Rogers, 5546 ; J. Sim ; Engler, etc.).

47. NEPHROLEPIS CORDIFOLIA (Linn.) Presl.

Plate 36. Nat. size. B Pinna, enlarged. C Tuber, nat. size.

Crown sub-erect, with numerous long, wiry, or in places tuberous runners from which new plants arise. Tubers elliptical, one inch long, set with soft scales when young. Frond two to three feet long, one and a half to two inches wide mostly of equal width, pinnate, glabrous except the

rachis which has numerous white scales when young, which become brown with age if persistent. Pinnae close, one-third inch wide, one to one and a half inches long, slightly crenate, rounded at the point, cordate at the base, auricled or lobed on the upper side at the base, the auricles overlapping on the under side of the rachis. Sori midway between the mid-rib and the edge. Said by Baker to differ from *N. exaltata* by its narrower frond, close blunt pinnae and sub-medial sori.

N. cordifolia (L.). Pr. Tent. 79, 1836; Hk. and Bkr, *Syn. Fil.* 300;

C. Chr. *Index*, 453.

Polypodium cordifolium. Linn. *Sp.* 2, 1089. 1753.

Aspidium tuberosum. Bory.

Tropics and subtropics, also common in cultivation where it is found to be very hardy against sunshine and drought. Its tubers render its escape from cultivation easy. A specimen in the Transvaal Museum Herbarium (P. Oranje, May 1905; T. M., No. 858) from Barberton is regarded as probably from cultivation or escape, as no other Transvaal collector has found it, and it is not included in Burt-Davy's list, and especially as that Herbarium also contains a crested specimen (T. M., No. 396) from the same collector, locality and date, of *N. acuminata* (Houtt) Kuhn (= *N. davallioides* Kze), a Java species, common in cultivation.

Rhodesia.—Umtali (J. F. Darling, 20); Victoria Falls (Richards, Holland, Engler, Miss Gibbs *vide* Baker); Matabeleland (Oates *vide* Baker); Chirinda Forest, 3700—4000 ft (Swynnerton, 856). The latter specimen is labelled by Gepp *Var. undulata* J. Sm., but does not differ from our illustration except in having pinnae rather fewer and not overlapping.

Genus 15. *DAVALLIA* Smith.

Fronds firm, decompose, jointed to the long woody rhizome. Sorus marginal, almost cuplike, opening outward; involucre coriaceous.

This genus contains 65 species, mostly tropical, of which only one is South African. In our first edition other two ferns were included in *Davallia* which are now removed into *Microlepia* and *Asplenium* respectively, and my *Davallia* (*Loxoscaphe*) *Hollandii* is also moved into *Asplenium*.

48. *DAVALLIA CHAEROPHYLLOIDES* (Poir.) Steud.

Plate 37. Nat. size. b Part of pinnule, magnified.

Rhizome very stout, woody, and set with most abundant linear, almost hair-like rusty brown scales. Frond deltoid, three-pinnate, four to twelve inches long, three to nine inches broad, on a firm wiry naked yellowish stalk six inches long, channelled along the front, and joined to the rhizome. Rachis and rachis of pinnae resembling the stalk, slightly winged only toward the point. Pinnae alternate, stalked, deltoid, the lower four to six inches long, two to four inches broad at the base, others smaller upward. Secondary pinnae stalked, alternate, deltoid, and having five to seven pairs of alternate, shortly stalked, ovate, pinnules, which are cut to, or near to the mid-rib, into cuneate five to seven-lobed segments, each bearing one or more sori at the apex. Frond glabrous, subcoriaceous, and firm. Involucre pouch-like, leathery, brown, open only at the top, rather longer than wide, terminal on the segments, and surmounted on each side by a point of lamina. Capsules on stalks from the bottom of the involucre. A specimen in Albany Museum is eighteen inches broad and eighteen inches long without stipe, finely cut, and rather sparse.

Kuhn gives this as *D. denticulata* Mett. (*D. elegans* Sw.) var. *intermedia* Mett., and McKen's *D. elegans* is said by Buchanan to be the same thing, while Lady Barkly calls it a variety, but gives no characters, and McKen's description is from *Syn. Fil.* and not from his own plant.

D. chaerophylloides (Poir.). Steud. *Nom.* 2, 146, 1824; C. Chr. *Index*, 208.

D. nitidula. Kunze, *Linnaea*, 10, 545; Pappe and Rawson, 24; Hk. and Bkr, *Syn. Fil.* 97; Sim, *Ferns of S. Afr.*, 1st ed., 62.

D. denticulata Mett., var. *intermedia* Mett. Kuhn, *Fil. Afr.* 158.

Trichomanes chaerophylloides Poir. *Enc.* 8, 80, 1808.

Found on trunks of trees, and in crevices in sandstone rock, etc., in sub-tropical South Africa and Angola only. Rock-grown specimens are often only a few inches high.

Kaffraria.—St John's River (Sir H. Barkly); Pondoland (Drège); Egossa, E. Pondoland (T. R. Sim).

Natal.—Coast Bush; at Umzinyati Falls, and at Umlaas, scarce (Wood); Kearsney (Buchanan); Ngoya Forest (Stayner), Murchison Flats, abundant on rocks (T. R. Sim).

Genus 16. *MICROLEPIA* Presl.

Stipe continuous with the creeping rhizome; frond decomposed; sorus at the base of a sinus; involucre membranaceous, intramarginal, opening outward. A genus of about 70 species, tropical and sub-tropical, included in *Davallia* in *Synopsis Filicum*. The only African species are *M. speluncae* which is widely distributed, and possibly another, *M. mada-gascariensis* (Kze) Pr. from Madagascar only, which is placed under *M. speluncae* by Baker but maintained by Christensen.

49. *MICROLEPIA SPELUNCAE* (Linn.) Moore.

Plate 38. Nat. size. b Pinnule, enlarged. c Sorus, enlarged.

Rhizome creeping, frond three-pinnatifid, flaccid, softly herbaceous in texture, three to four feet long, one to three feet broad, deltoid, ovate or ovate-lanceolate on a straw-coloured herbaceous stalk one to two feet long. Pinnae lanceolate from a wide base, almost sessile, alternate, usually six to eight inches long, two to three inches broad, sometimes larger. Lower pinnae about equal to, or sometimes much larger than, those above. Pinnules sessile, one to two inches long, a half to three-quarter inch broad, cut to or near the mid-rib into oblique, rounded, crenate or lobed segments, bearing a sorus below each sinus. Stalk and rachis rough, with short tubercle hairs, frond finely villose on both sides, especially on the veins. Involucre like a membranaceous scale opening outward, with a semi-circular attachment, early deciduous, situated more or less within the margin, and often as in *Dryopteris*. I have seen a specimen with the lower pinnae two feet long, five inches broad, and with pinnules two to three inches long, one inch broad.

Microlepia speluncae (Linn.). Moore, *Ind.* 93, 1857; Kuhn, *Fil. Afr.* 159; C. Chr. *Ind.* 428.

Davallia speluncae. Baker, *Syn. Fil.* 100; Sim, *Ferns of S. Afr.*, 1st ed., 63.

Polypodium speluncae. Linn. *Sp.* 2, 1093. 1753.

Davallia polypodioides Don. Hk. *Sp.* 1, 181.

Microlepia polypodioides Presl. Pappe and Rawson, 24.

(? *Davallia madagascariensis*. Kunze, *Bot. Zeit.*)

Widely distributed within the tropics and a little beyond, growing in swamps or moist woodlands. Often confused with *Hypolepis sparsisora*.

Natal.—Head of Natal Bay (McKen); Umpumulo (Buch.).

Zululand.—Itshoa (Buchanan) (= Eshowe, T. R. S.).

Transvaal.—Magalisberg (Burke, Zeyher).

Rhodesia.—Umtali (B. H. Holland).

Genus 17. *SCHIZOLOMA* Gaudichaud.

Small herbaceous ferns, having veins anastomosing, and linear marginal sori, covered by a membranous indusium attached a little within the margin, so that it equals the edge of the frond, and opens outward like a slit along the margin, at the bottom of which, all along, is the receptacle. Fourteen species occur, of which *S. ensifolium* is widely distributed, and another occurs in Madagascar and the Mascarenes.

50. *SCHIZOLOMA ENSIFOLIUM* (Sw.) J. Sm.

Plate 39. Nat. size. b Section of pinna, magnified. c Part of sorus, much enlarged.

Rhizome very short and thick, with lanceolate scales. Stipe three to nine inches long, round, glabrous. Frond six to fifteen inches long, glabrous, firmly herbaceous, simply pinnate, with one to six pairs of pinnae, and a long terminal one. Pinnae equal sided, three to six inches long, a quarter to half inch broad, linear or linear-lanceolate, tapering shortly to the point, and to the slightly stalked base, but otherwise of very equal width. Barren fronds, and the barren tips of fertile fronds, slightly toothed; fertile parts more or less contracted. Sori continuous along most of the fertile pinnae. Veins uniting freely and forming numerous irregular areolae.

This has the habit of *Pteris cretica*, but with the sori opening outward.

Schizoloma ensifolium (Sw.). J. Smith, *Jour. of Bot.* 3, 414, 1841; C. Chr. *Index*, 618.

Lindsaea ensifolia Swartz. *Schr. Jour.* 1800; Pappe and Rawson, 25; Kunze, *Linnaea*, 18, 121; Kuhn, *Fil. Afr.* 67; Hk. and Bkr, *Syn. Fil.* 112; Sim, *Ferns of South Africa*, 1st ed., 67.

Lindsaea pentaphylla. Hk. *Sp.* 1, 219.

Lindsaea lanceolata. Labill.

Lindsaea membranacea. Kunze, *Linnaea*, 18, 121.

Tropical Asia, Australia, Africa, and African islands.

Natal.—Streamlets in Coast Bush, where it was found by Gueinzus; Caedmore, Kirkly Vale near Umvoti, Attercliffe, Head of Natal Bay (McKen); near New Guelderland (Buchanan).

Credited in *Syn. Fil.* to Cape Colony, but no locality is known to me.

***** Asplenieae.

Genus 18. *ATHYRIUM* Roth.

Sori short, more or less curved, often horse-shoe shaped. Indusium present. Eighty-six species are included in this genus, some of which sport into varieties more distinct than our three species. *Athyrium* was included as a sub-genus of *Asplenium* in *Synopsis Filicum*.

Synopsis of the species :

51. *A. filix-femina*. Crown erect. Frond two-pinnate, green; pinnae not widened to the base; pinnules toothed, or slightly lobed.
52. *A. Schimperii*. Rhizome slender, creeping. Frond one to one and a half feet long, three to four inches broad, lanceolate, three-pinnate; pinnae widened to the base; segments toothed.
53. *A. aspidioides*. Frond ovate-deltoid, two to four feet long, eight to fourteen inches broad, three-pinnate, with toothed segments.

51. *ATHYRIUM FILIX-FEMINA* (Linn.) Roth.

Plate 40. Nat. size. b Fertile pinnule.

Crown erect, abundantly paleaceous. Frond herbaceous, glabrous, one and a half to two feet long, six to eight inches broad at the middle, rather less below, and with an almost

naked rachis, and a stipe six inches long, which has abundant, very long, narrow, brownish scales below, suddenly decreasing in size and number upward. Pinnae alternate, lanceolate, acuminate, three to four inches long, three-quarters to one inch broad, not increasing in width at the base, cut throughout into regular ovate-oblong, oblique pinnules, three to four lines long, one and a half to two lines broad, which are finely toothed, or slightly lobed below. Sori several on a pinnule, very short, varying from straight to nearly crescent-shaped.

Athyrium filix-femina (Linn.). Roth, *Röm. Mag.* 2^l, 106, 1799 ; C. Chr. *Ind.* 142.

Polypodium filix-femina Linn. *Sp.* 2, 1090. 1753.

Asplenium filix-femina. Bernh. 1806 ; Hk. and Bkr, *Syn. Fil.* 227 ; Sim, *Ferns of S. Afr.* 1st ed. 160.

An almost cosmopolitan species, which in Europe has broken into innumerable varieties, some of which are very distinct and permanent, and others crested or depauperate. What in Africa are known as *A. filix-femina*, *A. Schimperii* and *A. scandicinum* are closely connected forms, which, if well known in growth, would most likely be found to be inseparable in nature as species, but the two former being rare, and mostly known from a few dried specimens, the separation must still be retained.

The specimens from which our figure and the above description are taken were found by Buchanan on the top of the Drakensberg, and are preserved in the Government Herbaria in Cape Town and Natal. Wood quotes from Buchanan—"Very like *A. Schimperii*, but cut somewhat more finely, without any pink tint in its rachis, and with a perfectly upright rhizome."

Lady Barkly claims to have found it in Basutoland, but the specimens in her collection are *A. scandicinum*.

"It grows in the full blaze of the sun, and away from water, in the margin of the bush on the heights above Karkloof and Riet Vlei, Natal." (Buchanan.)

Natal.—As above.

Rhodesia.—Penahalonga Forest (Mrs Bennett) ; Umtali (Holland).

52. *ATHYRIUM SCHIMPERI* Moug.

Plate 41. Nat. size. b Fertile pinnule, enlarged.

Rhizome wide-creeping, slender, with long brown scales. Frond firmly herbaceous ovate-lanceolate, pointed, three to four inches broad, one to one and a half feet long, and with a stout pink-tinted stipe, six inches long, which is paleaceous at the base, but nearly naked above; pinnae deltoid, pointed widest at the base, one to two inches long, one inch broad, with six to ten pairs of distinct, deltoid, or ovate oblong pinnules. Pinnules cut to the mid-rib into four to six pairs of oblong toothed segments, somewhat confluent above. Sori longish, curved above; lower pinnae considerably reduced, and more distant.

Athyrium Schimper Moug. Fée, *Gen.* 187, 1850-52; C. Chr. *Ind.* 146.

Asplenium Schimper. A. Br. in Schweinf. *Beitr.* 224; Wood, *Natal Ferns*, 24; Buchanan's List, No. 75; Kuhn, *Fil. Afr.* 116; Hk. and Bkr, *Syn. Fil.* 489; Sim, *Ferns of S. Afr.*, 1st ed., 161.

Tropical Africa, extending to Natal, where it grows about exposed but damp rocks in Nottingham and Karkloof districts, and in bush at Cathkin, 4000 to 5000 feet alt.; also at Umpu-mulo, 2500 feet (Buchanan). Also in Transkei, Zuurbergen, 5500 ft (R. Schlechter, 6585).

53. *ATHYRIUM SCANDICINUM* (Willd.) Presl.

Plate 42. Nat. size.

Crown sub-erect, paleaceous. Frond herbaceous, tender, glabrous, ovate or ovate-deltoid, two to four feet long, eight to fourteen inches broad, with a green, slightly scaly stipe, six to twelve inches long. Pinnae ovate-lanceolate, six to ten inches long, one and a half to three inches broad, with attenuated points, and with ten to twenty bluntly ovate-deltoid pinnules, which are cut to the rachis into five to ten pairs of rounded, oblong, toothed segments. Sori oblong, curved, generally one to each segment.

This species varies considerably in size, and Schlechtendal's figure shows a pinna twelve inches long, four inches broad, and more distinctly cut than most specimens.

Athyrium scandicium (Willd.). Pr. Tent. 98, 1836; C. Chr. Ind. 146.
Asplenium aspidioides. Schl. Adum. 24, tab. 13; Kunze, *Linnaea*,
 18, 118; Pappe and Rawson, 21; Kuhn, *Fil. Afr.* 97; Hk. and Bkr,
Syn. Fil. 228; Wood, *Natal Ferns*, 24; Sim, *Ferns of S. Afr.*,
 1st ed., 162.

Athyrium laxum. Pappe and Rawson, 16; Moore's *Index*, 186;
 Kuhn, *Fil. Afr.* 105.

Aspidium scandicium. Willd. *Sp.* 5, 285. 1810.

African Islands, South Africa, and Hawaii.

East.—Fuller's Kloof, near West Hills, Grahamstown (Holland).

Natal.—In wet shady places from Inanda inland (Wood); Umpu-
 mulo, Karkloof, Kranskop, Noodsberg, Richmond, Maritzburg
 (Buchanan); Fort Nottingham (McKen); Buccleuch (W. Leighton);
 Sweetwaters (T. R. Sim).

Basutoland.—(Sir H. Barkly).

Transvaal.—Haenertsberg (Eastwood); Houtboschberg (W. Nelson,
 480). Woodbush, Nov. 1913 (Mrs R. Pott, 4664).

Rhodesia.—Umtali (Darling, Holland).

Genus 19. *ASPLENIUM* Linn.

Sori linear or oblong, placed obliquely between the mid-
 rib and the margin, and covered by an indusium. Sori
 sometimes through absence of lamina apparently marginal.
 This genus includes with us all ferns (except *Blechnum* and
Actiniopteris) which have longish sori, not marginal, but
 covered by an indusium. It is a very large and widely
 distributed genus, containing several more or less natural
 sub-genera. All our species have free veins, but a few foreign
 species have them anastomosing. Most of the species are
 very beautiful, and many of them favourites in cultivation,
 and easily grown. Some of the species vary excessively in
 cutting, and some of them even range into different sub-
 genera.

Synopsis of the species :

§ Sori linear or oblong, straight, not marginal (*Eu-asplenium* Bkr).

† Frond sharply pinnate, lanceolate, not more than two inches broad.

54. *A. Kraussii*. Frond four to six inches long, one-half to three-
 quarter inch broad, not proliferous, but the plant bearing separate
 leafless, proliferous fronds. Pinnae sessile, sharply toothed. Rachis
 green, fragile.

55. *A. Sandersoni*. Frond three to six inches long, one-half to three-quarter inch broad, proliferous at the apex. Pinnae stalked, with three to five blunt lobes. Rachis green.
56. *A. trichomanes*. Frond four to eight inches long, half-inch broad; pinnae almost round, sessile, minutely toothed. Rachis black, not margined.
57. *A. platyneuron*. Frond three to fifteen inches long, one-half to one and a half inches broad; pinnae sessile, ovate, or oblong, often auricled, serrate; rachis black, not margined. Sori several on each side of the mid-rib.
58. *A. monanthos*. Frond one to two feet long, one-half to one and a half inches broad; pinnae almost sessile, rhomboidal. Sori solitary along the lower edge. Rachis black, naked.
- †† Frond pinnate or two to three-pinnate, herbaceous, not more than three inches broad.
59. *A. lunulatum*. Frond one-half to two feet long, three-quarters to three inches broad; pinnae entire or pinnate in the different varieties. Rachis edged with green, glabrous. Sori on both sides the mid-rib.
- Vars. *a. lunulatum*. Pinnae one-half to three-quarter inch long, crenate, blunt, rhomboidal. Frond two to three feet long, proliferous.
- β. minor*. Pinnae as in var. *lunulatum*, but smaller. Frond six to nine inches high, proliferous.
- γ. erectum*. Pinnae one inch long, half-inch broad, acute, deeply toothed. Frond two to three feet long, proliferous.
- δ. Zeyheri*. Pinnae obtuse, cut below to near the mid-rib into rounded toothed lobes, deeply toothed above, not proliferous.
- ε. gracile*. Pinnae fully pinnate, with cuneate, toothed, or lobed pinnules. Frond one to two feet long, two to four inches broad, not proliferous.
60. *A. varians*. Frond three to eight inches long, one and a half to two inches broad, two-pinnate, with flabellate, toothed, rounded pinnules. Sori in the pinnules.
61. *A. Eylesii*. Frond deltoid, three inches long, pubescent, two-pinnatifid.
62. *A. pumilum*. Frond deltoid, six inches long, glabrous.
63. *A. Gueinzianum*. Frond nine inches long, one and a half inches broad; pinnae rhomboidal, cut away below, three-quarter inch long; cut to a widely winged mid-rib into several flabellate, bifid lobes. Sori sub-parallel with the mid-rib.

††† Frond pinnate (or two-pinnate in vars. of 64 and 71), lanceolate or ovate-lanceolate, more than three inches broad.

64. *A. protensum*. Frond two to five feet long, two to four inches broad; pinnae numerous, cut halfway to the mid-rib into two-toothed blunt lobes. Rachis and mid-rib pubescent.

Var. *bi-pinnatifidum*. Pinnae cut to the mid-rib into overlapping, rounded, serrate pinnules; plant stronger.

65. *A. laetum*. Pinnae one and a half inches long, half-inch broad, bluntly toothed, obtuse; frond two feet long, two to four inches broad.

66. *A. anisophyllum*. Frond herbaceous; pinnae twelve to twenty pairs, two to four inches long, one-half to one inch broad, bluntly toothed throughout. Sori oblong, swollen, oblique, reaching halfway to the edge.

67. *A. unilaterale*. Frond as in *A. anisophyllum*, but pinnae much cut away at base on lower side.

68. *A. prionitis*. Frond herbaceous; pinnae eight to fourteen pairs, stalked, six inches long, one to one and a half inches broad, sharply toothed throughout. Sori linear, reaching to near the edge.

69. *A. serra*, var. *natalense*. Frond coriaceous; pinnae fifteen to twenty pairs, three to five inches long, one-half to three-quarter inch broad, very much attenuated, cut halfway into toothed lobes. Sori close to the mid-rib, and almost parallel with it.

70. *A. adiantoides*. Somewhat similar, but sori reaching nearly to the edge.

71. *A. gemmiferum*. Frond coriaceous, simply pinnate; pinnae six to twelve pairs, four to six inches long, one to one and a quarter inches broad, pointed, entire or crenate, or bluntly toothed. Sori oblique, linear, reaching halfway to the edge.

Var. *β. flexuosum*. Pinnae cut halfway, or at the base more, into cuneate, flabellate, bluntly toothed, overlapping lobes. Sori irregular, or reaching the sinuses.

Var. *γ. discolor*. Pinnae cut throughout to a widely margined mid-rib, into distant, cuneate, bifid, or flabellate pinnules. Sori marginal.

†††† Fronds tapering from a wide base, coriaceous, two to three-pinnate; pinnules linear or cuneate; venation sub-flabellate.

72. *A. Rawsoni*. Frond two-pinnatifid, three inches long, one and a half inches broad, pinnules and upper pinnae roundly cuneate, crenate. Sori central on the pinnules, short.

73. *A. adiantum-nigrum*. Frond deltoid, two to three-pinnate, glabrous, three to nine inches long, two to six inches broad; lowest pinnae longest. Rhizome short, stout, not creeping. Pinnules rounded, toothed.

Var. β . *obtusum*. More cut; pinnules narrow, spatulate, and lobed, with three to five sharp, equal teeth, pointing inward.

74. *A. solidum*. Frond deltoid, three to four-pinnate, six to fifteen inches long, four to seven inches broad, cut throughout into linear or narrowly cuneate lobes, with three to five sharp, divergent teeth.

75. *A. cuneatum*. Rhizome creeping; fronds glabrous, two-pinnate, four to eight inches long, three to four inches broad; pinnae and pinnules rounded; lowest pinnae generally barren, not longer than those above them: Rachis almost naked.

Var. β . *splendens*. Pinnae and pinnules sharp pointed, fronds one to two and a half feet high, nine inches broad, three-pinnatifid; texture less leathery.

Var. γ . *angustatum*. Frond narrow and less cut; upper pinnae cuneate, or cuneate three-lobed; lower pinnatifid into about three cuneate pinnules. Rachis slightly paleaceous.

76. *A. praemorsum*. Frond two-pinnate, coriaceous, two to four inches broad, one to one and a half feet long; pinnae and pinnules pointed, with scattered, woolly scales, on one or both sides. Rachis and stipe fibrillose.

Var. β . *tripinnatum*. Frond larger and more cut, less coriaceous, and less paleaceous. Stipe and rachis fibrillose.

77. *A. abyssinicum*, var. *cicutarium*. Frond six to eighteen inches long, four to six inches broad, three-pinnate. Segments linear, rachis naked.

§§ Segments narrow; sori marginal or submarginal (Darea, Juss.).

(71. *A. gemmiferum*, var. γ . *discolor*.)

78. *A. Drègeanum*. Frond lanceolate, two-pinnate, six to fifteen inches long, one to one and a half inches broad. Pinnae one-half to three-quarter inches long, half inch broad, with five to eight linear pinnules.

79. *A. auriculatum*. Frond lanceolate, two-pinnate, one to two feet long, three to six inches broad; pinnae one and a half to two inches long, one-half to three-quarter inch broad, herbaceous. Segments linear, blunt, one line broad; sori submarginal.

(*A. flaccidum*. Frond two-pinnate, coriaceous, often proliferous. Pinnae alternate, pinnules short pointed, simple, or lower one forked or pinnatifid.)

80. *A. bipinnatum*. Frond two to three-pinnate, sub-coriaceous, several pinnules forked or pinnatifid. Segments half-line broad in mature plant, broader when young and barren. Sori marginal, oblong or longer.
81. *A. theciferum*. Fronds somewhat similar. Sori marginal, pouches at or near the apex of a pinnule.
82. *A. Hollandii*. Frond two to three feet long, four-pinnate; segments half line wide; sori davallioid.
83. *A. Mannii*. Frond three inches long, pinnate or two-pinnate; segments club-shaped.

54. ASPLENIUM KRAUSSII Moore.

Plate 43. Fig. 2. Nat. size.

Crown erect, very slender, slightly paleaceous. Fronds green, herbaceous, and delicate, simply pinnate, lanceolate, four to six inches long, one-half to three-quarter inch broad, with a fragile, green, naked stipe one to three inches long. Upper pinnae cuneate, with three to seven sharp teeth; lower pinnae as long as broad, nearly square, sessile, connected with the rachis at the lower corner; the lower and inner edges straight; the upper and outer edges sharply toothed; the lowest pair or pairs of pinnae more distant, rather reduced, flabellate, and connected at the middle. Veins flabellate. Sori one to three to each pinna, alternate. Besides the ordinary fronds which are not proliferous, this species produces leafless fronds, which bend over and produce young plants at the apex. It grows among moss on stones and trees in deep shade, and often a whole mass of it is connected by these runners. South African only.

No. 63 Herb. Barkl. seems to be this species, but the proliferous fronds are absent.

Kuhn quotes as a synonym *Asp. dentatum* Krauss (*Fil. Natal.*, 194; *Flora*, 1846, 131; Pappe and Rawson, 19), and Buchanan and Lady Barkly follow, but the description given by Pappe and Rawson applies to *A. Sandersoni*, not to this species; *A. dentatum* L. is a distinct American species.

A. Kraussii. Moore, *Index*, 139, 1859; Hk. *Sp. Fil.* III. 147, Pl. 180 A, 1860; Hk. and Bkr, *Syn. Fil.* 195; Kuhn, *Fil. Afr.* 104; Wood's *Natal Ferns*, 19; C. Chr. *Ind.* 117; Sim, *Ferns of S. Afr.*, 1st ed., 131.

East.—Sent from Graaffreinet by Mr Bolus under the name of *A. Macleayi* (Lady Barkly).

Kaff.—Toise River and Thomas Mountain, rare (T. R. Sim); and in the Transkei at Main (Mrs Young); Engcoba (Flanagan, 2722).

Natal.—Near Byrne (Wood); Bosjesman's Rand (Dr F. Krauss); Mooi River, Nottingham, Riet Vlei (Buchanan); Highlands (R. Schlechter, 5000 ft, 6846).

Transvaal.—(Lady Barkly); Pilgrim's Rest (L. Collins, 1911).

55. *ASPLENIUM SANDERSONI* Hk.

Plate 43. Fig. 1. Nat. size.

Crown procumbent, paleaceous. Fronds one-half to three-quarter inch broad, three to six inches long, shortly stalked, linear lanceolate, simply pinnate; pinnae terminating abruptly both above and below, with no terminal pinna, but the rachis often prolonged and proliferous. Rachis fragile, green, glabrous; pinnae one-sidedly cuneate, with a short, winged stalk, from which the lower edge curves into the terminal lobe, or sometimes there is one lobe on the lower side; while on the upper side there are two or three; the inner edge nearly parallel with the rachis at about one line distant. One vein goes into each of the blunt, crenate lobes, the lower veins bearing one short sorus each.

Baker (*Annals of Botany*, Aug. 1891) now states that *A. brachypterum* and *A. Drègeanum* Kze are dareoid forms of this species; but so far as I have seen they constitute one widely separate species, and Christensen treats them so.

A. Sandersoni. Hk. *Sp. Fil.* 3, p. 147, pl. 179, 1860; Kuhn, *Fil. Afr.* 116; Hk. and Bkr, *Syn. Fil.* 197; Wood, *Natal Ferns*, 20; Sim, *Ferns of S. Afr.*, 1st ed., 132; C. Chr. *Ind.* 130.

A. dentatum. P. and R. (See under *A. Kraussii*.)

Africa and African Islands. Mrs Kitton's Kaffrarian specimens, so named, belong to *A. Kraussii* Moore.

Natal.—Field's Hill (McKen); Umpumulo, Killiecrankie (Buchanan); Noodsberg and Inanda (Wood); Richmond (Sanderson); Zwaartkop (T. R. Sim).

Transvaal.—Houtbosch, 6800 ft (Schlechter, 4760); Houtboschberg (W. Nelson, 489); Haenertsberg (Mrs Pott, 4659).

Rhodesia.—Umtali (Mrs Bennett).

Portuguese East Africa.—Moramballa Mts (Waller).

56. *ASPENIUM TRICHOMANES* Linn.

Plate 44. Fig. 1. Nat. size.

Crowns tufted, several together, almost without scales except on the undeveloped young fronds. Frond four to eight inches long, half inch broad, simply pinnate, subcoriaceous, linear lanceolate, narrowed gradually to the point, and the lower pinnae more distant and reduced. Rachis black, shining, and glabrous; without margin, and similar to the wiry stipe, which is one to four inches in length. Pinnae one-quarter to half inch apart, alternate or sub-opposite, sessile, rhomboid, or nearly round, two to three lines broad and long, nearly equal-sided, or with the upper side rather larger. Upper pinnae cuneate; lowest flabellate; all minutely toothed round the outer edges. Veins pinnate, sori oblong, about five to a pinna, arranged three above, two below.

A. trichomanes. Linn. *Sp. Pl.* 2, 1080, 1753; Kunze, *Linnaea*, 13; Schk., *Fil.* pl. 74; Pappe and Rawson, 19; Kuhn, *Fil. Afr.* 118; Hk. and Bkr., *Syn. Fil.* 196; Sim, *Ferns of S. Afr.*, 1st ed., 133; C. Chr. *Ind.* 135.

Widely distributed in temperate regions, but in South Africa very rare, and generally over 4000 feet alt.

West.—Swellendam (Drège); Dutoit's Kloof (Drège); Kookfontein (S. Burger, 963).

East.—Bedford (Atherstone); Bellerne (Holland); near Graaffreinet (Bolus, 577); Boschberg (MacOwan).

Kaff.—Winterberg (E. and Z.); Witbergen (Kunze); Broughton, Molteno (Flanagan, 1677).

Natal.—Mooi River only (Wood, Buchanan).

Rhodesia.—Limestone caves at Sinoia, Lo Magundi, Hanyani River (H. M. Hole).

57. *ASPENIUM PLATYNEURON* (Linn.) Oakes.

Plate 45. Fig. 1. Nat. size of small plant. b Pinna.

Crown tufted or procumbent, slightly paleaceous. Frond lanceolate, three to fifteen inches long, one-half to one and a half inches broad, not proliferous, simply pinnate, tapering to the point, and with the lower pinnae approximate and

reduced; firmly herbaceous or sub-coriaceous, light green or glaucous, with a short stipe. Stipe and rachis naked, black, and polished, not edged with green. Pinnae sessile, and connected only by the mid-rib; ovate or oblong; two to three lines broad, one-quarter to one inch long, finely serrate; rounded at the point, often cordate at the base, or auricled on the upper side; the auricle overlapping the stipe. Upper pinnae more widely adnate, decurrent on the lower side; pinnae where not auricled nearly equal-sided, with the mid-rib near the centre. Veins pinnate, forked. Sori six to twenty to a pinna, in two lines, short, oblique.

When young or small hardly distinguishable from *A. trichomanes*, but when both are mature and strong they are quite distinct.

A. platyneuron (Linn.) Oakes. Eat. *Ferns N. Amer.* 1, 24, 1878; C. Chr. *Ind.* 126.

A. ebeneum. Ait. *Hort. Kew.* III. 462; Kze, *Linnaea*, 13; Pappe and Rawson, 19; Kuhn, *Fil. Afr.* 101; Hk. and Bkr, *Syn. Fil.* 198; Sim, *Ferns of S. Afr.*, 1st ed., 134.

America and South Africa. In South Africa generally over 2000 feet alt.; growing on steep rocky banks, under small bush.

East.—Karakamma (Eck.); Grahamstown (Holland); Oudeberg, 4800 feet (Bulus, 1697); Boschberg (MacOwan); Van Staadens (Mrs T. V. Patterson, 2002).

Kaff.—Katberg (Buchanan); Bazija (Baur); Komgha (Flanagan); Perie, Greytown, Toise River, Thomas Mountain.

Natal.—Mooi River, Riet Vlei, Nottingham, Umkomas (Buchanan); Zwaartkop, Karkloof, Bulwer (T. R. Sim).

58. ASPLENIUM MONANTHES Linn.

Plate 46. Fig. 1. Nat. size.

Crown sub-erect, tufted, paleaceous. Frond simply pinnate, firmly herbaceous, glabrous, lanceolate, one to two feet long, one-half to one and a half inches broad, with a brown polished rachis, on a similar naked black stipe, three to nine inches long; rachis not margined with green. Pinnae numerous,

almost sessile, quite close above, larger and more distant downward, except the lowest few, which are shorter, and a half to one inch apart. Pinnae rhomboidal, connected at the lower corner; lower edge entire and straight, at a right angle to the rachis, one-half to three-quarter inch long, inner edge entire, nearly parallel with the rachis, two to three lines long; upper and outer edges serrate, meeting in a blunt point. Lower pinnae somewhat auricled on the upper side; lowest few flabellate and smaller. Sori usually only one, linear, parallel with the lower edge, and near it, but opening upward; but frequently with other two or three shorter ones set obliquely across the pinna in addition. The frond is not proliferous at the apex, but on the stipe below the pinnae an adventitious bud is often to be found.

A. monanthes Linn. Mant. 130, 1767; C. Chr. *Ind.* 121.

A. monanthemum. Murr. 1784; Schl. *Adum.* 27; Kze, *Linn.* 10, 515; Pappe and Rawson, 19; Kuhn, *Fil. Afr.* 107; Hk. and Bkr, *Syn. Fil.* 197; Sim, *Ferns of S. Africa*, 1st ed. 135.

South America, Hawaii, Africa, and Canary Islands; not uncommon; growing in shady places by streams in bush. Some specimens from Perie forest show upper pinnae dareoid.

West.—Rondebosch and Kerstenbosch (Bergius); Table Mountain, Grootvadersbosch (Ecklon); Paarde Kraal, Knysna (Burchell, 5199).

East.—Kat River (Eck.); Grahamstown (MacOwan); Boschberg (Bolus, 1701); Bedford (Miss Cook).

Kaff.—Engcoba (A. G. McLoughlin, 99); Cala (Royffe, 240); Molteno, 6300 ft (Flanagan, 1678); frequent along the forest range; Chumie, Perie, Frankfort, Stutterheim, Toise River, etc., and Main, Transkei (Mrs Young).

Natal.—From Maritzburg to Drakensberg, 3000 to 5000 feet (Buchanan, Wood); Zwaartkop, Karkloof, Bulwer, Umkomaas, etc. (T. R. Sim); Lidgetton (A. Roberts, 1909).

Orange Free State.—Near Van Reenen (Prof. Bews).

Transvaal.—Haenertsberg (Miss Eastwood, 135); Mount West, 5200 ft (R. Schlechter, 6821); Rustenburg (M. Collins, 1909); Pilgrim's Rest (L. Collins, 1911); Barberton (Miss Williams, 1909); Rietfontein (R. Leendertz, 1905); Woodbush (T. J. Jenkins, 924); Lydenburg and Belfast (Miss Doidge).

Rhodesia.—Umtali, not common (Mrs Bennett).

59. *ASPLENIUM LUNULATUM* Sw.

Plates 45 (fig. 2), 47, 48, 49.

Crown erect, tufted, without scales. Fronds one-half to two feet long, three-quarters to three inches broad, herbaceous, glabrous, pinnate or two-pinnate, widest at the middle, tapering very gradually to each end, and often proliferous at the apex. Rachis green or brown, with a green margin, and not hairy. Pinnae about forty pairs, more or less one-sided, varying from entire to pinnate in different varieties. Sori numerous, oblong, oblique, in two rows. Veins pinnate, main vein near centre of the pinna. This is the most variable fern we have, and, as such, the most confusing. What we here regard as varieties have been made species by different authors, and each keeps true to its character, though its surrounding conditions be changed. Still though the extremes are very dissimilar, we find in the forest every intermediate grade from one form to another all through, and do not see how they can be satisfactorily separated; indeed, we find difficulty in excluding *A. varians* Wall. from the same group.

Included above are the following, which Pappe and Rawson give in a scattered fashion as species: *A. lunulatum* Sw., *A. erectum* Bory, *A. Zeyheri* P. and R., *A. lobatum* P. and R., *A. gracile* P. and R. Kuhn gives the same species, using the same names, except *A. gracile* P. and R., which he calls *A. Pappei* Moore, and adds *A. pulchrum* Th. Buchanan and Wood admit only three species, *A. lunulatum* Sw., *A. harpeodes* Kze, and *A. gracile* P. and R. Hk. and Bkr in *Syn. Fil.* include all under *A. lunulatum* Sw., mentioning *A. harpeodes* Kze, *A. lobatum* P. and R., and *A. gracile* P. and R. as forms, and Christensen keeps the group in *A. lunulatum* Sw.

The synonymy of these forms, especially the cut forms, is very much mixed in herbaria, and *A. varians* Wall. is frequently confused with them.

This species is widely distributed in one or other of its forms through the tropics, and we find the forms growing intermingled without any localisation, though Buchanan points out that in Natal *A. lunulatum* grows from the coast to 3000

feet alt., while *A. harpeodes* and *A. gracile* range from 2000 to 5000 feet alt.

A. lunulatum Swartz. Schr. Jour. 1800², 52, 1801; C. Chr. Index, 119; Hk. and Bkr, *Syn. Fil.* 202.

A. erectum Bory. Sim, *Ferns of South Africa*, 1st ed., 136.

Varieties are as under.

Var. *a.* LUNULATUM Sw.

Plate 47. Nat. size. b Pinna.

Pinnae straight and entire along the lower and inner edges, rounded at the point, not deeply toothed but crenate, a half to three-quarter inch long, two lines broad. Frond two to three feet long, sometimes proliferous.

A. erectum Bory, var. *lunulatum*. Sim in *Kaff. Ferns*, 40; Sim, *Ferns of S. Afr.*, 1st ed., 137.

A. lunulatum Swartz. Schrad. Jour.; Schl. Adum. 27; Kze, *Linnaea*, 10, 514; Pappe and Rawson, 19; Wood, *Natal Ferns*, 20; Hk. and Bkr, *Syn. Fil.* 202, in part; Kuhn, *Fil. Afr.* 105.

A. falcatum. Thunb. *Prod.* 172; *Fl. Cap.* 734.

Frequent throughout South Africa.

West.—Knysna.

East.—Uitenhage (E. and Z.); Kat River (Drège); Grahamstown (Holland); Van Staaden's River (Browning).

Kaff.—Frequent throughout the forest, Komgha (Flanagan); Engcoba (A. G. McLoughlin, 85).

Natal.—Coast to Umpumulo and Maritzburg (Buchanan); frequent everywhere (T. R. Sim).

Orange Free State.—Near Van Reenen (Prof. Bews).

Transvaal.—Houtboschberg (Schlechter).

Rhodesia.—Victoria Falls (Holland, Engler, J. Sim); Chirinda Forest, 3700 to 4000 ft (Swynnerton, 827).

Var. *β.* MINOR Sim.

Plate 45. Fig. 2. Nat. size. b Pinna.

Pinnae as in var. *lunulatum*, but smaller. Frond six to nine inches high, generally proliferous. Found at Dohne Hill, Kaffraria.

Var. γ . ERECTUM (Bory).

Plate 48. Nat. size. Plate 47. c Pinna.

Pinnæ pointed, deeply toothed on both upper and lower edges, except a little bit which is cut away on the lower side toward the base; the corresponding upper side enlarged, or sometimes with a distinct, toothed auricle. Frond two to three feet long, proliferous. Pinnæ one inch long, three-eighths to one-half inch broad. Teeth mostly single. A frond from Brown's Bush, Toise River, has a bud on the stipe at the lowest pinnule, but this is not usual, the bud being usually near the point of the frond.

A. erectum Bory. Schl. *Adum.* 28, tab. 15; Kze, *Linnaea*, 10, 513;

Pappe and Rawson, 18; Kuhn, *Fil. Afr.* 102.

A. harpeodes. Kze, *Linn.* 18, 329; Hk. and Bkr, *Syn. Fil.* 202; Wood, *Natal Ferns*, 20.

A. erectum Bory, var. *harpeodes* Kze. Buchanan, No. 57.

A. erectum Bory, var. *erectum.* Sim, *Ferns of S. Afr.*, 1st ed., 138.

The most common form.

West.—Table Mountain (Rawson); George (R. Schl. 2365); Knysna (T. H. Rex, 832).

East.—Grahamstown (Holland); Bedford (Miss Cook); Krakamma.

Kaff.—Komgha (Flanagan); Main (Mrs Young); frequent throughout the forest districts.

Natal.—Upper parts of colony common (T. R. Sim); Buccleuch (Leighton); Lidgetton (A. Roberts).

Transvaal.—Macamac (McLea, 12); Haenertsberg (Eastwood; Mrs Pott, 4676); Barberton (Miss Williams); Houtboschberg (W. Nelson, 482).

Orange Free State.—Near Van Reenen (Prof. Bews).

Rhodesia.—Umtali (Mrs Bennett).

Var. δ . ZEYHERI (P. and R.).

Plate 49. c Pinna, nat. size.

Pinnæ more obtuse than var. *erectum*, and less cut away at the lower base, but each blunt tooth cut near to the rachis, and the lower ones enlarged into rounded toothed lobes, cut to or near to the rachis; evidently intermediate between forms *erectum* and *gracile*. Frond eighteen inches long, and two inches broad.

Aspl. Zeyheri. P. and R. 18; Kuhn, *Fil. Afr.* 119.

A. polymorphum. Ecklon and Zeyher Herb.

A. erectum Bory, var. *Zeyheri*. Moore's *Index*, 127; Sim, *Kaff. Ferns*, 40; Sim, *Ferns of South Africa*, 1st ed., 139.

A. erectum Bory, var. β . Kze, *Linnaea*, 10, 513.

East.—Grahamstown (Holland); Uitenhage (Rubidge); Kat River (E. and Z.); Somerset East (Guthrie; Bolus, 1700).

Kaff.—Katberg (Buchanan); Perie, Dohne, etc., frequent (T. R. Sim).

Natal.—Lynedoch and Umpumulo (Buchanan); frequent (T. R. Sim).

Var. ϵ . GRACILE (P. and R.) Sim.

Plate 49. a Slightly reduced. b Pinna, nat. size.

Frond distinctly bi-pinnate; pinnules separate, cuneate, again toothed or lobed, with a green-edged rachis. Frond one to two feet long, two to three inches broad, tapering gradually to the point, and ending rather abruptly at the base; not proliferous.

A. gracile. Pappe and Rawson, 22.

A. erectum Bory, var. *lobatum*. Sim, *Kaff. Ferns*, 41; Sim, *Ferns of S. Afr.*, 1st ed., 139.

A. lobatum. Pappe and Rawson, 22; Moore's *Index*, 141; Kuhn, *Fil. Afr.* 105; Hk. and Bkr, *Syn. Fil.* 202 (under *A. lunulatum* Sw.).

A. Pappei. Moore's *Index*, 152; Kuhn, *Fil. Afr.* 110.

Buchanan also doubtfully places here *A. pulchrum* Thouars.

East.—Albany (Dr Atherstone); Fern Kloof, Grahamstown (Holland); Tzitzikamma (Dr Rubidge).

Kaff.—Main (Mrs Young); frequent in the forests, Perie, Frankfort, Dohne Hill, etc. (T. R. Sim); Zuurbergen, 5000 ft (R. Schlechter, 6602).

Natal.—Abundant (Buchanan); upper districts (Wood); Zululand forests (Marriott); frequent in all upland forests (T. R. Sim).

Transvaal.—Houtbösberg, 6000 ft (Schlechter, 4466); Mamotsinri (Burt-Davy, 205); Haenertsberg (Eastwood); Pilgrim's Rest (L. Collins, 906); Barberton (Miss Williams, 791).

Rhodesia.—Umtali (Holland, Mrs Bennett); Victoria Falls (J. Sim).

60. ASPLENIUM VARIANS Wall.

Plate 50. Fig. 2. Nat. size. Plate 57. Fig. 2. Small frond, nat. size.

Crown erect, tufted, without scales. Frond three to eight inches long, one and a half to two inches broad, two-pinnate or two-pinnatifid, herbaceous, glabrous, broadly lanceolate, with a short fragile stipe, and a slightly margined green

rachis; lower pinnae hardly less than those above; pinnae nearly equal sided, ovate, rounded at the point, and pinnately divided to the rachis into about six distinct, flabellate rounded, toothed pinnules, which are often cuneate at the base, with flabellate venation, and one to four sori in each pinnule. Easily recognised as a distinct form from *A. erectum*, var. *gracile* by its small size, comparatively greater breadth of the frond, and the more rounded outline of the pinnae and lobes.

A. varians Wall. Hk. and Gr. *Ic. Pl.* 172, 1830; Hk. and Bkr. *Syn. Fil.* 216; Sim, *Ferns of South Africa*, 1st ed., 140; C. Chr. *Ind.* 137. *A. fimbriatum*. Kze, *Linnaea*, 18, 117; Pappe and Rawson, 33; Kuhn, *Fil. Afr.* 102. (Not *A. fimbriatum*, Hk. *Syn. Fil.* 229.)

Eastern Asia and S. Africa; not growing here below 4000 ft altitude.

East.—Bedford (Miss Cook, Holland); Boschberg (MacOwan).

Kaff.—Katberg (Buchanan); Sage's Bush, Izeli (Leighton); Komgha (Flanagan); above Perie Mission Station (T. R. Sim).

Natal.—Between Omfondi and Tugela Rivers (Gueinzus); Verulam (Wood); Umpumulo, Maritzburg, Nottingham, Cathkin (Buchanan); Great Noodsberg (McKen); Howick, 3200 ft (R. Schl. 6782); Buccleuch (W. Leighton).

Transvaal.—Pilgrim's Rest (L. Collins, 902).

Rhodesia.—Umtali (J. F. Darling).

61. ASPLENIUM EYLESII Sim. (New species.)¹

Plate 61. Fig. 2. Nat. size.

Crown erect, set with brown scales. Fronds deltoid, two-pinnatifid, three inches long, one to two inches wide, softly

¹ 61. ASPLENIUM EYLESII Sim. (Species nova.)

Tab. 61. Fig. 2. Mag. nat.

Corona erecta, paleis fuscis ornata; folia deltoidea, bipinnatifida, 3" longa, 1—2" lata, lente herbacea, supra et infra pilis albescentibus pubescentia; stipes 1—2" longus, viridis, mollis, pilis numerosis ac mollibus obsitus; rachis non alata; folii pars superior pinnatifida, lobis rotundatis, crenatis, decurrentibus, infra quos una atque altera paria opposita pinnarum brevi-petiolatarum, lobatarum, nec non et deltoideum infimum par pinnarum 1" longarum, $\frac{1}{2}$ " latarum, semel paene ad costam incisarum; nervi flabellati; sori abundantes, obliqui, $\frac{1}{2}$ — $\frac{1}{3}$ " longi; indusium angustum, membranaceum.

Rhodesia, in monte Ironmask, Mazoe, 4500 ped. Jan. 1909, Eric Eyles (Herb. Eyles, 564). Dissimilis ulli cuilibet filici mihi notae.

herbaceous, and pubescent on both surfaces with white hairs. Stipe one to two inches long, green, soft, set with numerous soft hairs. Rachis not winged; upper portion of frond pinna-tifid, with rounded, crenate, decurrent lobes, below which are one or two opposite pairs of shortly stalked, lobed pinnae, and the deltoid lowest pair of pinnae which are one inch long, half inch wide and cut once nearly to the mid-rib. Veins flabellate. Sori abundant, oblique, one to two lines long, with narrow membranous indusium.

Rhodesia.—Ironmask Hill, Mazoe, 4500 ft. Jan. 1909, Eric Eyles (Herb. Eyles, 564).

Unlike any other fern known to me.

62. ASPLENIUM PUMILUM Sw.

Baker's description in *Synopsis Filicum* is:

"Stem tufted, 3—4 in. long, erect, naked, polished, ebeneous below; frond 4 to 6 in. each way, deltoid, the upper part sinuated only, the lower cut down to the rachis into distinct pinnae, of which the lowest pair is much the largest, the pinnules on the lower side sometimes 2 in. long, reaching down to a slightly winged rachis, acuminate and deeply lobed; texture herbaceous; rachis green, flaccid, compressed; sori very oblique, the lower ones sometimes $\frac{3}{4}$ to 1 inch long. Hk. *Sp.* 3, p. 174.

Hab. W. Indies to Columbia; and a small tender form (*A. tenerrimum* Hochst) has been gathered by Schimper in Abyssinia, and by Dr Kirk in Zambesiland. A very distinct species."

This is unknown to me.

63. ASPLENIUM GUEINZIANUM Mett.

Frond firmly herbaceous, glabrous, nine inches long, one and a half inches broad, with a short green stipe which has a few ovate, membranaceous scales. Pinnae numerous, decurrent into a petiole, rhomboid-oblong, rounded or auricled on the upper side at the base; cut away on the lower side; three-quarters of an inch long, lower rather less, cut to a broadly winged mid-rib into two to three pairs of lobes or pinnules, of which the lower one on the upper side is separate, roundly obovate from a cuneate base, and two to three times bifid; lobes sub-flabellate, spreading, obtuse, often bifid; upper undivided. Sori one to two, sub-parallel with the mid-rib,

not reaching the sinus of the lobes, and with one or two obliquely at the base of the lowest lobe.

A. Gueinzianum Mett. Kuhn, *Fil. Afr.* 103 (with description); Hk. and Bkr, *Syn. Fil.* 486; C. Chr. *Ind.* 114; Sim, *Ferns of South Africa*, 1st ed., 140.

Lady Barkly adds "originally called *A. laciniatum* by Kuhn."

Natal.—(Gueinzus). Not seen by me, and not in Kew Herbarium.

64. ASPLENIUM PROTENSUM Schrad.

Plate 51. Much reduced. b Pinna, nat. size.

Rhizome procumbent, short, naked, with the bases of the old stipes permanent, and thickened. Frond firmly herbaceous, pinnate or two-pinnatifid, lanceolate, tapering both ways, two to five feet long, two to four inches broad, with a channelled, pubescent rachis, and short pubescent stipe, sometimes glabrous when old. Pinnæ thirty to forty subopposite spreading pairs, nearly sessile, one to one and a half inches long, half an inch broad at the base, and tapering to a longish point; often falcate, cut on both edges halfway to the mid-rib into blunt lobes of about two teeth each. The pinnæ are unequal sided, the lowest two lobes on the lower side being wanting. Sori oblong, in two rows near the rachis, somewhat oblique, one on the principal vein of each lobe, and directed toward it. This fine fern is easily distinguished from all its relations by having the rachis covered with fine glandular hairs, which sometimes extend partly on to the pinnæ. It resembles large specimens of *A. erectum*, having the same herbaceous texture, and long narrow outline; and like it often produces a bud near the point of the frond.

A. protensum. Schrad. *Gött. Gel. Anz.* 1818; Schl. *Adum.* 29, tab. 16; Kze, *Linnaea*, 10, 513; Pappe and Rawson, 18; Kuhn, *Fil. Afr.* 113; Hk. and Bkr, *Syn. Fil.* 211; Sim, *Ferns of South Africa*, 1st ed., 141; C. Chr. *Ind.* 127.

Africa and African Islands; growing in wet places in deep shade; frequent.

West.—Knysna (Verreaux).

East.—Grahamstown (Holland); Boschberg (MacOwan).

Kaff.—Katberg (Miss Hartzenberg); Main (Mrs Young); Perie, Frankfort, etc. (T. R. Sim); Engcoba (A. G. McLoughlin, 96).

Natal.—Great Noodsberg and Umpumulo to Drakensberg, 2000 to 5000 feet (Buchanan); Buccleuch (W. Leighton); Nkandhla (Marriott); Umzimkulu, 4000 ft (R. Schl. 6629).

Transvaal.—Pilgrim's Rest (R. Collins, 907); Woodbush (T. J. Jenkins, 796).

Rhodesia.—Umtali (Holland, Mrs Bennett); Matopo Hills, 5000 ft (Eyles, 1022); Chirinda Forest, 4000 ft (Swyn. 879, 880); Gwaai River (J. Sim).

Var. BIPINNATIFIDUM Sim.

Plate 52. Nat. size.

Plant stronger in all its parts than the type, but habit, texture, and villose rachis, as well as the cutting when the plant is young, are the same. When the plant is mature fronds are two to four feet long, five to seven inches broad, lanceolate, the pinnae divided to the mid-rib toward the base into separate but overlapping, obovate, rounded, bluntly serrate, lobed pinnules. Upper pinnules rounded, more or less confluent. Sori flabellate in the free lobes, otherwise nearly parallel with the costa, and not reaching the sinus. Found at Dokamma (Drège, *fide* Kunze), and in the Perie Forest.

65. ASPLENIUM LAETUM Sw.

Plate 50. Fig. 1. Nat. size.

Crown erect, tufted; stipe round, without scales. Fronds two feet long, two to four inches broad, thinly herbaceous glabrous, pinnate, tapering rather rapidly to the point. Pinnae one and a half to two inches long, one-third to one-half inch wide, obtuse, cut away somewhat on the lower base, widest on the upper side at the base, bluntly toothed or double toothed. Sori long, narrow, oblique. This species was included under *A. erectum* as var. *brachyotus* in our first edition; it is often difficult to distinguish from forms of *A. lunulatum* and it also approaches *A. anisophyllum* closely in its larger forms, but is usually smaller, thinner in texture, with no scales, and longer, narrower sori. It is recorded from Trop. America, Madagascar, and South Africa.

A. laetum. Sw. *Syn.* 79, 271, 1806; C. Chr. *Index*, 117.

A. erectum Bory, var. *brachyotus*. Sim, *Ferns of S. Afr.*, 1st ed., 138.

A. brachyotus. Kunze, *Linnaea*, 10, 512; Pappe and Rawson, 18; Buchanan's List, No. 57; Kuhn, *Fil. Afr.* 99; Wood's *Natal Ferns*, 21.

Natal.—From coast to 3000 ft (Buchanan, Wood, Gueinzus); between the Omsamcaba and the Omsamwobo (Drège); Nkandhla (Marriott); Buccleuch (W. Leighton); Benvie (Marriott); Zwaartkop, Sweetwaters, Bulwer, Ngoya, etc. (T. R. Sim).

Rhodesia.—Chirinda Forest, 3700 to 4000 ft (Swynnerton, 840 and 840 B).

66. ASPLENIUM ANISOPHYLLUM Kze.

Plate 53. Nat. size. B Larger deeply cut form. C Venation and Sorus, enlarged.

Crown erect, paleaceous. Frond herbaceous, glabrous, simply pinnate, lanceolate, one and a half to two feet long, four to six inches broad, with a green stipe one foot long, glabrous above, but paleaceous towards the base, and a somewhat winged rachis. Pinnæ twelve to twenty pairs, shortly petioled, broadly lanceolate, from a shortly cuneate base, attenuated toward the point, two to four inches long, half to one inch broad, deeply toothed throughout except the two basal edges; the teeth mostly in pairs, and rather obtuse. Sori short, oblong, swollen, placed near the mid-rib, and reaching only about halfway to the edge. Lower pinnæ slightly reduced. Terminal pinna rather larger than those near it, and often subtended by a bud. In some fronds the pinnæ have a long narrow point, as in fig. B (var. *elongatum* Kze.), in others they are shorter and more obtuse, and approach *A. laetum*; but both can be found on one plant, and there is evidently no permanent form, though *A. Boltoni* Hk. is founded on a deeply inciso-crenate form, and the var. *microphylla*, of Kuhn, is a small state.

Nelson's 482 (Transvaal) is a large form, with fronds three feet long, nine inches wide, and the pinnæ deeply cut (Plate 53 B), but texture, venation, fructification, etc. are as in the typical form.

A. anisophyllum. Kze, *Linn.* 10, 511; Pappe and Rawson, 18; Kuhn, *Fil. Afr.* 96; Wood's *Natal Ferns*, 21; Hk. and Bkr, *Syn. Fil.* 204; Sim, *Ferns of South Africa*, 1st ed., 142; C. Chr. *Index*, 101.

S. America, W. Indies, and Africa south of the Equator. Among stones under trees, often where damp; frequent eastward.

East.—Kat River (E. and Z.); Grahamstown (Holland).

Kaff.—Alice, Perie, Frankfort, Dohne Hill, etc. (T. R. Sim); Main (Mrs Young); Engcoba (McLoughlin, 103).

Natal.—Inanda to beyond Maritzburg (Wood); Umpumulo, Karkloof, Richmond (Buchanan); Fort Buckingham, Noodsberg (McKen); Umzimkulu, 4000 ft (R. Schl. 6629); frequent in bush (T. R. Sim).

Transvaal.—Houtbosch (Dr Rehmann, 5589); Haenertsberg (Eastwood); Barberton (T. Thorncroft); Woodbush (W. Nelson, 482; Mrs Pott, 4661); Pilgrim's Rest (L. Collins, 972).

Rhodesia.—Umtali (J. F. Darling, Mrs Bennett).

67. ASPLENIUM UNILATERALE Lam.

Plate 54. Nat. size. B Pinnule.

Stipe slender, glabrous and without scales. Frond thinly herbaceous, eight to eighteen inches long, three to four inches wide, with ten to twenty pinnae on each side. Pinnae crenate, one and a half to three inches long, very oblique, the lamina on the lower side being absent for half-distance while on the upper edge it is full, and parallel with the rachis. Sori medial, linear. Resembles *A. laetum* and *A. anisophyllum*, but the pinnae are much more cut away at the lower base.

A. unilaterale. Lam. *Enc.* 2, 305, 1786; C. Chr. *Index Filicum*, 136.

A. resectum. Sm. 1791; Hk. and Bkr, *Syn. Fil.* 210.

Tropical and subtropical Asia, Polynesia, and Africa and African Islands.

Rhodesia.—Chirinda Forest, 3700 to 4000 ft (Swynnerton, 840 a, 841).

68. ASPLENIUM PRIONITIS Kunze.

Plate 55. Nat. size.

Crown erect, paleaceous, with long black pointed scales. Frond two feet long, eight to ten inches broad, glabrous,

herbaceous, simply pinnate, with a naked stipe about one foot long. Stipe and rachis green. Pinnae eight to fourteen sub-opposite pairs; lower ones with half-inch petiole; upper more shortly stalked, all sharply toothed throughout, six inches long, one to one and a half inches broad at the base, and for three inches, then tapering to a rather elongated sharp point. Base on the upper side at a right angle to the pinna mid-rib, and slightly decurrent; lower base very oblique. Sori linear, three-quarter inch long, reaching from near the mid-rib to near the edge, and sometimes shorter ones between and rather nearer the edge. Veins mostly forked, with the sori on the upper line, the other barren, or with short sori near the point. Teeth sharp, mostly single, but rather irregular.

A. prionitis. Kunze, *Linnaea*, 10, 511, 1836; Pappe and Rawson, 17; Kuhn, *Fil. Afr.* 112; Hk. and Bkr, *Syn. Fil.* 204; C. Chr. *Index*, 127; Sim, *Ferns of South Africa*, 1st ed., 143.

A. obliquum. Willd. 5, 315, part (*fide* Kuhn).

Eastern South Africa and Mascarenes.

East.—Blockhouse Kloof, Grahamstown (Dr Atherstone).

Kaff.—Manubie Forest (J. H. Bowker); Pondoland (Drège); Port St John (Flanagan, 2474); Ntlonyana (Mrs Young).

Natal.—Common in coast bush (Wood); as far inland as Inanda, 1500 feet (Buchanan); Noodsberg, Inanda, Palmiet, Maritzburg (McKen).

Transvaal.—Shiluvane (Junod, 1690).

69. ASPLENIUM SERRA Langs. and Fisch.

Plate 56. Nat. size.

Crown erect, paleaceous. Frond coriaceous, glabrous, two feet long, six to eight inches broad, ovate, simply pinnate, with a stipe twelve inches long, which is naked above, and scaly at the base. Pinnae fifteen to twenty pairs, shortly stalked, alternate or sub-opposite, three to five inches long, one-half to three-quarter inch broad at the base, and tapering to a long attenuated narrow point. Pinnae unequally wedge-shaped at the base, on our plant cut halfway to the rachis or less into oblong or rounded sharply toothed lobes, the lower

lobe on the upper side larger and sub-flabellate. Sori two to three lines long, almost contiguous, in two lines parallel to the rachis, and quite close to it, or slightly oblique.

A. serra Langs. and Fisch. *Ic. Fil.* 1810; C. Chr. *Index*, 132.

A. serra Langs. and Fisch., var. *Natalense*. Baker, *Syn. Fil.* 485; Buchanan's List, No. 62; Lady Barkly's List, No. 71; Sim, *Ferns of South Africa*, 1st ed., 144.

A. serra. Wood's *Natal Ferns*, 22.

A. serra is a South American species with the margin inciso-serrate, and this deeply cut variety is its South African representative. It occurs also on the Cameroon Mts.

Natal.—Under the drip of water in bush at southern terminus of Great Noodsberg only (Buchanan); in two ravines at Little Noodsberg and at Inanda (Wood).

Rhodesia.—Chimanimani Mts, 6500 ft (Swynnerton, 851. "Common among the crags and forest, perhaps the commonest fern of the mountains"); near Umtali (B. H. Holland).

70. ASPLENIUM ADIANTOIDES (Linn.) C. Chr.

Baker's description in *Synopsis Filicum*, under the name *Aspl. falcatum* Lam., is:

"St. tufted, 6—9 in. long, firm, erect, greyish, nearly naked; frond 6—18 in. long, 4—6 in. broad, with 6—20 stalked, nearly horizontal pinnae on each side, which are 2—3 in. long, $\frac{1}{2}$ —1 in. broad, the point acuminate, the edges lobed often one-third of the way down, and the lobes sharply toothed, the two sides unequal, and the lower one at the base obliquely truncate; texture coriaceous; rachis naked or slightly fibrillose; veins very oblique; sori in long irregular lines reaching nearly to the edge. Hk. *Sp.* 3, p. 160.

Hab. Polynesian Islands, Australia, N. Zealand, Malaccas, Ceylon, Indian Peninsula, Mascarene Isles, Zambesi-land."

This species, which Christensen (*Index*, 99) places in *A. adiantoides*, is not known to me. The original name was *Trichomanes adiantoides* Linn.

71. ASPLENIUM GEMMIFERUM Schr.

Plate 57. Fig. 1. Frond much reduced. b Pinna, nat. size.

Varieties on Plates 58 and 59.

Crown erect, paleaceous, with long, narrow, lacinated, black scales. Frond thick, sub-coriaceous, simply pinnate,

glabrous, ovate-lanceolate, two to four feet long, six to eight inches broad, with a channelled green stipe one foot long. Pinnae six to twelve pairs, shortly stalked, alternate, or sub-opposite, falcate, four to six inches long, one to one and a quarter inches broad for most of the length, then drawn to an acute point; lower edge sloping very gradually to the petiole; the upper edge rounded suddenly down at the base to the petiole. Edge entire, or with shallow crenations, or very bluntly toothed. Terminal pinna similar, but rather larger, often with a bud at the base; lower pinnae not reduced. Sori linear, oblique, four lines long, extending rather more than halfway to the edge.

This is a most beautiful fern, massive and heavy in the type, though lighter in the varieties. Schlechtendal's figure (*Adum.* pl. 14 A) is more toothed, and more sharply toothed than often occurs.

- A. gemmiferum.* Schrader, *Gött. Gel. Anz.* 1818, 916; Kze, *Linnaea*, 10, 510; Pappe and Rawson, 17; Hk. and Bkr, *Syn. Fil.* 207; Sim, *Ferns of South Africa*, 1st ed., 145; C. Chr. *Ind.* 113.
A. lucidum. Schl. *Adum.* 25, tab. 14 A.

Africa and African Islands south of the Equator; growing in wet ground in the forest; not common.

West.—Hangklip (Mund and Maire); Knysna (Burchell, 5405); Swellendam (Holland); Voorman's Bosch (Rawson); Knysna (T. H. Rex, 830).

East.—Tzitzikamma (P. and R.); Grahamstown (Atherstone); Boschberg (MacOwan).

Kaff.—Komgha (Flanagan; R. Schlechter, 6223); Thaba N'doda, Perie, Frankfort, Toise River, etc. (T. R. Sim).

Natal.—Upper districts, as low as Inanda (Wood); Umpumulo, Maritzburg, Richmond (Buchanan); Buccleuch (W. Leighton); Nkandhla (Marriott); Zwaartkop, Karkloof, Impetyne, etc. (T. R. Sim).

Transvaal.—Marovuni (Burt-Davy, 228); Barberton (Thorncroft); Haenertsberg (Mrs Pott, 4658).

Rhodesia.—Umtali (Holland, Mrs Bennett); Gwaai River (J. Sim); Chirinda Forest, 3700 to 4000 ft (Swynnerton, 402 and 853).

Var. β . FLEXUOSUM Schrad.

Plate 58. Nat. size.

This has frequently fronds similar to the ordinary form of *A. gemmiferum*, or rather more toothed, and with the teeth

in pairs, but other fronds on the same plants have the pinnae cut halfway to the rachis into irregular, bifid, four-toothed, overlapping lobes, or toward the base cut nearly to the rachis into overlapping, cuneate, flabellate pinnules, toothed on the outer edge; teeth blunt, in pairs. Sori very irregular, generally extending from near the mid-rib to the base of the sinus, or with shorter ones up in the lobes. Adventitious buds occur irregularly on the upper surface of the frond; often several on a frond.

This form is not very permanent, and consequently not satisfactorily distinct from *A. gemmiferum*, appearing intermediate between it and var. *discolor*, though no further gradation in that direction has been seen. Schlechtendal's tab. 14, fig. b, belongs to this species, though named *A. lucidum* Forst. var.

A. flexuosum Schrad. Schl. *Adum.* 29; Pappe and Rawson, App. No. 3; Hk. and Bkr, *Syn. Fil.* 208.

Knysna (Holland); Grahamstown (Dr Atherstone).

Kaff.—Kongha (Flanagan); Perie; rare.

Rhodesia.—Chirinda Forest, 4000 ft (Swynnerton, 844 and 844 a); Umtali (Mrs Bennett).

Var. γ . DISCOLOR.

Plate 59. Nat. size.

Habit similar to *A. gemmiferum*, but smaller; frond not exceeding two feet, with a black or greenish-black rachis and stipe, and gemmiferous below the terminal pinna. Pinnae cut throughout to a widely margined rachis into distant cuneate pinnules one to two lines broad at the base, two to five lines broad above, glaucous on the under surface. Upper pinnules two-toothed, lower bifid, and with each lobe two-toothed, or the lower one on the upper side even more divided or flabellate, pinnatifid. Sori two to three lines long, almost marginal, extending along the upper base of a pinnule from near the mid-rib; sometimes also there are short marginal sori along the sinus which divides the pinnule into two lobes. This is a very distinct form, and I have seen no gradation toward var. *flexuosum*. If none such occur it ought to stand as a species, and be placed in section *Darea*, near *A. flaccidum* Forst.

This appears from specimens in Cape Town and Grahams-town Herbaria to be *Aspl. discolor* P. and R. 17, where, however, *A. lucidum*, Schl. *Adum.* tab. 14, fig. 6, is quoted, which is our var. *flexuosum*; while *A. flexuosum* Schr. is placed among the unknown species in the appendix. Wood's var. *flexuosum* is allied, and *A. gemmiferum* Schr., var. *laciniatum* Mett. is made by Kuhn to include both this and var. *flexuosum*.

West.—Knysna (Miss Dalgairns); Seven Oaks (Holland).

East.—Grahamstown (Atherstone); Brookhuizen's Poort (MacOwan); Kat River (E. and Z.).

Kaff.—Katberg.

Natal.—Seven-mile Bush, Upper Umkomaas, 4000 feet, and Inanda (Wood).

72. ASPLENIUM RAWSONI Baker.

Plate 63. Nat. size.

Crown tufted, slightly paleaceous. Frond deltoid, glabrous, simply pinnate, two-pinnatifid or two-pinnate, three inches long, one and a half inches broad, with a slender green channelled stipe three inches long, paleaceous only at the base, with small brown scales. Pinnae about four sub-opposite pairs; upper pinnae nearly round or slightly cuneate, shortly stalked, three to five lines long and broad, thinly coriaceous, crenate at the outer rounded margin; lower pair of pinnae larger, more or less lobed, or cut nearly or quite to the midrib into round lobes. Sori short, occupying the centre of the pinnule, and leaving a wide space outside. Veins distinctly flabellate.

This is named *A. ruta-muraria* Linn. in Pappe and Rawson's *Synopsis*, but the specimens I have seen are quite distinct from this species, and also from *A. cuneatum* Lam. which it approaches.

A. Rawsoni. Baker, *Journ. Bot.* 1872, p. 362; Hk. and Bkr, *Syn. Fil.* 487; Lady Barkly's List, No. 76; Sim, *Ferns of South Africa*, 1st ed. 147; not maintained in C. Chr. *Ind.* 128 but this is probably a printer's error as *A. ruta-muraria* P. and R. is referred to it, p. 130.

A. ruta-muraria. Pappe and Rawson, quoted by Kuhn, *Fil. Afr.* 115 (not *A. ruta-muraria* L.).

Top of Muizenberg Mountains, in crevices of rocks (Hon. R. W. Rawson, 1857).

Lady Barkly adds that only one plant was found, and further search has proved vain.

73. *ASPLENIUM ADIANTUM-NIGRUM* Linn.

Plate 46. Fig. 2. Small frond, nat. size. b Pinnule of
var. *obtusum*.

Crown procumbent, short, slightly branched, glabrous, or slightly paleaceous, thickened by the enlarged basis of decayed fronds. Fronds deltoid, coriaceous, glabrous, two to three-pinnate, varying from three inches long and two broad to nine inches long and six broad, with numerous, alternate, or sub-opposite pinnae, and a dark, naked, furrowed stipe, one to six inches long, swollen into a fleshy base below. Lower pinnae largest, deltoid, stalked, one to three inches long, one to one and a half inches broad; in large fronds two-pinnatifid, with three to four pairs of distant, stalked, deltoid, pinnatifid, toothed pinnules, one inch long, half inch broad; in small fronds, only the lower pinnules separate, roundly ovate, lobed and toothed, with upper pinnules close, rounded, confluent, and upper pinnae also confluent. Pinnae with a broad point, and rounded at the apex; lobes and pinnules broadly rounded, all sharply toothed, but with the teeth short and not divergent. Sori abundant, one to one and a half lines long, in two rows in each lobe or pinnule, slightly oblique, and reaching halfway from the centre to the edge, afterwards confluent in one long mass of capsules.

A. adiantum-nigrum Linn. Schl. *Adum.* 31, tab. 17; Pappe and Rawson, 21; Moore's *Index*, 109; Hk. and Bkr. *Syn. Fil.* 214; Kuhn, *Fil. Afr.* 95; Sim, *Ferns of South Africa*, 1st ed. 148; C. Chr. *Index*, 99.

A. tabulare. Schrad. *Gött. Gel. Anz.* 1818, 916.

A. argutum. Kaulf. *Enum.* 176.

Temperate Europe, Asia, Africa, and African Islands. In South Africa, local and not common; growing on rocky banks.

West.—Table Mountain, Grootvader's Bosch (Rawson); Devil's Mountain, Dutoitskloof (Kunze); Genadendal, 1000 ft (R. Schl. 9865); Rietfontein Poort, 120 ft (R. Schl. 9701); Houtsbay, 400 ft (R. Schl. 1219); Sneeuwkop, above Bowesdorp (Prof. Pearson, 5838).

East.—Grahamstown (Holland); Graaffreinet (Bolus, 206); Winterhoek (McLea); Boschberg (MacOwan).

Kaff.—Thabase (Baur); Komgha (Flanagan); Dohne, Cathcart, Alice.

Natal.—Midland and upper districts (Wood); Umpumulo, Greytown, Maritzburg, Mooi River, Riet Vlei (Buchanan).

Transvaal.—Johannesburg (A. Pehrsson, 263).

Orange Free State.—Ficksburg (W. A. Quail).

Rhodesia.—Umtali (J. F. Darling).

Var. β . *OBTUSUM* (Willd.).

Plate 46. Fig. 2. b Pinnule.

Generally a stronger growing form than the type, rather more cut, with narrow, spatulate, and lobed pinnules, and with three to five sharp, but not divergent, equal teeth on each lobe. This form approaches *A. solidum* Kze, which may also be a more altered form of *A. adiantum-nigrum*, as another further grade appears in *A. acutum* Bory.

In the fine series of European specimens of this group in Herb. Gub., the more rounded form appears as *A. adiantum-nigrum* L., and our var. *obtusum* as *A. serpentini* Tausch, but *A. solidum* is not represented.

Schlechtendal gives two forms of *A. adiantum-nigrum*, the one representing our type, and the other is described as being *A. acutum* Bory, but the figures are both of the type, and almost alike except in size.

A. adiantum-nigrum L., var. γ *obtusum*. Hk. and Bkr. *Syn. Fil.* 216; Sim, *Ferns of South Africa*, 1st ed. 149.

A. obtusum Kit.

A. serpentini. Tausch, *Flora*, 1839.

Moore also mentions as synonyms here :

A. adiantum-nigrum capense of Schimp. Herb. Abys.

A. Fosteri Sadl.

This variety occurs where the species is growing vigorously, or among grass, but its separate distribution has not been noted, and its localities are included above with those of the type.

74. *ASPLENIUM SOLIDUM* Kunze.

Plate 62. Nat. size. b Fertile pinnule.

Crown procumbent, glabrous. Fronds deltoid, coriaceous, glabrous, shining, green, three to four-pinnatifid, six to fifteen

inches long, four to seven inches broad, with a channelled, green or brown naked stipe, four to six inches long. Pinnæ mostly alternate, numerous, stalked, deltoid, sharp pointed, increasing in size downward; the lowest three to four inches long, one and a half inches broad, with about five pairs of alternate, shortly stalked, deltoid pinnules, one-half to one inch apart. Pinnules cut to the mid-rib below, into narrowly cuneate, three-lobed segments, which have three to five sharp pointed divergent teeth on each lobe. Upper segments narrower, not lobed, slightly confluent, but similarly toothed; and the pinnule pointed, with a few large alternate simple teeth. Sori one to two lines long, alternate, and near the mid-rib above, or two to three in each pinnule below.

Kunze mentions two varieties, *A. platyphyllum* and *A. stenophyllum*. The latter is the form in our figure, the former is slightly broader in all its parts, and while evidently a form of *A. solidum*, it also comes very near *A. adiantum-nigrum* L., var. *acutum*, which, like this, has three to five long teeth with the central one longest, and which is well known as a European plant, and quoted in Moore's *Index* as from South Africa, though this is the only representative of it I have seen. *A. solidum* resembles a *Darea* in the cutting, but has the sori facing inward, and not quite marginal.

A. solidum. Kze, *Linnaea*, 10, 520, 1836; Pappe and Rawson, 21; Moore's *Index*, 169; Kuhn, *Fil. Afr.* 116; Hk. and Bkr, *Syn. Fil.* 214; Sim, *Ferns of South Africa*, 1st ed., 150; C. Chr. *Ind.* 133.
Darea mucronata. De Cand. Herb.

This species grows under bushes, mostly among coast sands, and is rather rare.

West.—George (Lady Barkly); Ruigte Valley (Drège); Port Elizabeth (Mrs T. V. Patterson, 820).

East.—Algoa Bay (Forbes); Bushman's River (Holland); Kowiemouth (MacOwan).

Kaff.—Alice (Dr Stewart); Komgha (Flanagan); East London (T. R. Sim).

Natal.—Near Peel's, Umlaas (McKen); Durban sand dunes (T. R. Sim).

75. *ASPLENIUM CUNEATUM* Lam.

Plate 64. Fig. 1. Nat. size.

Rhizome subterranean, slender, creeping, paleaceous. Fronds deltoid, glabrous, sub-coriaceous, two-pinnate, four to eight inches long, three to four inches broad, on a wiry, green or brown stipe, six inches long, scaly below only. Pinnae shortly stalked, deltoid, blunt, with four to six obtuse, rounded or lobed, distinct pinnules, which are cuneate at the base, and sharply serrate round the outer edge. Lower pinnae generally not longer than those above them. Sori numerous, flabellate, mostly short, often absent from the lower pinnae. Veins very numerous, conspicuous.

A. cuneatum. Lam. *Enc.* 2, 309, 1786; Pappe and Rawson, 20; Kunze, *Linnaea*, 10, 516; Kuhn, *Fil. Afr.* 100; Hk. and Bkr, *Syn. Fil.* 214; Sim, *Ferns of South Africa*, 1st ed., 151; C. Chr. *Index*, 107. *A. multifforme* Krasser. (*Plantae Pentherianae, Ann. des K. und K. Nat. Hof.* 15, 1, Vienna 1900, from Griqualand East.)

Central America, Polynesia, South Africa, and African Islands. This form, which is not so common as var. *splendens*, grows on rocks away from the present forest range, but which most likely had been under forest at some previous time. Grown on walls it becomes small and dwarfed, and might be mistaken for being specifically distinct.

East.—Somerset East (MacOwan); Grahamstown (Dr Atherstone); Sidbury (Miss M. Daly, 779).

Kaff.—Izeli, and near Peddie (T. R. Sim); Kei Road (Rev. F. A. Rogers, 3220); Main (Mrs Young).

Natal.—Nearly everywhere in bush from Palmiet to Nottingham (Buchanan, Wood; but both include var. *splendens* here); Nkandhla (Marriott); Wellington, Rosetta, Besters, Umzimkulu, Zwaartkop, etc. (T. R. Sim).

Orange Free State.—Tweespruit (Marriott); Van Reenen Kloofs (Prof. Bews).

Transvaal.—Marovuni (Burt-Davy, 217, 239); Barberton (L. C. de Beer, 127); Belfast, 1909 (R. Leendertz, 2783); Lydenburg (J. Pienaar); Haenertsberg (Mrs Pott, 4657).

Var. *β*. *SPLENDENS* (Kze).

Plate 64. Fig. 2. Pinna, nat. size.

Larger in all its parts than the type. Fronds three-pinnatifid, often two feet long, nine inches broad, and with

a stipe nine inches long. Pinnae three to four inches long, one and a half to two inches broad, pointed, or sometimes with an attenuated point, and about four pairs of pinnules, also pointed more or less; the lower ones larger, and cut nearly to the mid-rib into roundly cuneate lobes. The texture is less leathery than in the type, and occasionally it has a few scattered ovate scales on the stipe and rachis. This form is everywhere in the forest, and cannot be regarded as other than a conditional form.

A. splendens. Kze, *Linnaea*, 10, 516; Pappe and Rawson, 21; Moore's *Index*, 169; Kuhn, *Fil. Afr.* 117; Hk. and Bkr, *Syn. Fil.*, ed. 2, 487; Sim, *Ferns of South Africa*, 1st ed., 191; C. Chr. *Index*, 133.
A. splendens Kze, var. *elongatum*. Kze, *Linn.* 10, 516.

East.—Krakakamma (E. and Z.); Grahamstown (Holland).

Kaff.—Kat River (E. and Z.); Komgha (Flanagan); Pondoland (Drège); St John's River (Sir H. Barkly); abundant in Perie, Frankfort, Stutterheim, Toise River, etc. (T. R. Sim).

Natal.—Not distinguished from *A. cuneatum* by Natal botanists, but present in all forests; Nkandhla (Marriott); Highlands (R. Schl. 6843).

Transvaal.—Woodbush (T. J. Jenkins, 798); Pilgrim's Rest (L. Collins, 905).

Var. γ . *ANGUSTATUM* Sim (in *Ferns of South Africa*, 1st ed., 152).

Plate 63. Fig. 2. Nat. size.

Frond proportionally narrower and less cut than in *A. cuneatum*, coriaceous, glabrous, two to two and a half inches broad, twelve to fifteen inches long, including a stipe of six inches. Pinnae about eight sub-opposite pairs, of which the upper are cuneate or cuneate three-lobed; lower stalked, deltoid, pinnatifid into about three cuneate pinnules, of which the terminal is longest, lobed, and pointed, and the others rounded. Outer edges all crenate-serrate; cuneate sides entire. Rachis more or less paleaceous, with dark, lanceolate, hard, deciduous scales. Frond without scales except on the short petioles. Sori half-inch long, three to six in a pinnule, and like the conspicuous veins, flabellate. This approaches the smaller woolly form of *A. praemorsum* Sw. in general outline, but is less cut, less pointed, and

almost naked, and evidently belongs to *A. cuneatum*. Found by Lady Barkly at Knysna, and labelled by her *Asplenium dimidiatum* Swartz.

76. ASPLENIUM PRAEMORSUM Sw.

Plate 65. Nat. size.

Rhizome procumbent on the surface, three to six inches long, densely set with longish, dark brown, linear, shining scales. Frond two-pinnate, coriaceous, ovate-lanceolate, two to four inches broad, one to one and a half feet long, with about twelve pairs of sub-opposite or alternate pinnae, and a stipe of six inches. Pinnae deltoid, pointed, shortly stalked, cut nearly or quite to the rachis into four to six cuneate pinnules; the lower distinct and flabellate or trifid, the others oblong pointed, and slightly confluent; all with the upper margin sharply toothed, and tapering to a point. Sori two to three lines long, flabellate or central in the pinnules, and in two lines close to, and nearly parallel with the mid-rib in the upper part of the pinnae, facing inward. Stipe and rachis nearly black, abundantly set with rusty brown, fibrillose scales, which increase in size downward. Pinnae also set more or less thickly on both sides with scattered brown woolly scales.

A. praemorsum. Sw. *Prod.* 130, 1788; Kze, *Linnaea*, 10, 519; Pappe and Rawson, 19; Kuhn, *Fil. Afr.* 111; C. Chr. *Index*, 127.

A. furcatum. Thunb. *Prod.* 172; *Fl. Cap.* 735; Schl. *Adum.* 30; Hk. and Bkr, *Syn. Fil.* 214; Sim, *Ferns of South Africa*, 1st ed., 152.

A. praemorsum (including both forms) grows through most of the tropics. Here, var. *tripinnatum* is the more common plant, growing abundantly in forest districts, and some of the localities quoted below may belong to that form. The less divided form grows on exposed rocks, and though very different in the extremes they cannot be separated, as every intermediate gradation between the two occurs. A minute, simply pinnate, scaly form, three to four inches high, grows on a rock near Bollasi, King William's Town.

West.—Ceres (Dr H. H. W. Pearson, 3500); Table Mountain, Rondebosch (Bergius); Wellington (M. Knobel, 966); Paarlberg (Kunze); George, 900 ft (R. Schl. 2364).

East.—Uitenhage (Krauss); Algoa Bay (Forbes); Bedford (Miss Cook); Krakakamma, Zwaartkop, Frames Drift, Port Elizabeth (Mrs T. V. Patterson, 2029).

Kaff.—Dohne Hill, Tamacha, Bollasi, etc. (T. R. Sim); Main (Mrs Young); Cala (Royffe, 197).

Natal.—Plentiful in upper districts; Maritzburg and Umpumulo to Drakensberg (T. R. Sim); Howick (R. Schl. 6787); Buccleuch (W. Leighton).

Transvaal.—Magalisberg (Sanderson); Fairy Glen (R. Leendertz, 1616); Mamotsinri (Burt-Davy, 211); Crocodile and Magalies Rivers (Burt-Davy, 199); Haenertsberg (Eastwood); Woodbush (W. Nelson, 468); Rietfontein (R. Leendertz, 874); Ermelo (R. Leendertz, 2958); Rosehaugh (J. M. Sim).

Rhodesia.—Salisbury (J. F. Darling); Borrowdale (H. M. Hole); Umtali (Holland, Mrs Bennett); Mazoe, 4500 ft (Eyles, 338, 477); Bulawayo (Eyles and Johnson, 1022); Matopo Hills (Miss Gibbs); Victoria Falls (Garbutt, J. Sim); Chirinda Forest, 4000 ft (Swyn. 845); Chimanimani Mts, 7000 ft (Swyn. 846 a); Melsetter, 6000 ft (Swyn. 808); Mt Pene, 7000 ft (Swyn. 6026).

Var. β . TRIPINNATUM.

Plate 66. Nat. size.

Larger and more cut throughout than the type, also less coriaceous, and less paleaceous. Frond five to nine inches broad, one and a half to two and a half feet long, with a stipe six to nine inches long, three-pinnatifid. Pinnae shortly stalked, deltoid, one and a half inches broad, three to four inches long, with woolly scales on the lower side only. Pinnules distinct, deltoid, shortly stalked, pinnately cut to the mid-rib into five to seven cuneate, or flabellate, three-lobed, toothed pinnules. The stipe and rachis are abundantly fibrillose, and the channelled, slightly margined, rachises of the pinnae, and the under side of the pinnae, are also more or less fibrillose, but the upper surface is generally almost naked and shining. In deep shade it is sometimes nearly destitute of scales throughout, and quite herbaceous in texture; but is then easily distinguished from *A. cuneatum* by its more numerous and proportionally shorter pinnae, and also by the lower pinnae being rather less than those at the middle of the frond.

A. furcatum Thunb., var. *tripinnatum*. Bkr, *Syn. Fil.* 487; Wood, *Ferns of Natal*, 23; Sim, *Ferns of S. Africa*, 1st ed., 154.

A. furcatum Thb., var. *tripinnatifidum*. Sim, *Kaff. Ferns*, 45.

A. laserpitiifolium. McKen, *Natal Ferns*, No. 59.

A. furcatum. P. and R. 20.

Localities have not formerly been recorded for this as separate from *A. furcatum*, but it is the more common form, and possibly some quoted for the species belong to this variety.

West.—Knysna (T. H. Rex, 829).

East.—Grahamstown (Dr Atherstone); Boschberg (MacOwan).

Kaff.—Kongha (Flanagan); Main (Mrs Young), and through all the Amatolla Forests (T. R. Sim); Katberg (F. A. Rogers, 3881).

Natal.—Noodsberg (Wood); Van Reenen's Pass, Drakensberg (Dr Rehmann, 7217); Nottingham (Buchanan); Peel's on the Umlaas (McKen); Highlands (R. Schl. 6843).

Transvaal.—Barberton Mts (Burt-Davy, 330; and J. Thornecroft, 97); Mamotsinri and Marovuni (Burt-Davy, 208, 216); Modderpoort (F. A. Rogers, 91); Houtboschberg (J. Nelson, 462); Woodbush (Mrs Pott, 4663).

Rhodesia.—Umtali (J. F. Darling, Mrs Bennett); Mt Pene, 7000 ft (Swyn. 846, 6027).

(ASPLENIUM BULBIFERUM Forst.

This well-known fern is credited in Hk. and Bkr, *Syn. Fil.*, to Natal, but Buchanan thinks it is a mistake, while Kuhn, McKen, and Wood all omit it. There are no specimens in the South African herbaria, and it seems likely that the locality is a mistake, though not deleted in the second edition of *Syn. Fil.* nor in the more recent revision in *Annals of Botany*. Christensen does not credit it to Africa.)

77. ASPLENIUM ABYSSINICUM Fée.

Plate 70. Nat. size. b, c Pinnules, enlarged.

Frond eighteen inches long, six inches broad at the middle, rather less below, tapering to a fine point, and having a naked stipe of six inches. Pinnæ about twenty pairs, alternate, or the lower sub-opposite, spreading; those on one side an inch apart at the middle; the lower more distant and reduced; the upper much closer and gradually smaller. Mid-pinnæ lanceolate, three inches long, three-quarter inch broad at the base, sessile, with a slender rachis, and ten to twelve pairs of alternate, deltoid, shortly stalked pinnules, half inch long,

three to four lines broad, which again are cut to the mid-rib into two to three pairs of alternate segments, of which the upper are linear-oblong, pointed, one line long, half line broad; and the lower are broader, flabellately two to three lobed, and narrowed to the base. The lower segment on the upper side is nearer the pinna rachis than that on the lower side, and the pinnule is thus unequal sided. Sori on the veins; one near the base of each simple segment, and opening toward the point of the pinnule; two to three face to face on the flabellate segments, short, frequently curved, and not reaching near the margin. Frond glabrous, quite destitute of scales, and thinly herbaceous in texture. Rachis slender, brown, slightly green, margined. A most graceful fern found only in tropical Africa, but very closely allied to the American *A. cicutarium* Sw., under which it was formerly placed.

In Hk. and Bkr, *Syn. Fil.*, 1st edition, *A. rhizophyllum* Kunze is also credited as sent by Sanderson from Natal; but in 2nd edition this locality is omitted, and Lady Barkly and Buchanan both trace it to his *A. cicutarium*, which is the present species.

A. abyssinicum. Fée, *Gen.* 199, 1850-52; C. Chr. *Index*, 98.

A. cicutarium Sw. Hk. and Bkr, *Syn. Fil.* 220; Kuhn, *Fil. Afr.* 99; Sim, *Ferns of S. Afr.*, 1st ed., 155.

Transvaal.—Magalisberg (Sanderson).

Rhodesia.—Umtali (J. F. Darling, Mrs Bennett); Chirinda Forest, 3100—4000 ft (Swyn. 819); Zambesi, near Victoria Falls (J. Sim); Rhodesia (B. H. Holland).

78. ASPLENIUM DRÈGEANUM Kze.

Plate 67. Nat. size.

Crown erect, tufted, slightly paleaceous, with brown scales, or almost naked. Fronds herbaceous, glabrous, tender, lanceolate, acuminate, six to fifteen inches long, one to one and a half inches broad, with a slender green rachis, and a stipe three inches long. The frond produces a proliferous bud below the terminal pinnule, and has fifteen to thirty pairs of shortly stalked pinnae, one-half to three-quarter inch long, half inch broad, cut to the mid-rib into one to three pairs of simple linear pinnules, besides the lower one on the upper

side, which is often bifid or trifid, and which has no corresponding pinnule on the lower side. The pinnules or lobes are one to two lines long, and a half line or less broad, with the sori marginal or intramarginal along its upper edge. Lower pinnae gradually reduced to half the size of middle ones.

A. brachypterum Kze differs only in being smaller, and is merged in *Drègeanum* by Kuhn, while Baker (*Annals of Botany*, Aug. 1891) now says that "*A. brachypterum* and *Drègeanum* Kze are dareoid forms of *A. Sandersoni* Hk." If these can be connected, I do not see why *A. auriculatum* (Thun.) Kuhn should not be held to belong to the same group of forms, under one broken species, but meantime I look on the three latter as distinct.

A. Drègeanum. Kze, *Linn.* 10, 517, 1836; Suppl. to Schk. *Fil.* tab. 27; Pappe and Rawson, 22; Kuhn, *Fil. Afr.* 101; Hk. and Bkr, *Syn. Fil.* 221; Sim, *Ferns of S. Afr.*, 1st ed., 156; C. Chr. *Index*, 109.

A. brachypterum. (?Kze, *Linn.* 23, 232); Hk. and Bkr, *Syn. Fil.* 221; Wood, *Natal Ferns*, 23; Lady Barkly's List, No. 85; Wood, *Handbook of the Flora of Natal*, 171. (In C. Chr. *Index Filicum Suppl.* 1906—1912, *A. brachypterum* Kze, *Linn.* 23, 232, 1850; Hieron. *Deutsche Zentralafr. Exp.* 2, 8 (1910) is restored, as from tropical Africa only. Baker (*Syn. Fil.* 221) gives distribution as Madagascar, Natal, Angola, and Guinea Coast.)

Africa and African Islands; growing in deep shady ravines.

Kaff.—Omsamcaba (Drège); Port St John's, 1200 ft (Flanagan, 2472). Natal.—Abundant at Umpumulo, 2000 to 3000 feet (Buch.); Inanda, Maritzburg, and midland districts; Buccleuch (W. Leighton). Rhodesia.—Umtali (Darling).

79. ASPLENIUM AURICULATUM (Thbg) Kuhn.

Plate 68. Nat. size.

Crown erect, tufted. Frond herbaceous, glabrous, widely lanceolate, one to two feet long, three to six inches broad, with a green, herbaceous, flattened, glabrous rachis, and a naked, channelled stipe, six inches long. Frond proliferous below the terminal pinnule. Pinnae twenty to thirty pairs, one and a half to two and a half inches long, one-half to three-quarter inch broad at the base, and tapering to a rather

blunt point, cut uniformly to the broadly winged mid-rib into eight to twelve pairs of regular, close, bluntly oblong, simple pinnules, one line broad, one to three lines long; the lower pinnule on the upper side broader, sub-flabellate, 2-3-4-fid, or pinnatifid. Sori oblong on the upper side of the vein but not marginal; mid-rib, together with its wings, one line broad. Pinnae longest at the middle of the frond. Baker suggests that it may be a dareoid form of *A. lunulatum*, while Pappe and Rawson, and Wood remark on its growing in company with *A. Drègeanum*, to which it is closely related. Kunze mentions a form with falcate pinnae.

Asplenium auriculatum (Th.). Kuhn, *Fil. Afr.* 97; C. Chr. *Index*, 102.

Asplenium Thunbergii. Kze, *Linn.* 10, 517; Pappe and Rawson, 22;

Hk. and Bkr, *Syn. Fil.* 223; Wood, *Natal Ferns*, 23; Sim, *Ferns of South Africa*, 1st ed., 157.

Caenopteris auriculata. Thunb. *Nov. Act. Petrop.* 1791.

Darea auriculata Willd. Schl. *Adum.* 32.

Cape of Good Hope (Thunberg).

Natal.—Near streamlets in bush, Great Noodsberg, Inanda, Maritzburg (McKen); abundant at Umpumulo, 2000 to 3000 feet (Buch.);

Benvie (Marriott); Zwaartkop (T. R. Sim); Buccleuch (W. Leighton).

Rhodesia.—Chirinda Forest, 3700—4000 ft (Swyn. 806); Chipetzana, 4000 ft (Swyn. 807); Mt Pene, 7000 ft (Swyn. 6017).

(ASPLENIUM FLACCIDUM Forst.

Plate 60. Nat. size. b Fertile pinnule, enlarged.

Crown erect, tufted, naked or almost so. Frond firmly coriaceous, glaucous, glabrous, one and a half feet long, including stipe of six inches. Pinnae six pairs, linear acuminate, alternate, three to four inches long, one line broad at the sinuses and point, about four lines broad across the segments. Pinnules acute, one line broad and long, somewhat decurrent. Terminal pinna four inches long, with longer pinnules and sori than the others; lower pinnae barren, not pinnatifid, but waved at the margin. Rachis and stipe slightly winged, wing disappearing below. Sori short, marginal on the upper margin of the pinnules, opening outward. The above description, as well as our figure, are from Sanderson's specimen in Herb. Gub.; but the plant often grows stronger abroad, with fronds two to three feet long, and with numerous,

flaccid, coriaceous-pinnæ, half inch broad and six inches long, cut into regular, linear or forked, pointed pinnules, three lines long, one line broad, and having one line between each; the lowest pinnule on the upper side longer, and again pinnatifid. Adventitious buds are produced irregularly on the upper surface of the frond. This is another of Sanderson's finds which has not been seen since. I include it here simply to draw the attention of collectors to the matter.

Buchanan remarks—"It seems to be a mistake. Mr Sanderson knows nothing of it, and Kuhn positively denies it to be a South African plant (*Fil. Afr.* 203)." However, as explained elsewhere, Sanderson sent home up-country specimens without keeping notes or duplicates, and this may have been among them. The specimen in Herb. Gub. is distinctly *A. flaccidum*, but it does not have Sanderson's label, nor any explanation of how it came there, though attributed to Sanderson.

A. odontites R. Br. (*Caenopteris* Thunb., P. and R.; *Darea* Willd., Schl. *Adum.* 32), recorded as found by Thunberg at the Cape, seems to be the same plant, but the locality is denied by Kuhn.)

80. ASPLENIUM BIPINNATUM (Forsk.) C. Chr.

Platè 71. Fig. 1. Frond of young plant, nat. size. Fig. 2. Fertile frond of mature plant, nat. size. b Fertile segment. c Section of stipe.

Crown erect, paleaceous, with numerous, lanceolate, dark scales. Frond two to three-pinnate, deep green, firmly herbaceous, or sub-coriaceous, glabrous, ovate lanceolate, one-half to one and a half feet long, two to six inches broad, with a channelled, green, naked rachis, and a similar stipe three to six inches long. Pinnæ ten to twenty alternate or sub-opposite pairs, deltoid or deltoid acuminate, often all fertile except the lower two pairs, which are then shorter, and not so much cut as the others, but frequently whole fronds are barren when they are different from the fertile. Barren pinnæ blunt, cut to near the mid-rib into several cuneate,

flabellate, deeply lobed pinnules, above which are bifid, and then simple pinnules, more or less confluent. Fertile pinnae longer, cut throughout into distinct, separate, pointed pinnules, of which the upper are simple, gradually longer downward, then bifid and trifid, and with the lower pinnules ranging from flabellately three to five-lobed to fully pinnate, with three to four pairs of linear, or sometimes bifid, pointed segments. All the pinnules or segments, as well as the rachis of the pinna, are about a half line broad, and consist of a thickly margined vein only. Sori one to three lines long, marginal along the inner face of each segment, or in partly fertile fronds sometimes intramarginal. The lower pinnules on the upper side of the pinnae are parallel with the rachis, and sometimes very noticeable when much larger than the others, but with no corresponding pinnule on the lower side. This is a most variable plant, and has been made into several species; but there is every possible gradation, and even permanent forms cannot be selected.

Caenopteris furcata Bergius (*Asplenium stans* Kze) is the small plant growing on trees, in which the pinnules are all simple, or the lower only bifid.

A frond in the Albany Museum marked var. β is two and a half feet long, one foot broad at the middle, very unlike the ordinary form, and more nearly approaching *A. flaccidum* except in texture. It has pinnae six inches long, one inch broad at the base, and tapering to a point, only the lower pinnules six to seven lobed, the next bifid, then simple, distant, linear lobes. The two lowest pinnae are different, two inches long, one inch broad, and like usual barren lower pinnae of *A. bipinnatum*. But even this curious form is connected with *A. bipinnatum* by as large a frond in Natal Govt Herb., which is similar in all respects, except that three to four of the lowest pinnules are pinnate. The lowest one on the upper side is parallel with the rachis, and the others point outward. The texture is as in the common form.

In habit, habitat, cutting, etc. the simpler forms of *A. bipinnatum* and *A. theciferum* are very much alike, and Kuhn places the latter in *Asplenium*, where it would stand

next to this species, and be distinguished by the shorter and more terminal sori.

A. bipinnatum (Forsk.) C. Chr.; Hieron. *Deutsche Zentralafr. Exp.* 2, 11, 1910; C. Chr. *Index Fil. Suppl.* 1906—1912, 10.

A. achilleifolium (Lam.). C. Chr. *Ind.* 99, 1905.

A. rutaefolium. Kze, 10, 521; Pappe and Rawson, 23; Hk. and Bkr, *Syn. Fil.* 222; Kuhn, *Fil. Afr.* 115; Sim, *Ferns of South Africa*, 1st ed., 158.

Caenopteris rutaefolia. Bergius, *Act. Petr.* 6, 249; Thunb. *Prod.* 172; *Flora Cap.* 734.

Darea rutaefolia J. Smith, Willd. *Schl. Adum.* 33.

Asplenium stans. Kze, *Linnaea*, 10, 521; Pappe and Rawson, 23.

Darea stans. Bory.

Caenopteris furcata. Bergius, *Act. Petr.* 1778, 6, 248.

Darea furcata J. Smith. *Schl. Adum.* 33.

Adiantum achilleifolium. Lam. *Enc.* 1, 43, 1783.

Lonchitis bipinnatum. Forsk. *Fl. Aeg. Arab.* 184, 1775.

Fiji, New Caledonia, South Africa and its islands, and East Asia. One of our most common ferns throughout the forest districts, easily cultivated, and known as the Carrot Fern.

West.	}—Frequent in bush, or on rocks among scrub.
East.	
Kaffraria.	
Natal.	

Transvaal.—Houtbosch (Dr Rehmann, 5584); Houtboschberg, 6000 ft (R. Schl. 4463); Marovuni (Burt-Davy, 237); Haenertsberg (Eastwood; Mrs Pott, 4660); Barberton (Miss Williams); Forbes Reef, Swaziland, 5100 ft (Burt-Davy, 2731).

Rhodesia.—Umtali (Holland, Mrs Bennett); Chipetzana headwaters, Mafusi, 4000 ft (Swyn. 807, in part).

81. ASPLENIUM THECIFERUM (H. B. K.) Mett.

Plate 72. Nat. size. b Fertile pinnule, enlarged.

Crown tufted, or shortly creeping, and set with lanceolate, hard, nearly black scales. Frond lanceolate, nearly glabrous, two to four inches broad, half foot to two feet long, on a stalk half as long, which is rounded at the back, and furrowed in front, and more or less scaly below. Rachis with a thick rounded wing throughout. Pinnæ and pinnules simply winged veins, but of firm coriaceous texture. Pinnæ alternate,

widest at the base, and with three to five pairs of alternate linear or forked pinnules, one line broad, half inch long, each bearing a nearly terminal sorus, surmounted on the lower side by a rounded wing of lamina. Involucre shortly cup-shaped, as wide as the pinnule. Sometimes the habit is closer than figured, and the pinnules only half a line broad and surmounted—candelabra fashion—by the wider saucer-shaped involucre.

Asplenium theciferum (H. B. K.). Mett. *Ann. Sc. Nat.* 5, 2, 227, 1864; C. Chr. *Ind.* 135.

Davallia concinna Schrad. Kze, *Linnaea*, 13, 152; Schl. *Adum.* 55; Pappe and Rawson, 25; Hk. and Bkr, *Syn. Fil.* ed. 1, 100; Sim, *Ferns of S. Afr.*, 1st ed., 65.

Davallia thecifera H. B. K. Hk. and Bkr, *Syn. Fil.* ed. 2, 100.

Davallia campyloptera. Kunze, *Linnaea*, 10, 544; Suppl. to Schk. *Fil.* t. 75.

Davallia Schimperii. Hk. *Sp.* 1, 193.

Asplenium concinnum. Kuhn, *Fil. Afr.* 99.

Asplenium theciferum Mett. Kuhn, *Fil. Afr.* 117.

Loxoscaphe concinnum and *theciferum* Moore.

South America, Africa, and African Islands.

This is very like *Asplenium bipinnatum* in habit, habitat, cutting, and texture, and probably often passed as such, but the involucre here is almost terminal and compressed cup-shaped, while in *A. bipinnatum* it opens along the side of the pinnule as a marginal slit, and is longer than deep.

Epiphytal on trees, mostly inland.

West.—Knysna (Lady Barkly); Plettenberg's Bay (P. and R.); George, Klein-Bosch River (Drège).

East.—Brookhuizen's Poort, and Blockhouse Kloof (Dr Atherstone); Zwaart-hoogdens, near Grahamstown (MacOwan); Riversdale (R. Schl. 1801).

Kaff.—Katberg (Miss Hartzenberg); Fort Beaufort (Holland); Main, Transkei (Mrs Young); Toise River, and rare in Evelyn Valley, Perie (T. R. Sim); Port St John's (Flanagan, 2468).

Natal.—Umpumulo, Karkloof (Buchanan); Maritzburg, Richmond, Nottingham, Cathkin (McKen); Van Reenen (R. Schl. 1004).

Transvaal.—Houtbosch (Dr Rehmann, 5606; R. Schl. 4700); Belfast (R. Leendertz, 2786).

Rhodesia.—Gwaai River (J. Sim).

Portuguese East Africa.—Moramballa (Kirk).

82. *ASPLENIUM HOLLANDII* Sim¹.

Plate 69. Nat. size. b Fertile pinnule, enlarged.

Stipe paleaceous, six inches long. Frond ovate-deltoid, quadripinnate, thinly coriaceous, two feet long, twelve inches wide below the middle, rather narrower to the base and gradually less upward. Rachis brown, fibrillose, grooved. Pinnæ six inches long, two inches wide below, with a margined rachis and alternate pinnules, of which the lowest is on the upper side. Pinnules one inch long, half inch wide, cut into stalked segments, of which the upper are simple and the lower 3—4-fid. Ultimate segments pointed, two to three lines long, half line wide or less, their stalks narrower. Segments of barren frond blunt. Sori abundant, lateral, short, flattened, one near the base of each ultimate segment; the involucre scarious and attached at the base and sides. A beautiful fern, one of the largest and most finely cut Dareae, but with davallioid sori, which led to its being described by me at first as *Davallia* (*Loxoscaphe*) *Hollandii* in *Trans. S. A. Phil. Soc.* Vol. XVI. Pt 3, 274, Aug. 1906. The illustration there used is here reproduced.

Rhodesia.—Near Umtali (Holland, Mrs Bennett); Gwaai River (J. Sim).

Well worth cultivation.

¹ 82. *ASPLENIUM HOLLANDII* Sim.

Tab. 69. Mag. nat. b Pinnula fertilis, amplif.

Stipes paleaceus, 6" longus; folia ovato-deltoidæa, quadripinnata, tenuiter coriacea, 2' longa, 12" lata infra medium, basin versus paulo angustiora, sursum sensim minora; rachis fusca, fibrillosa, sulcata; pinnæ 6" longæ, infra 2" latae, rachi marginata et pinnulis alternantibus, quarum infima in latere superiore existit; pinnulae 1" longæ, $\frac{1}{2}$ " latae, in segmenta petiolulata divisæ, quorum superiora simplicia, inferiora tri—quadri-fida; segmenta ultima acuminata, $\frac{1}{8}$ — $\frac{1}{4}$ " longa, $\frac{1}{2}$ " sive minus lata, petiolis angustioribus; steriliū segmenta obtusa; sori abundantes, laterales, breves, depressi, singuli prope basin ultimi cuiusque segmenti; involucre scariosum, basi ac lateribus adfixum. Filix pulchra, una ex maximis atque elegantissimis Dareis, sori autem davallioidei, qua de causa primo a me est descripta ut *Davallia* (*Loxoscaphe*) *Hollandii* in *Trans. S. A. Phil. Soc.* Vol. XVI. 3. 274, Aug. 1906.

Rhodesia, prope Umtali (Holland, Mrs Bennett); ad flumen Gwaai (J. Sim). Cultura admodum digna.

83. *ASPLENIUM MANNII* Hk.

Plate 61. Fig. 3. Nat. size. c Sorus, enlarged.

Crown erect, fibrillose; fronds (including stipe) three inches long, three-quarter to one inch wide, softly coriaceous, glabrous, simply pinnate or the lower pinnae once or twice dichotomously forked; rachis and pinnae very narrow, but the pinnae club-shaped above, with the sorus near the lower margin of that portion, the indusium opening to the other side, the sorus consequently being hardly marginal. A distinct little fern, somewhat resembling small plants of *A. bipinnatum*, but with the club-shaped pinnules and more central sori.

Tropical Africa and Madagascar.

A. Mannii. Hk. 2, *Cent.* t. 60, 1861; Hk. and Bkr, *Syn. Fil.* 221; C. Chr. *Ind.* 120.

Rhodesia.—Mt Pene, 7000 ft (Swyn. 6015); Chipete Forest, 3800 ft (Swyn. 427).

Portuguese East Africa.—Zambesiland (Dr Kirk).

(Buchanan mentions (Revised List, p. 30)—“A large *Asplenium*, apparently near to *A. polypodioides*, if not a variety of it,” as sent by Mr Ayres from Macamac gold-fields, Transvaal.

A. polypodioides Mett. is a large, pinnate, East Indian fern, with a short tree-like stem, and belongs to the section *Diplazium*, in which the sori extend to both sides of the veins. *Diplazium* is not otherwise represented in South Africa, and Mr Baker writes that *A. polypodioides* is not known at Kew from this district, so having seen no specimens, I can only mention it here. *A. polypodioides* Sw. is our *A. platyneuron*, which is not a large fern.)

Asplenium Marlothii Hieron. *Engl. Jahrb.* 46, 357, 1911; C. Chr. *Index Fil. Suppl.* 1906—1912, 12, from British Bechuanaland, is known to me only by name. It is closely allied to *A. pumilum*, Sw. See p. 353.

Genus 20. *CETERACH* Lam.

Sori linear, without true indusium, but hidden among closely imbricated brown chaffy scales. This small genus, in which four closely allied species are placed by Christensen, has been the subject of many changes, and in *Synopsis*

Filicum Baker, in dealing with three of these which are hardly distinguishable, puts one into *Gymnogramme* and two into *Asplenium*, with the character "involucre very rudimentary." In our first edition this was included in *Gymnogramme*.

84. *CETERACH CORDATUM* (Thbg) Desv.

Plate 73. Fig. 1. Rock-grown plant, nat. size. b Fertile pinna; Fig. 2, Frond grown in shade; Fig. 3, Var. *Namaquensis*. c Pinna of same, enlarged. Plate 141. Fig. 2, Var. *pinnatifidum*.

Crown sub-erect, paleaceous. Frond lanceolate or ovate-lanceolate, pinnatifid, pinnate or two-pinnatifid, herbaceous or sub-coriaceous, glabrous on the upper surface, densely clothed with ovate-lanceolate reddish scales on the under surface, three to eight inches long, one to two inches broad, with a short paleaceous stipe. Pinnae ovate or ovate-oblong, the upper confluent; the lower rounded or cordate at the base, cut halfway to the mid-rib or more (or less) into rounded, toothed, decurrent lobes. Veins flabellate in the lobes, with the oblong sori mostly nearly parallel with the mid-rib.

Rock-grown specimens correspond entirely with the European *Ceterach officinarum* D. C. (= *Aspl. ceterach* Linn. of *Syn. Fil.*), while plants grown under bush are widely different, but there is every gradation between.

In *Ceterach officinarum* D. C. the veins anastomose more or less, while in our plant they are generally free; but plants with some veins united are not uncommon. Though there is no true indusium in this species, there is a row of scales covering the sori, and the whole under surface is more or less thickly set with scales. It varies a good deal, rock-grown specimens being three inches long or less, leathery in texture and densely scaly; while under trees or bushes it becomes six to nine inches long, thinly membranaceous in texture, and with very few scales. In some specimens it is also more deeply cut than in others. It curls up when dry and again unfolds when damp in the same way as *Polypodium polypodioides*. Dr Atherstone's specimens from Currie's Kloof are much more shaggy than usual, with brown scales a quarter inch long.

- Ceterach cordatum* (Thunb.). Desv. *Prod.* 223, 1827; C. Chr. *Ind.* 170.
Gymnogramme cordata. Schl. *Adum.* 16; Hk. and Bkr, *Syn. Fil.* 379; Kuhn, *Fil. Afr.* 60; Sim, *Ferns of S. Afr.*, 1st ed., 210.
Acrostichum cordatum. Thunb. *Prod.* 171; *Fl. Cap.* 732.
Grammitis cordata. *Sp. Pl.* ed. Willd. 5, 142.
Ceterach cordata. Kze, *Linn.* 10, 497; P. and R. 24.
Gymnogramme capensis. Spr.
Grammitis capensis. Moore.
Ceterach capensis. Kze, *Linn.* 10, 496; P. and R. 23.
Ceterach crenata. Willd.
Ceterach officinarum. Pappe and Rawson, 23.

South Africa and St Helena. Probably this will eventually be united with *C. officinarum* D. C., in which case *C. cordatum* is the older name. In that case the distribution would include Europe, Madeira, Himalayas and Western Asia. Baker, in dealing with his *Aspl. ceterach*, says "There is a Cape specimen in Herb. Rawson," and C. Christensen shows both as South African.

West.—Flache Klip (Bergius); Mount Bärenkopf (Mund); Lion's Mountain (Zeyher); Clan William, Table Mountain, Dutoitskloof; Namaqualand (Dr Pearson, 2935); North of Anenous (Dr Pearson, 6184).

East.—Bushman's River, Uitenhage, Grahamstown (Atherstone); Sunday's River, Zwaart-hoogdens (Kunze); Colesberg (Holland); Graaffreinet (Bulus, 416).

Kaff.—Kat River, Winterberg (Zeyher); Komgha (Flanagan); common under bushes and at Dohne, Peddie, Yellow Woods, etc., on rocks.

Natal.—Midland and upper districts (Wood); Spring Vale, Mooi River, Cathkin, Bishopstowe, Umlaas (McKen); Umpumulo, 2000 to 5000 feet alt. (Buchanan); frequent but not common almost everywhere (T. R. Sim).

Orange Free State.—Hebron (Flanagan, 1675); Tweespruit (Marriott). Transvaal.—Magalisberg (Burke); Crocodile and Magalies Rivers (Burt-Davy, 208); Ermelo, Standerton, Rustenburg, Belfast (R. Leendertz, 2690, 4008, 3381, 2787); Potchefstroom (W. Nelson, 338).

Rhodesia.—Lo Magundi and Fort Salisbury (J. F. Darling); Matopo Hills, 4800 ft (Eyles, 1021; Miss Gibbs, 29).

Var. NAMAQUENSIS (P. and R.) Sim.

Plate 73. Fig. 3. Frond, nat. size. c Pinna, magnified.

Frond lanceolate, on a longer stipe. Pinnae all distinct, sub-coriaceous, cut throughout to the winged mid-rib into

separate, roundish, flabellate, one-sided, decurrent, sub-opposite, toothed pinnules, clothed on the under side with reddish linear scales; upper side glabrous. Veins free.

Pappe and Rawson describe this as annual, but that applies to the fronds only, not to the plant.

Gymnogramme namaquensis. P. and R. 42.

West.—Near Modderfontein, Namaqualand (Rev. H. Whitehead); Namaqualand (Scully); Great Namaqualand (Hans Schinz); Fish River (MacOwan); Olifant River (R. Schlechter, 7999). Rhodesia.—Common round Salisbury (H. M. Hole).

Var. PINNATIFIDA Sim.

Plate 141. Fig. 2. Nat. size.

Simply pinnatifid, pinnules hardly lobed; densely scaly below, glabrous above.

East.—Grahamstown (Miss M. Daly, 2c); Boschberg, Somerset East (R. Schl. 2703).

Kaff.—Engcoba (A. G. McLoughlin, 113); Perie Forest (T. R. Sim).

Transvaal.—Heidelberg (R. Leendertz, 1077); Zeerust (T. J. Jenkins, 985).

The var. *bipinnata* of our first edition is now separated as *Notholaena bipinnata*.

Genus 21. *BLECHNUM* Linn.

Fronds dimorphous, the fertile pinnae usually narrower than the barren. Sori linear, parallel with the mid-rib and intramarginal, or occupying the whole under surface of the fertile pinnae (variable in some species). Indusium present, opening toward the mid-rib. A very natural genus in which most of the species agree in habit, having dimorphous fronds, and sub-erect rhizomes, or erect caudices. One of our species, *B. punctulatum*, sometimes adheres to the above generic character, but the sori vary, and forms of it occur answering to *Blechnum*, *Asplenium*, and *Scolopendrium*. *B. australe* also varies very considerably.

As now constituted, *Blechnum* includes both *Blechnum* and *Lomaria* of our first edition, which are now looked upon

as sub-genera. It includes 135 species, scattered all over the tropical and temperate zones, and even beyond.

Synopsis of the species :

Sub-genus 1. LOMARIA. Sori occupying the whole under side of the contracted fertile pinnae, except the mid-rib, and covered by a continuous, marginal or almost marginal indusium. Fertile fronds usually distinct.

§ Pinnae of barren frond attached to the mid-rib along the whole of its widened base.

85. *B. inflexum*. Barren frond one foot long; fertile frond six to nine inches long, one inch broad.

86. *B. attenuatum*. Both barren and fertile fronds three to five feet long, eight to ten inches broad at the middle.

§§ Pinnae of barren frond narrowed to the base or stalked.

87. *B. punctulatum*. Pinnae numerous, the lower gradually much reduced; rhizome sub-erect.

Var. *Atherstoni*. Sori close to and parallel with the mid-rib; indusium straight as in *Eu-Blechnum*.

Var. *intermedium*. Sori close to the mid-rib, but diverging from it, and indusium interrupted.

Var. *Krebsii*. Sori medial, two meeting face to face, as in *Scolopendrium*.

88. *B. capense*. Lower pinnae not reduced; rhizome creeping.

89. *B. tabulare*. Lower pinnae not much reduced, caudex erect, tree-like, several feet high.

Sub-genus 2. EU-BLECHNUM. Sori parallel with the mid-rib and the margin; placed about halfway between them; continuous, and with indusium opening inward.

90. *B. australe*. Rachis and frond destitute of glandular hairs.

91. *B. auriculatum*. Rachis and frond densely covered with very short, glandular hairs.

85. BLECHNUM INFLEXUM (Kunze) Kuhn.

Plate 74. Nat. size. b Fertile pinna, magnified.

Crown three to four inches long, one inch diameter, sub-erect, densely clothed with dark brown, lanceolate scales. Fronds simply pinnate. Barren fronds twelve inches long, one to one and a half inches broad, lanceolate, and tapering gradually to both ends. Rachis destitute of scales, except

below the pinnae, which begin one inch above the crown, but that portion is covered with long, narrow, brown scales. Pinnae blunt or slightly pointed, suddenly widened at the base on the upper side, connected with the rachis along the whole base. Texture leathery. Fertile frond about six inches long, and one inch broad; pinnae very close, comparatively broad, and more or less infolded. Indusium very broad, afterwards torn. The barren fronds are not unlike those of *B. attenuatum* on a small scale, but the fertile fronds are very different.

This species has caused much confusion. Lady Barkly mentions the name as a synonym for *L. punctulata*, with which it has no connection, but introduces into her list the name *L. discolor* Willd., upon the same plant. Baker, in 2nd ed. of *Syn. Fil.*, makes it *L. discolor* W., var. *Natalensis* Bkr., and in *Kaffrarian Ferns* I named it *L. lanceolata* Spr., in mistake.

Blechnum inflexum (Kunze). Kuhn, *Fil. Afr.* 92, 1868; C. Chr. *Index*, 155.

Lomaria inflexa. Kze, *Linnaea*, 18, 117; Suppl. to Schk. 150, tab. 65; Pappe and Rawson, 28; Hk. *Sp.* 3, 37; Sim, *Ferns of S. Afr.*, 1st ed., 116.

L. discolor Willd. var. *Natalensis*. Baker, *Syn. Fil.* ed. 2, 481; Buchanan's List, No. 44.

L. lanceolata. Sim, *Kaff. Ferns*, 34 (not *L. lanceolata* Spr.).

South Africa only; growing beside open streamlets.

Kaff.—Above Perie Forest between Evelyn Valley and Kabula; in one place only, but there abundant (T. R. Sim).

Natal.—Found by Gueinzus; Nottingham, Karkloof, and on Drakensberg at Cathkin abundant (Buchanan, Wood); Zwaartkop (T. R. Sim).

86. BLECHNUM ATTENUATUM (Sw.) Mett.

Plate 75. a Part of barren frond, nat. size. b Part of fertile frond, nat. size. Plate 76, fig. 2, Young plant. Plate 76, fig. 3, Bipinnate form.

Crown shortly procumbent, branched, making a tufted mass, and set with narrow, brown scales. Both barren and fertile fronds ovate-lanceolate, simply pinnate, glabrous, coriaceous, three to five feet long, eight to twelve inches broad at the middle, tapering to both ends, and having a nearly naked stipe, six to twelve inches long. Barren pinnae adnate at

the base, alternate, linear, lanceolate, four to six lines broad, meeting at the base, except the lower ones, which are separate, and very much reduced. Fertile pinnae separate, linear, one to two lines broad and pointed; indusium broad, torn, or fringed. Veins forked, often ending in transparent cells near the edge of the frond. This splendid fern generally grows in clumps of four or five crowns together, each with twelve to twenty fronds. The pinnae are about equal in breadth for three-fourths of their length, then gradually taper to a long narrow point, while at the lower end they widen out at the very base and are connected with the rachis all along, meeting the base of the next pinna. The narrow pinnae of the fertile frond are about six inches long, and curve gracefully outward. In the seedling plants the fronds are entire at first, and afterwards waved (Plate 76, fig. 2). Sometimes plants become fertile when only one foot high if dry grown, but the fertile frond is then a miniature of the ordinary, and not contracted as in *B. inflexum*. Young barren fronds are sometimes green, but often of a bright pink colour.

A form occurs in which the barren fronds are distinctly bi-pinnate on the lower half, and wavy and crisped in the upper portion (Plate 76, fig. 3). This is *Lomaria heterophylla* Desv. (*Blechnum* Schl.), but is not constant enough in its character to deserve a name, and Kunze uses the name *L. heterophylla* Desv. for the ordinary form of this species. Kunze also mentions *L. hamata* Klf., a variety with sterile pinnae narrower, fertile, falcate. *L. decipiens* P. and R. seems to have been founded on young plants of *L. attenuata* Willd.

Blechnum attenuatum (Sw.). Mett. *Fil. Lips.* 64, 1856; C. Chr. *Ind.* 151.

Lomaria attenuata. Willd. *Sp. Pl.* 5, 290; Kze, *Linnaea*, 18, 116;

Pappe and Rawson, 28; Hk. and Bkr, *Syn. Fil.* 176; Sim, *Ferns of S. Afr.*, 1st ed., 118.

Lomaria gigantea. Klfs.

Blechnum giganteum. Schl. *Adum.* 36, tab. 20 and 22, fig. 1.

Lomaria heterophylla (Desv. see above). Kunze, *Linn.* 10, 506; Pappe and Rawson, 27.

Blechnum onocleoides. Swartz.

Onoclea attenuata. Swartz, *Schr. Jour.*

Blechnum polypodioides. Kuhn, *Fil. Afr.* 92.

Osmunda polypodioides. Sw. *Prod.* 127.

Polynesia, African Islands, and South Africa: growing in deep, wet, and shady ravines, and about waterfalls in the forest; often in running water.

West.—Kerstenbosch (Bergius); Dutoitskloof, ravines on Table Mountain above Wynberg, George (Drège); Caledon, Koratra, Krom River; Knysna (Rex, 841).

East.—Grahamstown, plentiful; Krakakamma, Kat River, etc. (T. R. Sim).

Kaff.—Alice, Thaba N'doda, Perie, Frankfort, Stutterheim, Toise River, etc. (T. R. Sim); Engcoba (McLoughlin).

Natal.—Common all over the colony (T. R. Sim).

Transvaal.—Magalisberg (Sanderson, Bolus); Rustenberg Kloof (M. Collins, 97); Woodbush (Miss Eastwood); Rietfontein (R. Leendertz, 877); Belfast (R. Leendertz, 2773); Barberton (Burt-Davy, 327); Marovuni, Mamotsinri (Burt-Davy, 224); Haenertsberg (Eastwood); Belfast (Miss Doidge).

Rhodesia.—Umtali (J. F. Darling, Mrs Bennett); Chimanimani Mts, 7000 ft (Swyn. 835 a); Mt Pene, 7000 ft (Swyn. 6023, 6024); Gwaai River and Victoria Falls (J. Sim).

The bi-pinnate form grows at Frankfort, Perie, and Bedford; and Desvaux' record is from *Prom. Bon. Spei*.

(LOMARIA SPICANT Desv.

(Pappe and Rawson, 29; Hk. and Baker, *Syn. Fil.* 178.

Blechnum spicant J. Smith. Kuhn, *Fil. Afr.* 93.

Blechnum boreale Sw. Schl. *Adum.* 38; Schk. *Fil. tab.* 110.)

This northern species is included by Schlechtendal from the Cape on the strength of a specimen in Herb. Bory de St Vincent, collected by Mr Riche, but as it has not been seen since, south of Morocco and Madeira, the locality is doubted by Kuhn, and omitted by Baker. No South African specimens exist in South African herbaria, and it is, therefore, omitted as a mistake.)

87. BLECHNUM PUNCTULATUM Swartz.

Plate 77. a Barren frond, nat. size. b Fertile frond, nat. size.
c Section of fertile pinna.

Varieties in Plates 78, 79, 80, 81.

Crown stout, erect, or shortly procumbent, paleaceous. Fronds simply pinnate, coriaceous, glabrous, widely lanceo-

late, one to two feet long, three to six inches broad at the middle, tapering to the point, and to the short slightly paleaceous stipe. Rachis naked, channelled. Pinnae alternate, numerous, one to every three-quarter inch; pinnae of the barren frond somewhat falcate, two to three inches long, four lines broad, tapering to the sharp or rounded point, cordate at the base, or hastate, or auricled on the upper side, connected to the rachis by a short stalk only, or the upper pinnae somewhat adnate at the base. The lower pinnae are more distant, and reduced to rounded deflexed auricles. Fertile pinnae two to three inches long, one to two lines broad, less pointed, and less cordate at the base, except the lower ones, which are short, and often more or less barren. Involucre continuous, marginal, or intramarginal, nearly entire, broad; sori often covering the whole underside except the mid-rib. This is a most changeable plant; sometimes not unlike a small state of *B. attenuatum*, but distinguished by its free pinnae; at other times having the character of *Eu-Blechnum*, and difficult to distinguish from *Blechnum australe* L., with which it is confused in several Cape herbaria.

A two-pinnatifid form (Plate 78) sometimes occurs, not unlike a similar form of *B. australe*, and like it, fertile and falcate in the upper pinnae, and barren below; but it does not appear to be constant.

As some of the varieties of *B. punctulatum* are more or less permanent, and have received names placing them in different genera, the most distinct are given here, retaining the above as the type, for which synonyms are as under.

Blechnum punctulatum. Sw. *Schrad. Jour.* (1801); Schl. *Adum.* 37, tab. 21 and 22, fig. 2; Kuhn, *Fil. Afr.* 93; C. Chr. *Ind.* 158.

Lomaria punctulata. Kze, *Linnaea*, 10, 507; Pappe and Rawson, 28;

Hk. and Bkr, *Syn. Fil.* 179; Sim, *Ferns of S. Afr.*, 1st ed., 118.

Lomaria densa. Kaulf. *En.* 151.

Lomaria auriculata. Desv.

Lomaria Drègeana. Fée.

Lady Barkly includes here *L. inflexa* Kze in mistake.

South Africa; growing in damp parts of the forest, or among shaded rocks. Said by Lady Barkly to be common

throughout South Africa, but I have not found it in Kaffraria, and in almost every collection it is more or less confused with *B. australe* L.

West.—Table Mountain, Devil's Mountain, Dutoitskloof, etc.; Knysna (T. H. Rex, 842); George, 900 ft (R. Schl. 2465).

East.—Van Staaden's River (Browning; Bolus, 1720); Grahamstown, abundant; Krakakamma.

Kaff.—Omsamculu (Drège).

Natal.—Palmiet to Drakensberg, common (Buch.); Buccleuch (W. Leighton).

Rhodesia.—Mazoe, not plentiful, 5000 ft (F. Eyles, 342); Victoria Falls (Rogers, 5546).

Var. *ATHERSTONI* (P. and R.).

Plate 79. Nat. size.

Similar in all respects to the type, except that the fertile frond is not contracted, but less cordate at the base than the barren, while the sori lie parallel with and close to the mid-rib, in a continuous straight line in the upper pinnae, but broken into short, oval, but parallel, distinct sori in the lower pinnae (as in *Doodia*). If this could be maintained as a distinct species, it would belong to sub-genus *Eu-Blechnum* rather than *Lomaria*.

Pappe and Rawson founded their *Blechnum Atherstoni* on the Grahamstown plant, but do not mention the sori further than the generic character of *Blechnum*, and I have doubts as to whether this keeps distinct from the next form, which also grows in Fern Kloof, Grahamstown. Buchanan, who had frequent opportunity of seeing this in its native habitat, says: "Regarded at Kew as only a Blechnoid variety of *Lom. punctulata* Kze, but retained by Kuhn as a distinct species; and we are inclined to agree with him. There is a Blechnoid form of *L. punctulata*, resembling the normal plant in size and texture, and *Scolopendrium Krebsii* is not much different in these respects; whereas this plant is large and coarse, of quite coriaceous texture, and indistinct venation, with very tough stipes. It has often a creeping rhizome. The sori are usually quite Blechnoid in the upper part of the frond; in the

middle and lower parts where the sori gradually draw away from the rachis to the tips of the pinnae the inner portion of the fructification is broken up into small dots somewhat as in *Doodia*. But in all cases the sori lie close to the mid-rib; never as in *Scol. Krebsii* midway towards or near to the margin. Its habitat is never like the latter and *L. punctulata* in wet places, but usually the comparatively dry upper margins of bush."

Blechnum punctulatum Sw., var. *Atherstoni* Sim, *Ferns of S. Afr.*, 2nd ed., 183.

Lomaria punctulata Kze, var. *Atherstoni*. Sim, *Ferns of S. Afr.*, 1st ed., 120.

Blechnum Atherstoni. Pappe and Rawson, 16; Hk. *Sp. Fil.* 3, 31, 62; Buchanan, No. 49.

East.—Grahamstown Kloofs.

Kaff.—Bazija (Baur, 460; alt. 3000 feet).

Natal.—Inanda, Great Noodsberg, Umpumulo, Karkloof (Buchanan); Nkandhla (Marriott).

Var. INTERMEDIUM Sim.

Plate 80. Nat. size.

Plant similar to the type or stronger. Fertile pinnae similar to the barren, or slightly narrower, crenulated, and more drawn to a point, but not contracted as in *Lomaria*. Sori contiguous in an interrupted line along the mid-rib, and close to it, but not parallel with it; each indusium one to two lines long, starting from the mid-rib in a slightly oblique direction, and meeting a shorter one, which also rises from the mid-rib, but in an opposite direction. The line therefore takes the appearance of a saw edge, quite sharp in the lower pinnae, but more undulating in the upper pinnae. Besides this there are frequently small, detached sori outside this line, and running obliquely toward the edge of the frond as in *Asplenium*, or sometimes the two meeting sori of the main line are continued outward face to face as in *Scolopendrium*. This is a most curious and evidently variable form, growing in the Grahamstown Kloofs, and also sent by Buchanan from Natal.

Var. KREBSII (Kze) Sim.

Plate 81. Nat. size. b Fertile part, magnified.

Fertile frond similar to the barren, both with pinnae three inches long, four lines broad, more or less crenate, with a wider cordate base, or auricled on one or both sides. Sori halfway between the mid-rib and the edge, attached to the veins, the two from different veins meeting face to face, as in *Scolopendrium*, and when mature forming one rounded, or oval, oblique sorus. Wood remarks—"An examination of some of the immature fronds will show that while the whole of the sori near the base of the frond are at an acute angle with the rachis, at the apex they become almost parallel with it, and are single and not double as at the base. Different forms are found, at last completely merging in true *punctulata*." Wood also mentions a bi-pinnate or bi-pinnatifid form.

In a letter dated Apr. 8, 1913, Dr Wood writes:

"I wish to renew my opinion, published more than 30 years ago, that *Scolopendrium* should stand as originally named, and not as a variety of *Lomaria punctulata*. I am still of the opinion that the varieties connecting var. *Krebsii* with the *Lomaria* are dying out, and am confirmed in that opinion from recent collections in Natal."

We have had no opportunity of studying this plant alive, but understand Prof. Bower of Glasgow University is looking into the matter and has been supplied with living plants by Dr Wood.

Blechnum punctulatum Sw., var. *Krebsii* Sim, *Ferns of S. Afr.*, 2nd ed., 185.

Lomaria punctulata Kze, var. *Krebsii*. Sim, *Ferns of S. Afr.*, 1st ed., 122.

Onychium Krebsii. Kze, *Linnaea*, 10, 504.

Scolopendrium Krebsii. Kze, *Linnaea*, 18, 119; Suppl. to Schk. *Fil.* tab. 74; *Bot. Mag.* pl. 4768; Wood, *Natal Ferns*, 17; Buchanan's List, No. 46 A; Pappe and Rawson, 24.

Blechnum punctulatum Sw., var. *scolopendrioides*. Mett. *Msc.*; Kuhn, *Fil. Afr.* 93.

East.—Amos Kloof, Grahamstown.

Natal.—Between Omfondi and Tugela Rivers (Gueinzus); from Patillo's through Inanda and Noodsberg to Umpumulo, 1500 to 2500 feet (Buchanan).

88. BLECHNUM CAPENSE (Linn.) Schlecht.

Plate 82. a Small barren frond, nat. size. b Fertile frond, nat. size.

Rhizome procumbent, four to six inches long, two to three inches diameter, paleaceous, with short, broad, ovate pointed, dark scales. Frond simply pinnate, herbaceous, or thinly coriaceous, broadest at the base, one to two feet long, six to ten inches broad, with stipe twelve to eighteen inches long, which is very paleaceous below, and more or less scaly and channelled above, and on the rachis. Pinnæ of barren frond five to eight lines broad, three to five inches long, pointed, entire, or minutely serrate, not tapering to the base, but suddenly rounded to a very short petiole, even the upper ones not adnate. They are set obliquely across the rachis so that the lower edge of each pinna overlaps the upper edge of the one below it, and are sometimes glabrous; sometimes set with woolly shag on one or both surfaces, especially when young; or sometimes they have ovate pointed, white scales along the mid-rib on the under surface only. Fertile pinnæ four to five inches long, two to three lines broad, pointed, flat on the upper surface, and with a marginal line extending beyond the indusium, which is membranaceous and much torn, or with each piece fringed. Veins conspicuous.

Sometimes the pinnæ of the barren frond are auricled at the base, and Kunze mentions a variety in which the pinnæ are cut toward the point.

Blechnum capense (Linn.). Schl. *Adum.* 34, tab. 18 (1825); C. Chr. *Index*, 152.

Lomaria procera Sprengel. Hk. and Bkr, *Syn. Fil.* 179; Sim, *Ferns of S. Afr.* 1st ed. 122.

Osmunda capensis. Linn. *Sp.* 7760 (not Presl).

Onoclea capensis. Thunb. *Prod.* 171; *Flora Cap.* 731.

Lomaria capensis Willd. Kunze, *Linnaea*, 10, 505; Pappe and Rawson, 27.

Tropics and southward; widely spread; often growing in full sunshine.

West.—Below Table and Devil's Mountains, Paradise, Paarlberg, etc.; Platte Klip, Capetown (Rogers, 3038); Knysna (T. H. Rex, 823).

East.—Van Staaden's River (Browning); Albany, Bedford, etc.; Uitenhage (Mrs T. V. Patterson, 952).

Kaff.—Frequent by streams in bush or above it, not under 3000 feet (T. R. Sim).

Natal.—Many places in the midlands (T. R. Sim); Buccleuch (W. Leighton).

Rhodesia.—Common in Chirinda Forest, 3700—4000 ft (Swyn. 832).

89. BLECHNUM TABULARE (Thbg) Kuhn.

Plate 83. a Plant, much reduced. b Barren frond, reduced. c Scale from crown. d Fertile frond, reduced. e Fertile pinna, nat. size.

Stem stout, tree-like, erect, two to three feet long, three to nine inches diameter, densely clothed with linear, dark brown scales, one to two inches long, half-line broad. Fronds simply pinnate, thick and coriaceous, abundant, the barren fronds more or less spreading; the fertile produced annually in the centre and more upright in habit. Barren fronds one to three feet long, six to nine inches broad at the middle, ovate-lanceolate, and generally with shorter pinnae toward the base; glabrous on the upper surface except when young, but with scattered, brown, downy shag on the under surface and rachis, though this sometimes disappears with age. Pinnae lanceolate, or ovate-lanceolate, entire, narrowed to the base, or stalked, or the upper more or less adnate. Fertile fronds rather longer, with thick linear pinnae, fertile throughout, or often partly barren in the lower pinnae. Involucre slightly within the margin, white, membranaceous, much cut, but at first entire. Rachis channelled. Stipe six to twelve inches long, very paleaceous at the base. This fine fern is easily distinguished by its stout stem and long scales.

L. Dalgairnsiae P. and R. is this, with the upper pinnae more confluent. It is maintained by Christensen, but is not distinct.

L. cycadoides P. and R. has the lower pinnae auricled, and though maintained as a species by Kuhn and Christensen, grows among the ordinary form and ranges into it. A Natal specimen of this nature has an auricle or single pinnule at the base of each pinna.

Blechnum tabulare (Thbg). Kuhn, *Fil. Afr.* 94 (1868); C. Chr. *Index*, 160.

Lomaria Boryana Willd. Kze, *Linn.* 10, 505: 13, 152; Pappe and Rawson, 27; Hk. and Bkr, *Syn. Fil.* 180; Sim, *Ferns of S. Afr.*, 1st ed., 123.

Onoclea Boryana Sw. Schk. 98, tab. 105.

Blechnum Boryanum. Schl. *Adum.* 35, tab. 19.

Pteris tabularis. Thunb. *Prod.* 171; *Fl. Cap.* 732; Pappe and Rawson, App. 51.

Lomaria tabularis. Mett.

Lomaria coriacea. Schrad.

Lomaria Gueinzii. Fée.

Lomaria cycadooides. Pappe and Rawson.

West Indies, South America, African Islands, and South Africa. Not rare in eastern districts, but local, and always on upper edge of the forest at 3000 to 5000 feet alt.

West.—Dutoitskloof (Drège); Table Mountain (Thunberg); Knysna; Swellendam (Holland); George.

East.—Krakakamma, Uitenhage, Kat River (E. and Z.).

Kaff.—Transkei (Drège); Perie, Evelyn Valley, Dohne Hill, etc. (T. R. Sim).

Natal.—Inanda, Noodsberg, Greytown, Botha's Hill, Umpumulo, Richmond (Buchanan); plentiful in the midland districts near springs (Wood); Ixopo, 4000 ft (R. Schl. 6649); Shafton (Mrs H. Hutton, 139).

Transvaal.—Mauchsberg to Sabie Falls (Burt-Davy, 485); Shilouvane (Junod, 881); Marovuni (Burt-Davy, 234); Haenertsberg (Eastwood; Mrs Potts, 4666); Rosehaugh (J. M. Sim).

Rhodesia.—Umtali (J. F. Darling, Mrs Bennett); Chimanmani Mts, 7000 ft (Swyn. 835); Mt Pene, 7000 ft (Swyn. 837, 6022); Gwaai River (J. Sim).

(LOMARIA ERIOPUS Kze (*Linnaea*, 13, 152: 18, 116) is *Stangeria paradoxa* Moore, not a fern.)

90. BLECHNUM AUSTRALE Linn.

Plate 84. a Barren frond, nat. size. b Fertile frond, nat. size.

c Pinna of toothed form.

Crown procumbent, paleaceous, producing many simply pinnate, lanceolate, coriaceous fronds, and a few slender, subterranean rhizomes, which produce, at a distance of six to twenty-four inches, a new crown, but with few or no

fronds between. Fronds six to twenty-four inches long, one to two inches broad at the middle, and tapering very gradually to the point, and also to the base, where the pinnae are distant, and very much reduced; the lowest often within two inches of the crown, but sometimes leaving a bare stipe of six to eight inches, which is paleaceous below, but glabrous above, and like the glabrous rachis, slightly channelled in front. Pinnae of barren frond very various, generally one-half to one and a half inches long, three to four lines broad, oblong or widely lanceolate, often falcate, tapering to a sharp point, the upper adnate by almost their whole bases; those in the middle of the frond sessile, but rounded to a narrow connection; those below auricled on one or both sides, and connected by the mid-rib only; while the reduced lower ones are triangular, and often three-pointed. Fertile pinnae one and a half to three lines broad, except at the base, where the upper ones widen a little, and the lower ones are hastate auricled, and less fertile, or often quite barren. Indusium continuous, at first entire, afterwards somewhat torn; placed about halfway between the mid-rib and the edge, or in some cases near the edge; sometimes filled with capsules to near the mid-rib, but often with a space between. Often in the lower pinnae the sori are short and separate, as in *Doodia*. Both fertile and barren pinnae in the lower half of the frond are set across the rachis, so that the lower auricle overlaps the front, and the upper auricle the back of it. Frond quite glabrous even when young, by which it is easily distinguished from the glandular *B. auriculatum*. It is often confused with *B. punctulatum*, and as both vary in their fructification from typical *Lomaria* and typical *Blechnum*, that character cannot be given. In this the frond is generally narrower, and always narrower compared with the length, pinnae closer, more pointed, continued further down the stipe, and the rhizomes are also different.

A form occurs in which all the middle pinnae are set along their lower edges with four to eight tooth-like lobes, similar to the auricles (fig. c), and in the fertile frond the sori extend into these lobes.

This is a most changeable species, and when growing in bottom lands, beside a stream, assumes a luxuriant habit quite unlike the dwarf plant to be found creeping round stones on dry mountain tops. The latter is *Lomaria pumila* Kze, but cannot be classified even as a variety, as it changes its habit as soon as it is given suitable conditions.

Blechnum australe. Linn. *Mant.* 130, 1767; Thunb. *Prod.* 172; *Fl. Cap.* 734; Schk. *Fil.* 103, tab. 110 B; Schl. *Adum.* 38; C. Chr. *Index*, 151. Sim, *Ferns of S. Afr.*, 1st ed., 125.

Lomaria pumila. Kze, *Linnaea*, 10, 508: 23, 261; Pappe and Rawson, 29.

South Africa and African Islands; in damp situations near to or in the forest, and among rocks up to the highest levels; not uncommon.

West.—Table Mtn, Lion's Mtn, Rondebosch, Paarlberg, etc.; Leliefontein (Prof. Pearson, 6373).

East.—Boontjes River, Grahamstown, Bedford, etc.

Kaff.—Komgha (Flanagan); Bazija (Baur); Perie, Alice, Frankfort, Dohne, etc. (T. R. Sim); Broughton, Molteno, 6300 ft (Flanagan, 1684); Main (Mrs Young); Cala (H. Royffe, 198).

Natal.—From Inanda inland (Wood); 3000—5000 ft (Buchanan); Nkandhla (Marriott); Lidgetton (A. Roberts, 1010); frequent (T. R. Sim).

Orange Free State.—Ficksburg (Quail); Tweespruit (Marriott); near Van Reenen (Prof. Bews).

Transvaal.—Magalisberg (Sanderson); Marovuni (Burt-Davy, 221); Haenertsberg (Eastwood); Rustenburg (M. Collins, 98); Belfast (J. Collins); Middelburg (J. T. Jenkins); Pilgrim's Rest (L. Collins, 896).

The toothed form has been found near Perie Mission Station, and at Greytown, Dohne, and Somerset East.

91. BLECHNUM AURICULATUM Cav.

Plate 76. Fig. 1. Nat. size. b Fertile pinna. c Glandular hairs.

Rhizome short, stout, procumbent, but without the slender running rhizomes of *B. australe*. Crown set with reddish lanceolate scales, and having six to eight fronds. Frond three to fifteen inches long, half to one and a half inches broad, pinnate, lanceolate, or ovate-lanceolate, narrowed

gradually to both ends. Pinnae connected with the rachis by the mid veins only, in the lower half of the frond; but in the upper half connected by the whole of their rather narrowed bases. Pinnae oblong, abruptly pointed or mucronate, with a base rounded away below, but larger or with a lobe on the upper side. Fertile pinnae rather narrower. Sorus about halfway between the margin and the mid vein, and with a distinct clear space between it and both. Rachis round, with a groove down the front. Scales only below the pinnae; but the whole frond on both sides set with minute glandular hairs, especially the rachis. Texture thin, membranaceous, becoming firm with age. Veins very distinct, veinlets forked, or sometimes twice forked. Sori rather interrupted; indusium torn. This is like the small form of *B. australe*, but quite distinct. Baker writes (*Nature*, May, 1891), in reference to this which I named *B. remotum* Pr. in my *Ferns of Kaffraria* and also in my *Ferns of South Africa*, 1st ed.: "*B. remotum* is a variety of the American *B. hastatum* Kaulf., which I do not think can stand as distinct specifically from the common Cape *B. australe*." I find that in cultivation, as well as in the wild state, it keeps permanently distinct, and is easily identified when alive, though dried specimens are very much alike. I have seen no specimens except those collected by myself above Perie Mission Station; and at Evelyn Valley, near Bailey's Grave. At the latter locality, it is abundant near where *Blechnum inflexum* grows. *B. remotum* Pr. and also *B. hastatum* Klf. are placed by Christensen in the South American *B. auriculatum* Cav., hence the adoption of that name here. I consider the plant distinct from *B. australe*.

Genus 22. *STENOCHLAENA* J. Sm.

Fronds dimorphous. Sori occupying the whole under surface of the fertile frond, without indusium. Eleven species are now grouped into this genus after having mostly been in *Lomaria* and *Acrostichum*. Four of these are from Africa and its islands, including our one species, and all these are confined to this continent.

92. *STENOCHLAENA TENUIFOLIA* (Desv.) Moore.

Plates { 85. Part of barren frond. Nat. size.
 86. Part of fertile frond. Nat. size.

Rhizome many yards long, one-quarter inch diameter, woody. Sometimes branched, procumbent on the surface, or scandent, green, with scattered, lanceolate, dark scales two lines long. Fronds distant; the barren pinnate; the fertile irregularly two-pinnate. Barren frond pinnate, coriaceous, glabrous, glossy green, ovate-lanceolate, three to four feet long, one to one and a half feet broad, with a stipe one to two feet long, and about twenty pairs of alternate, lanceolate acuminate, shortly stalked, undulated pinnae, which are sharply serrate along the cartilaginous margin, six to twelve inches long, and one inch broad, with a conspicuous mid-rib; and close, visible, parallel, free veinlets. Fertile frond two-pinnate, three to four feet long, one foot broad, with a one to two feet stipe, and stout rachis; the pinnae one and a half inches apart, stalked, rather flaccid, four to six inches long, two to three inches broad, with numerous distinct, linear, very irregular, more or less pointed pinnules one-half to two inches long, one line broad, covered along the under surface with sori, and after maturity all twisted into a confused mass. The rachis of the pinnae is sometimes also fertile in part, and occasionally fertile fronds occur (on the same plants as ordinary fertile fronds) in which the fertile pinnae are six to eight inches long, one line broad, and without pinnules, or with only an occasional one. Wood remarks—"Its rhizomes sometimes almost encircle the trees upon which it grows, and its fronds are often produced at twenty to thirty feet from the ground; the fertile fronds to be found only about January or February." The young rhizomes are sometimes several yards long before fronds are produced.

Stenochlaena tenuifolia (Desv.). Moore, *Gard. Chron.* 1856.

Acrostichum (*Stenochlaena*) *tenuifolium*. Baker, *Syn. Fil.* 412; Sim, *Ferns of S. Afr.*, 1st ed., 224.

Lomaria tenuifolia. Desv.

Acrostichum Meyerianum. Hk. *Sp.* 5, 250.

Stenochlaena Meyeriana Presl. Pappe and Rawson, 43.

Lomaria Meyeriana. Mett.

Polybotrya tenuifolia. Kuhn, *Fil. Afr.* 52.

Mascarene Islands, tropical Africa, and coast districts of Natal and Kaffraria.

Kaff.—Manubie Forest (J. H. Bowker).

Natal.—Common in Wet Coast Bush, reaching to Inanda and Umsundusi Mission Station, 2000 feet (Buchanan, McKen); Port Shepstone, Umtwalumi, Ngoya Forest, Umtunzini, etc. (T. R. Sim). Portuguese East Africa.—Matola, Limpopo, Inhambane (T. R. Sim).

***** **Pterideae.**

A. GYMNOGRAMMINAE.

Genus 23. *ANOGRAMMA* Link.

Plant small, annual. Fronds decompose; venation of the pinnules flabellate; sori linear, simple or forked, situated on the veins in the upper part of the pinnule, without indusium. Eight species are included in this genus, mostly from Eastern Asia and South America; our only species occurs in many countries. Included in *Gymnogramme* in our first edition.

93. *ANOGRAMMA LEPTOPHYLLA* (Linn.) Link.

Plate 109. Fig. 1. Small fertile plant, nat. size.

Plant annual, delicately herbaceous, yellowish green, with a small erect crown producing four to eight fronds. First fronds barren, and much more foliaceous and flabellate than the more advanced fertile fronds, which are glabrous, deltoid, two-pinnate or three-pinnatifid, three inches long, one and a half inches broad, on a naked green stipe one inch or more long. Pinnae cut to the mid-rib into distinct, cuneate, flabellate, three-fid or pinnately five to seven-fid, narrow lobes, with one vein in each, on which is placed the linear sori, mostly in the lobes but sometimes confluent below. Frond not powdered.

Anogramma leptophylla (Linn.). Link, *Fil. Sp.* 137, 1841; C. Chr. *Ind.* 58.

Gymnogramme leptophylla Desv. Pappe and Rawson, 42; Hk. and Bkr, *Syn. Fil.* 383; Kuhn, *Fil. Afr.* 60; Sim, *Ferns of S. Afr.*, 1st ed., 212.

Polypodium leptophyllum. Linn. *Sp.* 7908; Schk. *Fil.* 26, tab. 26.

Grammitis. Swartz.

Widely distributed in Europe, Asia, Africa, and America.

West.—In moist vegetable soil at the Rondebosch Waterfall, Devil's Mountain, where it has been collected by Mund, Dr Alexander (1848), Browning, etc., and where it is still found.

Rhodesia.—Ironmask Hill, Mazoe, 5000 ft (E. Eyles; F. Eyles, 563).

Genus 24. *GYMNOGRAMMA* Desv.

Sori oblong or linear, simple or forked, following the course of the veins, rising from them, and having no indusium. Veins free. Plant perennial, in our species three-pinnatifid. Forty-eight species are placed here by Christensen, mostly South American. In our first edition *Gymnogramme* was a wider genus, including several species now placed elsewhere. Baker (*Syn. Fil.*) includes *G. argentea* in his section *Ceropteris*, concerning which he says: "Differs from *Eu-gymnogramme* only by the fronds being coated beneath with white or yellow powder." Christensen restores *Ceropteris* as a genus, but includes our species in *Gymnogramma* though so coated. We follow Christensen only for herbarium convenience, but think if that be the only difference, both our species should be in *Ceropteris*.

94. *GYMNOGRAMMA ARGENTEA* (Willd.) Mett.

Plate 87. Nat. size. b Fertile pinnule, enlarged.

Crown erect, slender, tufted, somewhat coated with white powder. Fronds herbaceous, fragile, deltoid, four-pinnatifid, green and glabrous on the upper surface, and on the under surface coated with white or pinkish powder, which is generally very abundant, but sometimes nearly absent. Fronds one half to two feet long, four to eighteen inches broad, with a

slender naked brown stipe six to twelve inches long. Pinnae distant, ovate pointed or deltoid, the lower ones largest, four to nine inches long, two to four inches broad, the lower pinnules on the lower side much larger than the others. Pinnules numerous, separate, shortly stalked, bluntly ovate-deltoid, decreasing in size regularly up the pinnae, and divided to the mid-rib into separate, flabellate, bifid, trifid, or pinnatifid segments, the ultimate lobes a half-line broad, rounded at the apex, and having one veinlet each. Sori brown, linear, following the veins and meeting below.

G. argentea (Willd.). Mett. MS.; Kuhn, *Fil. Afr.* 59; Hk. and Bkr, ed. 2, 385; Buchanan's List, No. 114; Sim, *Ferns of S. Afr.*, 1st ed., 214; C. Chr. *Index*, 333.

Hemionitis argentea. Willd. *Sp.* 5, 132, 1810.

Acrostichum argenteum. Bory.

G. conspersa. Kze, *Linnaea*, 18, 116; Pappe and Rawson, 41; Hk. *Sp.* 5, 147.

G. rosea Desv. Hk. and Bkr, *Syn. Fil.* ed. 1, 385; Moore's *Index*, 62; McKen's *Natal Ferns*, 104.

South Africa and Mascarene Islands only; known as the silver fern, and Wood remarks that it is very difficult to transplant from the wild state.

Natal.—In the crevices of rocks near the cataract between the Omfondi and Tugela Rivers (Gueinzus); rocks in damp ravines, common on Noodsberg, Isangwana, Karkloof (McKen); Umpumulo rare, 3000 feet alt. (Buchanan); Buccleuch (W. Leighton).

Transvaal.—Drakensberg, near Macamac Gold Fields (McLea).

Rhodesia.—Chimanimani Mts, 7000 ft (Swyn. 677).

95. GYMNOGRAMMA AUREA Desv.

Plate 184. Fig. 1. Nat. size. B Pinnule, enlarged.

Similar in some respects to *G. argentea*, but much smaller and the powder on the under surface of the frond is bright yellow instead of white. Usually only three to four inches high; fronds deltoid, three to four-pinnatifid.

Gymnogramme aurea. Desv.; *Berl. Mag.* 5, 303, 1911.

Acrostichum aureum. Bory.

G. argentea Mett., var. *aurea*. Mett. MS.; Kuhn, *Fil. Afr.* 59; Sim, *Ferns of S. Afr.*, 1st ed., 215.

Found in Madagascar, Angola, Bourbon, and South Africa.

Natal.—Rare beside Iskoti, on Little Noodsberg (Buchanan); Indwedwe, north side of Umhloti, Inanda (McKen).

Orange Free State.—(Buchanan).

Transvaal.—Magalisberg (J. H. McLea); Barberton (A. J. T. Janse, 927); Zoutpansberg, 1905 (H. Junod, 2921); Belfast (Miss Doidge).

Rhodesia.—Mazoe, plentiful locally (F. Eyles, 340); Ironmask Hill, 5000 ft (E. Eyles).

Genus 25. *CEROPTERIS* Link.

Sori following the outer veinlets, simple or forked, without indusium. Under surface coated with white or yellow powder; frond (in our species) four-pinnatifid. Seven species, formerly included in *Gymnogramme*, confined to America, except as under. As mentioned in dealing with *Gymnogramma*, the species we have described under that genus seem to belong here.

96. *CEROPTERIS CALOMELANOS* (Linn.) Und. *Bull. Torr.* *Cl.*

Plate 88. Nat. size. b Fertile pinnule, enlarged.

Crown erect, tufted, paleaceous, the young unrolled fronds clothed in yellowish scales. Fronds numerous, firmly herbaceous, ovate-deltoid, acuminate, three-pinnatifid below, two-pinnatifid above, glabrous on the upper surface, coated with yellow powder on the under surface, one to one and a half feet long, five to seven inches broad at the base, with a furrowed brown stipe six to twelve inches long, which is dusted with white powder, and more or less paleaceous toward the base, with lanceolate spreading scales. On old fronds the powder is often absent from the stipe, and sometimes also from the under surface, except among the sori. Rachis furrowed, slightly green-margined. Pinnae lanceolate, widest at the base, distinct, and shortly stalked, except the upper ones which are slightly connected at the base. Lower pinnae two to three inches long, one inch broad, cut to the mid-rib into separate sessile, ovate-oblong, pinnatifid pinnules. Pinnae above the middle of the frond, cut to the mid-rib only at the base into ovate obtuse, toothed or nearly entire pinnules.

The pinnae are less deeply cut upward, ending in a simply toothed blunt apex. Sori diverging obliquely from near the mid-rib into the teeth or lobes in the upper part of the pinnae, ultimately sub-confluent, parallel with the mid-rib.

Ceropteris calomelanos (Linn.). Und. *Bull. Torr. Cl.* 29, 632, 1902; C. Chr. *Ind.* 169.

Gymnogramme tartarea Desv., var. β *ochracea*. Hk. and Bkr, *Syn. Fil.* 384.

G. ochracea (Presl). Sim, *Ferns of S. Afr.*, 1st ed., 214.

Acrostichum calomelanos. Linn. *Sp.* 2, 1072. 1753.

A tropical American species included as African by Kuhn from Fernando Po and by Christensen on Gerrard's specimen concerning which Baker in *Syn. Fil.*, under *Gym. tartarea* Desv., var. β *ochracea* says: "We cannot distinguish from *G. ochracea* a plant gathered by Gerrard in Natal." I have doubts if this plant is really South African.

Natal.—(Gerrard, *vide* Hk. and Bkr, *Syn. Fil.*). Railway cutting between Seaview and South Coast Junction, abundant, on Sandstone rock (T. R. Sim, July, 1914)¹.

Transvaal.—(Herb. Bolus).

B. CHEILANTHINAE.

Genus 26. *PELLAEA* Link.

Small ferns of rigid habit, having divided fronds, often coriaceous, lanceolate or triangular, and generally with free veins. Sori marginal, with a rather wide continuous or interrupted indusium, under which the sori are at first separate and terminal on the veins, produced upon the lamina, but afterwards more or less continuous. From *Cheilanthes* this is distinguished by the continuous indusium, though sometimes it is so much interrupted as to make the limit between the two genera rather indefinite. From *Pteris* it is distinguished by the sori being at first confined to the ends of the veins, upon the lamina instead of in a continuous line in the axil of the indusium, but as the capsules mature this character becomes lost, and these two genera then appear almost too closely connected.

The *Pellaeas* are widely distributed, but most numerous in Western North America and in South Africa.

¹ See p. 48.

Synopsis of the species :

97. *P. dura*. Veins anastomosing (the only species in which they do so). Frond pinnate or two-pinnate.
98. *P. auriculata*. Frond lanceolate, simply pinnate or nearly so, herbaceous; pinnae ovate; indusium very broad, crenate.
99. *P. Goudotii*. Frond lanceolate, pinnate, rigid, coriaceous, more or less clothed with adpressed woolly scales, pinnules linear.
100. *P. lancifolia*. Frond lanceolate, glabrous, two-pinnate; pinnules ovate or deltoid, with a narrow base; indusium very broad. Texture herbaceous.
101. *P. quadripinnata*. Frond three to four-pinnate, deltoid, about as long as broad, more than four inches each way. Stipe and rachis brown.
102. <i>P. Boivini</i>	} Frond twice as long as broad, three-pinnate or two-pinnate, stem and rachis brown, except in <i>P. leucomelas</i> . A very closely connected group, having no arbitrary characters distinguishing them.
103. <i>P. namaquensis</i>	
104. <i>P. involuta</i>	
105. <i>P. viridis</i>	
106. <i>P. leucomelas</i>	
107. *P. Doniana*. Frond simply pinnate, glabrous; rachis pubescent.
108. *P. hastata*. Frond two to three-pinnate, deltoid; stipe, rachis, and petioles, black and shining; pinnules stalked, cordate, or deltoid, glabrous.
109. *P. Swynnertoniana*. Similar to *P. hastata*, but pinnules very large, ivy-leaved.
110. *P. pteroides*. Frond deltoid, three-pinnate, glabrous, pinnules stalked, half inch long, oval, entire; involucre one to each veinlet.

97. PELLAEA DURA (Willd.) Baker.

Plate 90. Fig. 1. Nat. size.

Crown tufted; fronds three to nine inches long, two to four inches broad, deltoid, pinnate or two-pinnate, coriaceous, glabrous. Upper pinnae linear-lanceolate from a cordate base, rounded at the point, one to one and a half inches long, one and a half to three lines broad; lower pinnae similar, or with a similar terminal pinnule and one to four pairs of smaller side pinnules. Veins anastomosing freely, but rather obscure, except the central one which is like the rachis and stipe, black, shining, and naked. Involucre rather narrow, intramarginal. When barren the pinnules are rather wider than when fertile.

It seems to vary considerably; one specimen in Herb. Gub. has frond eighteen inches long, and resembling *P. viridis* (Forsk.) but with the indistinctly reticulated venation.

Pellaea dura (Willd.). Baker, *Jour. of Bot.* 1880; C. Chr. *Index*, 480.

Pellaea Burkeana. Bkr, *Syn. Fil.* 153; Sim, *Ferns of S. Afr.*, 1st ed., 105.

Pteris Burkeana. Hk. *Sp.* 2, 213, tab. 126β.

Pteris dura. Willd. *Sp.* 5, 376, 1810; Kuhn, *Fil. Afr.* 80.

South Africa and African Islands; not known south of Natal. It grows in crevices of wet rocks.

Transvaal.—Magalisberg (Burke).

Natal.—Not rare but not very common (Wood); Great Noodsberg, Inanda, Umpumulo (Buchanan).

Rhodesia —Mazoe, 5000 ft (F. Eyles, 263); Salisbury (J. F. Darling);

Umtali (Holland, Mrs Bennett); Borrowdale (H. M. Hole); a tasselled form at Salisbury (J. F. Darling).

98. PELLAEA AURICULATA (Thbg) Fée.

Plate 89. Nat. size. B Pinna, enlarged. C Falcate pinna, nat. size.

Crown tufted, paleaceous, with lanceolate rusty-brown scales, or sometimes almost without scales. Frond herbaceous, lanceolate, simply pinnate, or sometimes two-pinnatifid, two to nine inches long, half to one inch broad, with a short brown-black soft naked or slightly scaly stipe, and a polished brown naked green-margined rachis. Pinnae about eighteen pairs, not regularly opposite, sessile or very shortly stalked, bluntly pointed, ovate or cordate-ovate, or sometimes with one or more lobes at the base, hastate, or cut nearly to the mid-rib; barren pinnae more rounded than others. Indusium nearly a line wide, similar in texture to the frond, crenate along its edge, and the margin of the frond is also crenate-wrinkled. The crenations on the indusium appear almost like the separate indusia of *Cheilanthes*, but are only vein wrinkles, and not distinct lobes.

This species is very various in cutting, and seems to include both *Adiantum auriculatum* and *Pteris confluens* of Thunberg, unless the latter belong to *P. lancifolia* which is nearly related to this; indeed, Schlechtendal's fig. d on Tab. XXIII approaches *P. lancifolia* closely. The fronds

die off during drought, but the ripened crown is capable of standing a long-continued drought, even when detached from the roots.

Pellaea auriculata (Thun.). Fée, *Gen.* 129, 1850-52; C. Chr. *Ind.* 478.

Pellaea auriculata (Link.). Hk. *Sp. Fil.* 2, 140; Hk. and Gr. *Ic.* tab. 116; Hk. and Bkr, *Syn. Fil.* 145; Sim, *Ferns of S. Afr.*, 1st ed., 91.

Cheilanthes auriculata. Link. *Hort. Berol.* 2, 36; Kunze, *Linnaea*, 10, 531: 23, 242; Kuhn, *Fil. Afr.* 69.

Pteris auriculata. Swartz, *Schrad. Jour.* 1800, 2, 69; Schl. *Adum.* 41, tab. 23.

Allosorus auriculatus. Presl, tab. 153; Pappe and Rawson, 31.

Adiantum auriculatum. Thunb. *Prod.* 173, 1800; *Flor. Cap.* 736.

Pteris confluens. Thunb. *Prod.* 173; *Flor. Cap.* 733, 1800.

Adiantum hastatum Thunb., in Hb. Kaulf. (*fide* Kuhn, though Thunberg gives *Adiantum hastatum* L. as a synonym for his *Pteris hastata*=*Pellaea hastata* (Thbg) Prantl).

S.-W. Africa only, growing on moist, shady, rotten rocks.

West.—Table and Devil's Mts and neighbourhood, common (T. R. Sim); Piquetberg, Muizenberg and Clan William (Ecklon, 76); Paarlberg (Drège); Mitchell's Pass and Namaqualand (Sir H. Barkly); Kamiesbergen (Drège); Olifant's River (R. Schl. 4998); Leliefontein (Prof. Pearson, 6691).

Stated by Kuhn to have been collected in Natal by Krauss, but not found since. Not known in Eastern Province nor in Kaffraria.

99. PELLAEA GOUDOTII (Kze) C. Chr.

Plate 90. Fig. 2. Nat. size. Plate 98. Fig. 1. Var. *major*.

Crown procumbent or shortly creeping, with abundant lanceolate, reddish scales. Frond simply pinnate, six to twelve inches long, one to three inches broad, on a stout stipe four to six inches long, which is scaly at the base, and like the rigid rachis clothed with adpressed woolly scales. Pinnae fifteen to thirty nearly opposite pairs, very shortly stalked, linear, rounded at the point, cordate or slightly auricled at the base, three-quarters to one and a half inches long, one line broad; edges very much rolled back. Upper surface glabrous and shining, or like the under surface (except

the indusium) slightly woolly. Rachis and pinnules very rigid and coriaceous. Involucre same texture as the frond, intra-marginal. Pinnules when barren broader, and not revolute; and the lower ones reduced. Veins forked, free ("or very rarely anastomosing," Kuhn), but lost in the firm frond, and not easily seen. Easily confused with *P. dura*.

Var. MAJOR Sim (Plate 98, fig. 1) has nine pairs of pinnae each about one and a half inches long, one-third to one-half inch wide, fertile throughout; rachis pubescent. It is from Ironmask Hill, Mazoe, Rhodesia, 5000 ft (Eric Eyles).

Pellaea Goudotii (Kze). C. Chr. *Ind.* 480, 1906.

Pellaea pectiniformis. Bkr, *Syn. Fil.* 2nd ed. 147; Sim, *Ferns of S. Afr.*, 1st ed., 95.

Pteris pectiniformis. Godet, Hb.; Kuhn, *Fil. Afr.* 87 (with description).

Pteris Goudotii. Kze, Hb.

Pteris dura. Hk. and Bkr, *Syn. Fil.* ed. 1, 147 (where *P. Burkeana* Bkr is included in it).

African islands, and South Africa south to Natal.

Natal.—1000 to 3000 feet alt., Umzinyate Falls, Inanda, and Killiecrankie (Buchanan); Umhloti (Wood); Broadmoor, Schroeders (T. R. Sim).

Transvaal.—(Bolus); Marovuni, dry rocks, not common (Burt-Davy, 235).

Rhodesia.—Matopo Hills near American Mission (Miss Gibbs, 294); Mazoe, in crevices of cliff, sheltered aspect, fairly common locally (F. Eyles, 250).

100. PELLAEA LANCIFOLIA Baker.

Plate 91. Fig. 2. Nat. size. c Pinnule, magnified.

Crown much tufted, slightly paleaceous, or almost naked. Frond lanceolate, three to six inches long, one to one and a half inches broad at the middle, rather narrower below, two-pinnate, glabrous and herbaceous, with a naked brown stipe two inches long, and a naked rachis. Pinnae almost sessile, a half to one inch long, half inch broad; upper pinnae entire or lobed; middle and lower pinnae cut to the rachis into three to seven cordate, ovate, or deltoid, entire, oblique pinnules three to four lines long, two to three lines broad, cut away

below into a broad petiole, or adnate. Barren fronds are very thin, and with rounded decurrent lobes, and the margin is crenate even when fertile. Involucre very wide, of same texture as the frond, except the margin, which is scarious and undivided, or at least not regularly lobed. Baker remarks: "differs from *P. profusa*¹ by its naked rachis and very broad indusium"; but it seems to me to be more nearly connected with the cut forms of *P. auriculata* Link.

In *Journal of Botany* the indusium is described as crenate, but in *Annals of Botany* this is omitted. The specimens I have examined are neither crenate nor regularly lobed, as *P. auriculata* always is.

P. lancifolia. Baker in *Journal of Botany*, July, 1874; *Annals of Botany*, 5, No. 18; Lady Barkly's Revised List, No. 43; Sim, *Ferns of S. Afr.*, 1st ed., 96; C. Chr. *Ind.* 481.

Allosorus. O. Ktze, 1891.

West.—At foot of Kamiesberg, Namaqualand, where it was discovered by Sir Henry Barkly, and again collected by Mr Bolus; Karree-bergen, 2000 ft (R. Schlechter, 8205).

(In the Transvaal Mus. Herbarium is a specimen eight inches high from Piquimier's Kloof (R. Schlechter, 4951) labelled *P. lancifolia* Baker, which has evidently been grown in shade and is young, the lobes rounded and sharply toothed; it is an unusual form of *Adiantopsis capensis* (Thbg) Fée.)

101. PELLAEA QUADRIPINNATA (Forsk) Prantl.

Plate 92. Lower pinnae, nat. size. b Pinnule, magnified.

Crown tufted, paleaceous. Fronds three to four-pinnate, deltoid, four to eighteen inches long and broad, on a naked, shining, brown, furrowed stipe, of equal length, paleaceous at the base. Pinnae deltoid, but with larger pinnae on the lower side; secondary pinnae also deltoid with larger pinnules on the lower side. Pinnules sessile, divided to near the rachis into two to five pairs of oblong or obtuse toothed lobes with a larger terminal one, or sometimes again pinnate and having lobed pinnules. Sori intramarginal, with a narrow membranous indusium. Pinnules narrowed when fertile, and not toothed as they are when barren. Whole frond glabrous, or

¹ = *P. involuta* (Sw.) Baker.

with the stipe slightly paleaceous when young, coriaceous, and of a brownish-green colour. *P. Bojeri* Hk. is stated to be a form of this by Baker (*Syn. Fil.* 150) and by Christensen, but Wood's and Buchanan's plant so named is *P. involuta*.

Ecklon and Zeyher's specimen in Albany Museum marked "*Pteris capensis* Thbg. 136" also belongs to this species, though the name is a mistake.

Pellaea quadripinnata (Forsk.). Prantl, *Engl. Jahrb.* 3, 420, 1882; C. Chr. *Ind.* 482.

Pellaea consobrina. Hk. *Sp.* 2, 145; t. 117 A; Hk. and Bkr. *Syn. Fil.* 150; Sim, *Ferns of S. Afr.*, 1st ed., 97.

Pteris consobrina. Kze, *Linnaea*, 10, 526.

Pteris quadripinnata. Forsk. *Fl. Aeq. Arab.* 186, 1775.

Cheilanthes quadripinnata. Kuhn, *Fil. Afr.* 74.

Allosorus consobrinus. Pappe and Rawson, 31.

Cheilanthes triangula. Kunze, *Linnaea*, 10, 536.

Cheilanthes Atherstonei. Hk. *Sp.* 2, 107; Pappe and Rawson, 37.

Cheilanthes firma Moore. Pappe and Rawson, 37,

Cheilanthes linearis Moore. Pappe and Rawson, 37, } *teste* Kuhn
and Christensen.

Africa and African islands; growing on open banks or near bush in the upper districts, 2000 feet and upward; very common eastward.

West.—Knysna (Miss Dalgairns).

East.—Krakakamma (E. and Z.); Albany (Dr Atherstone); Howison's Poort (Holland); Boschberg, 4500 ft (MacOwan); Oudeberg, Graaffreinet (Bulus, 172).

Kaff.—Komgha (Flanagan); Witbergen, Stormberg (Drège); frequent above the forest at Perie, Dohne, Toise River, Kei Road, and S.-W. of King William's Town (T. R. Sim); Engcoba (A. G. McLoughlin); Main (Mrs Young).

Natal.—Upper districts down to Noodsberg (Wood); Maritzburg, Drakensberg, Umpumulo, etc. (Buchanan); Majuba (F. A. Rogers, 110); common (T. R. Sim).

Orange Free State.—Ficksburg (Quail); Tweespruit (Marriott); near Van Reenen (Dr Bews).

Transvaal.—Pilgrim's Rest, Macamac Fields (McLea, 46); Mamot-sinri (Burt-Davy, 204); Belfast, 6000 ft (Burt-Davy, 1238); Shilouvane (H. Junod, 119); Woodbush (T. J. Jenkins, 920; Mrs R. Potts, 4678).

Rhodesia.—(Oates); Mazoe and Umtali (J. F. Darling; Mrs Bennett; F. Eyles, 357); Chimanimani Mts, 7000 ft (Swyn. 852); Mt Pene, 7000 ft (Swyn. 6028).

(PELLAEA ANDROMEDAEOFOLIA Fée.

Allosorus andromedaefolia. P. and R. 31; Kunze, *Linnaea*, 10, 503.

This is included by Pappe and Rawson, Kunze, and Lady Barkly from Drège's specimens collected at Kendo, and is still retained in *Syn. Fil.* (150), but was not seen by Pappe and Rawson nor Lady Barkly, while Kuhn excludes it from Africa as a mistake.

An unnamed specimen in Herb. Gub. without locality does not differ in any essential point from the description in *Syn. Fil.* of *P. andromedaefolia*, but is certainly a dry grown and very much involuted form of *P. quadripinnata*. Baker, however, writes me that "*P. andromedaefolia* is in Hb. Drège from 'dry localities at Kendo'—Herb. Kew, Herb. Rawson." Christensen credits it to America only.)

102. PELLAEA BOIVINI Hk.

Plate 93. Nat. size.

Frond deltoid, two-pinnate or three-pinnate, four to nine inches long, three to six inches broad, on a black stipe three to six inches long. Pinnae stalked, ascending, deltoid, in opposite pairs; the lowest the largest, three inches long, two inches broad at the base, and having about four pairs of opposite pinnules, of which the upper are simple, and the lower three-foliate; other pinnae smaller upward, and mostly with simple pinnules. Pinnules coriaceous, three-quarter inch long, two to three lines broad, broadest below the middle, and tapering upward to the blunt point, and downward to the cordate base; all shortly stalked, and with a black mid-rib prominent to the point on the under side. Rachis and secondary rachises black, and densely set with short brown tomentum. Sori intramarginal, with a very broad indusium. This species is near the larger form of *P. viridis*, var. *glauca*, but has blacker, more rigid, and tomentose rachis, and broader indusium.

Found near Magalisberg, Transvaal, by Zeyher and Burke, and it also occurs in Madagascar, Mauritius, and India.

I have seen no South African specimen, but the description and figure are from Ceylon specimens kindly forwarded to me from Kew.

103. PELLAEA NAMAQUENSIS Baker.

Plate 94. Fig. 2. Nat. size. b Pinnule, magnified. c Barren pinna, nat. size.

Crown tufted, stout, paleaceous, with linear brown scales, usually burned or withered off. Fronds ovate pointed, one inch broad, two to four inches long, on a stout stipe one to two inches long, and having four to six pairs of deltoid sub-opposite pinnae; the lower the largest, half-inch broad, three-quarters to one inch long, shortly stalked, equal sided, erecto-patent, ascending and cut to the rachis into several lobed, trifid, or pinnatifid pinnules, having a shortly cuneate base, and wide attachment, or sometimes shortly stalked. Barren pinnae longer, thinly membranaceous, crenate. Rachises and stipe stout, brown, and shining, with scattered, small, stiff, brown, lanceolate, but not hair-like, scales, which are more abundant towards the base. Texture firmly herbaceous; frond glabrous on both surfaces; indusium continuous, narrow, folding back early. Baker describes this as "about midway between *P. involuta* and *P. consobrina* in cutting and general aspect."

P. namaquensis. Bkr in *Jour. of Botany*, July, 1874; and *Annals of Botany*, Vol. 5, No. 18, April 1891; Sim, *Ferns of S. Afr.*, 1st ed., 99; C. Chr. *Ind.* 481.

Allosorus. O. Ktze.

West.—Foot of the Kamiesberg, Namaqualand (Sir H. Barkly, Dr Bolus); rock crevice near top of Rattel Poort, Little Namaqualand (Dr H. H. W. Pearson, 2970).

104. PELLAEA INVOLUTA (Sw.) Baker.

Plate 95. Nat. size.

Rhizome shortly creeping or tufted, with linear, shining, light brown, hair-pointed scales. Frond four to nine inches long, two to three inches broad, lanceolate or oblong-lanceolate, two-pinnatifid or sometimes three-pinnatifid, on a channelled, brown stipe, equal in length to the frond. Stipe,

rachis, and mid-ribs set with soft, spreading, hair-like, yellowish scales, very abundant below. Pinnæ one to one and a half inches long, plain, deltoid, hardly equal-sided, cut to or near the rachis into entire oblong lobes, having a broad attachment, or the lower ones pinnatifid with one to four pairs of lobes; upper pinnæ less divided, more or less confluent. Texture firmly herbaceous; pinnæ glabrous on both surfaces, and edged by the narrow, white, membranous, intramarginal, and early reflexed, entire, but often undulated indusium. I cannot distinguish from this the Natal specimens in which the scales of the stipe are adpressed, more rigid, and brown, and the pinnules rounded at the base or almost stalked. These are the *P. Bojeri* of Buchanan's List and of Wood's *Natal Ferns*, but Christensen places *P. Bojeri* Hk. under *P. quadripinnata*.

This is a badly understood and most confusing plant. I find difficulty in drawing a line between it and *P. viridis*, var. *glauca*. Buchanan found the same difficulty, while Lady Barkly and Pappe and Rawson included both here, and the Graaffreinet specimens identified as this at Kew approach var. *glauca* very closely. The paleaceous stipe and rachis, less divided, less triangular, and more plain frond, characterise this plant, which appears to be rather rare though widely spread. The connection with *P. quadripinnata* is much more distant, but *P. namaquensis* is very close.

Pellaea involuta (Swartz). Baker, *Syn. Fil.* ed. 2, 148; Sim, *Ferns of S. Afr.*, 1st ed., 100; C. Chr. *Ind.* 481.

Pteris involuta Sw. Schl. *Adum.* 46; Kze, *Linnaea*, 10, 526; Pappe and Rawson, 51; Kuhn, *Fil. Afr.* 82.

Pellaea profusa J. Smith. Hk. and Bkr, *Syn. Fil.* ed. 1, 148.

Cheilanthes profusa. Kze, *Linn.* 10, 536; Suppl. to Schk. *Fil.*, tab. 17; Hk. *Sp.* 2, 108.

Cheilanthes cornuta. Kze, *Linnaea*, 10, 534; Pappe and Rawson, 36 (see under *Cheilanthes depauperata*).

Cheilanthes distans Mett., var. *profusa* Mett. Kuhn, *Fil. Afr.* 71.

Pellaea Bojeri (Hk.?). Buchanan's List; Wood's *Natal Ferns*.

South Africa only; north to Zanzibar.

West.—Silverfontein, Namaqualand, Buffeljagds-Rivier, and Rietkuil (Drège).

East.—Oudeberg, near Graaffreinet (Bolus, 4200).

Kaff.—Kongha (Flanagan); near Kei Bridge (Flanagan, 1240).

Natal.—Inanda, Umpumulo, Kranzkloof, and abundant all along the road to Newcastle (Buchanan).

Transvaal.—Lekker Kraal (G. Krantz); Pilgrim's Rest (L. Collins, 897); Waterval Onder (T. J. Jenkins).

105. *PELLAEA VIRIDIS* (Forsk) Prantl.

Plate 96. Nat. size of small frond. Varieties on Plates 97, 98, 99.

Rhizome subterranean, creeping, short, nearly naked. Frond very various, ovate-lanceolate, or sub-deltoid, one to three feet long, on a nearly naked, shining, brown, wiry stipe, one foot long, which, when young, has scattered, soft, adpressed, woolly scales toward the base. Frond generally two-pinnate, the lower pinnae not longer than those above, and having one to four pairs of broadly lanceolate or ovate pinnules, three-quarters to two inches long, cordate or rounded at the sessile, but not adnate, base, rounded at the point; crenate when fertile as well as when barren, as the indusium is slightly intramarginal. Indusium linear, narrow, membranous, not lobed, crenate, nor waved, and when mature standing at right angles to the frond. Colour deep green; texture coriaceous; veins distinct; upper surface glabrous; lower surface and secondary rachises in some plants densely villose, in others glabrous. Rachis deeply channelled in front, more or less villose in the upper part. This is a variable plant with a wide range of cutting.

This is *P. hastata* Link. of our first edition, and the change of names is very confusing, as *P. calomelanos* Link. of that edition now becomes *P. hastata* (Thbg) Prantl.

Pellaea viridis (Forsk). Prantl, *Eng. Jahrb.* 3, 420, 1882; McKen; C. Chr. *Ind.* 483.

Pellaea hastata Link. Hk. *Sp.* 2, 145, tab. 116 B; Hk. and Bkr, *Syn. Fil.* 152; Sim, *Ferns of S. Afr.*, 1st ed., 101.

Pteris hastata. Sw. *Schrad. Jour.* 1801; Schl. *Adum.* 42 (not *Pteris hastata* of Thunberg (1800) or Kuhn).

Allosorus hastatus Presl. Pappe and Rawson, 30.

Cheilanthes hastata. Kze, *Linnaea*, 10, 532.

Cheilanthes hastata, var. *stenophylla*. Kze, *Linnaea*, 10, 533.

Cheilanthes hastaeifolia. Kze, *Linn.* 23, 307.

Pteris viridis. Forsk, *Fl. Aeq. Arab.* (1775); Kuhn, *Fil. Afr.* 89.

Cheilanthes viridis Sw. Hk. *Sp.* 2, 110.

Adiantum hastatum. Linn. *Suppl.* 447.

Pteris auriculata. Thunb. *Prod.* 172; *Flor. Cap.* 733.

Lady Barkly includes here Pappe and Rawson's *Allosorus cordifolius* P. and R., and *Allosorus capensis* Pr., both of which belong to *Pteris aquilina*; also *Cheilanthes firma* Moore, and *C. linearis* Moore, both of which were afterwards merged by Moore into *C. triangula* Kze, a synonym of *P. quadripinnata*.

Africa and African islands. It is perhaps the most common fern throughout the whole of South Africa, growing both in the forest and on the veld, from the coast to the mountains, wherever it has a little bush shelter, and frequently without shelter. It is also the most variable, from simply pinnate to three-pinnate. It occurs north to Abyssinia.

West.	}	—The most common fern in or out of the forest.
East.		
Kaffraria.		
Natal.		

Orange Free State.—Rietfontein Hills, near Parijs (Potts, 568); near Van Reenen (Dr Bews).

Transvaal.—Johannesburg (Burt-Davy, 2123); Marovuni (Burt-Davy, 229); Belfast (Burt-Davy, 1245); Lomatie Valley, Barberton (Burt-Davy, 326); Haenertsberg (Eastwood; Mrs Potts, 4671); Zeerust (T. J. Jenkins); and many other places.

Rhodesia.—Salisbury (H. M. Hole); Umtali (Mrs Bennett); Jumbo Mine (Holland); Zimbabwe ruins (Holland); Mazoe, 4400 ft (F. Eyles, 312); Matopo Hills, 5000 ft (Eyles, 1018; Miss Gibbs, 89); Bulawayo (Eyles and Johnson); Gwaai River and Victoria Falls (J. Sim).

Portuguese East Africa.—Lourenço Marques (R. Schlechter, 11,653); Umbelusi (T. R. Sim); Inyamadzi Valley, 2500 ft (Swyn. 848); Moramballa Mts (Kirk).

Var. *MACROPHYLLA*. (Plate 99, nat. size) has the frond usually only once pinnate, with pinnae much larger, and more pointed, than the pinnules in the ordinary form; or sometimes with the lowest pinnae again divided. It varies considerably, and is possibly only a young state, and passing gradually into the ordinary form. Not uncommon in forest. I have also

Rhodesian specimens from Chirinda Mts, 4000 ft (Swyn. 800) and Victoria Falls (Carbutt).

Allosorus hastatus, var. *macrophylla*. Pappe and Rawson, 30.

Cheilanthes macrophylla. Kze, *Linn.* 23, 307.

Pellaea hastata, var. *macrophylla*. Hk. *Sp.* 2, 146; Sim, *Ferns of S. Afr.*, 1st ed., 102.

Cheilanthes hastata, var. *macrophylla*. Kze, *Linn.* 10, 81.

Var. **GLAUCA** Sim (Plate 97, nat. size). Fronds triangular, three to eight inches long, two to five inches broad, on a stipe one to four inches long; two-pinnate, with the pinnules deeply lobed, or sometimes three-pinnatifid. Lower pinnae largest, equal-sided, ascending, erecto-patent, or with the pinnules on both sides of the rachis pointing upward so as nearly to meet. Frond glabrous on both surfaces, firmly herbaceous, glaucous, and with the brown or nearly black rachis and stipe almost destitute of scales, except at the base. It is not unlike *P. hastata* (Thbg) Prantl, and has been passed by high authorities from dried specimens as a variety of that fern; but the stipe is not so black, nor the texture so coriaceous, and as the fronds get old their connection with *P. viridis* becomes more apparent.

There are two forms of it, often growing together, which in their extremes might well be set down as distinct species, but they run into one another, and the larger one approaches the ordinary *P. viridis*, though generally distinguishable. Its close connection with *P. involuta* has been noticed under that species.

The smaller form is seldom more than four inches high, quite deltoid, and glaucous, and with the small pinnules meeting above the rachis, and cut into decurrent lobes. The larger form (Plate 98, Fig. 2) is generally over six inches and under twelve inches in height, not so glaucous, and with pinnules not so much lobed, but sometimes cut again into distinct oval segments.

P. hastata Link., var. *glauca*. Sim, *Kaff. Ferns*; Sim, *Ferns of S. Afr.*, 1st ed., 102.

Pteris adiantoides. Bory.

This form grows on the top of nearly bare rock or among stones.

West.—Damaraland at Okahandja (Marloth).

East.—Bellerne, near Bedford (Holland).

Kaff.—S.-W. of King William's Town, Izeli, Mount Coke, etc. (T. R. Sim); Main (Mrs Young).

Natal.—(Buchanan); Buccleuch (W. Leighton); Port Shepstone, Murchison Falls, Bulwer, Ngomi, etc. (T. R. Sim).

Orange Free State.—Rietfontein Hills near Parijs (Prof. Potts, 567).

Transvaal.—Lydenburg (F. Wilms, 1895); Rustenburg (T. J. Jenkins, 773); Pretoria (M. Collins, 167); Magalisbergen (Mrs Pott, 3704); Hennops River (T. J. Jenkins); Heidelberg (R. Leendertz, 2660); Waterval Onder (T. J. Jenkins, 764); Houtboschberg, 6000 ft (R. Schlechter, 4431); Haenertsberg (Mrs R. Potts, 4677).

Rhodesia.—Mazoe and Salisbury (J. F. Darling, H. M. Hole, Holland); Matabeleland (Fry); Gwaai River (J. Sim).

106. PELLAEA LEUCOMELAS (Mett.) Baker.

(Not seen. Description translated from Kuhn, *Fil. Afr.* p. 83.)

"Rhizome short, densely set with black keeled scales. Frond thick, green above, paler below, glabrous. Petiole paleaceous tomentose at the base, one inch long, like the rachis ebeneous shining; upper surface of the rachis depressed or channelled margined. Frond five inches long, ovate-oblong, two-pinnate. Pinnae patent, approximate, distinctly petioled, one and a half inches long, ovate or ovate-oblong, obtuse. Pinnules three to five-jugate, very shortly petioled, obliquely oblong-ovate, somewhat pointed, distinctly petioled in the lower part, sessile above; terminal pinnules often three-lobed; veins immersed, repeatedly forked; margin revolute, narrow.

Allosorus. Kze, Hb., Mett. MSS. South Africa (Breutel)."

Gathered also by Mr Todd, of Inanda, in the Transvaal; and Mr Wood, who saw the specimen, describes it as having the colour and texture of *P. calomelanos*, together with the form of *P. hastata* Link. Possibly it belongs to *P. viridis*, var. *glauca*.

Pellaea leucomelas (Mett.). Baker, *Syn. Fil.* 478; C. Chr. *Ind.* 481.

Pteris leucomelas Mett. Kuhn, *Fil. Afr.* 83.

107. PELLAEA DONIANA (J. Sm.) Hooker.

Plate 102. Nat. size.

Frond simply pinnate or slightly more divided, oblong-lanceolate, coriaceous, glabrous except the rachis which is pubescent. Pinnae eight to fifteen pairs, two to four inches long, half to one inch wide, shortly stalked, rounded at the base, tapering above. Mid-rib black and polished on the under surface. Not unlike *P. viridis*, var. *macrophylla*, but more rigid, with pubescent rachis and black polished mid-rib. Apparently distinct.

P. Doniana (J. Sm.). Hk. *Sp.* 2, 137, 1858; Hk. and Bkr. *Syn. Fil.* 152; C. Chr. *Ind.* 479.

Platyloma. J. Smith.

Tropical Africa and the Seychelles.

Rhodesia.—Umtali (Mrs Bennett).

Zambesia and Angola (*Synopsis Filicum*).

108. PELLAEA HASTATA (Thbg) Prantl.

Plate 100. Nat. size.

Crown tufted, shaggy, with long, narrow, linear brown scales. Frond two to three-pinnate, deltoid, six to eight inches long, four to six inches broad, with a stout stipe of three to four inches, which is slightly paleaceous, with adpressed woolly scales below, but in the upper part, rachis, and petioles, quite naked, wiry, and shining black. Lower pinnae deltoid, erecto-patent, with three to five pairs of pinnules, or sometimes these are again pinnate; pinnules distinctly though shortly stalked, two to six lines broad and long; cordate, ovate-deltoid, hastate, or three-lobed, but generally from a cordate base, and always more or less rounded at the point; very thick in texture, glaucous, and glabrous. Terminal pinnule of each pinna not much different, but generally three-lobed. Involucre quite marginal, narrow, membranaceous, entire, not opening out flat when mature.

This is more rigid and leathery in texture than any of the other Pellaeas, and when the pinnae get old they drop off, leaving the petiole as if they had been jointed on to the top of it. Some specimens are remarkably hastate in every pinnule, others almost round, but often the first fronds are round, and later ones hastate.

This was *P. calomelanos* in our first edition, while *P. viridis* was there named *P. hastata* Link.

Pellaea hastata (Thbg). Prantl, *Engl. Jahrb.* 3, 418, 1882; C. Chr. *Index*, 480.

Pellaea calomelanos Link. Hk. *Sp.* 2, 140; Hk. and Bkr, *Syn. Fil.* 152; Sim, *Ferns of S. Afr.* 1st ed. 104.

Pteris calomelanos Sw. *Schrad. Jour.* 1800; Schl. *Adum.* 43, tab. 24; Kze, *Linnaea*, 10, 525.

Allosorus calomelanos. Pappe and Rawson, 30.

Pteris hastata. Thunb. *Prod.* 172 (1800); *Flor. Cap.* 733; Kuhn, *Fil. Afr.* 81 (not *Pteris hastata* Sw.).

Africa, Bourbon, India, and China; growing always among stones or in the crevices of rocks; widely scattered in South Africa.

West.—Frequent; also extending to the north-west, including Kwebe Hills, Ngamiland (Mrs E. J. Lugard, 225); Grundoven, Great Namaqualand (Dr H. H. W. Pearson, 3124); Okahandja, etc.

East.

Kaffraria. } Occurs everywhere among rocks, but seldom abundant.
Natal. }

Orange River Colony.—Wepener (Harper); Ficksburg (Quail); Tweespruit (Marriott); near Van Reenen (Dr Bews); near Parijs (Prof. Potts, 569).

Transvaal.—Magalisberg (Zeyher, Burke); Shilouvane (Junod, 519); Marovuni, Crocodile and Magalies Rivers, Waterval Boven, and Pretoria (Burt-Davy, 212, 231, 1436, 5023); De Wilt (S. Viljoen); Zoutpan (G. v. Dam); Klerksdorp (W. Nelson, 309); Krugersdorp (T. J. Jenkins, 867); Heidelberg, Standerton, Belfast, Ermelo, Zerust and Paul Pieters Rust (R. Leendertz, 2575, 4044, 2785, 3085, 4300, and 1423); Lydenburg (F. Wilms); Johannesburg (Williams); Barberton (Miss Williams); Matabas River (G. Krantz, 763); Rosehaugh (J. M. Sim).

Rhodesia.—Matopas (F. Eyles, 394); near grave of C. J. Rhodes (Holland); Salisbury (H. M. Hole); Matabeleland (Fry); Umtali (Mrs Bennett).

109. PELLAEA SWYNNERTONIANA Sim. (New species.)¹

Plate 101. Nat. size. B Margin of frond, $\times 2$.

Frond rigid, two-pinnate, deltoid, six to eight inches long, six inches wide, on a stout stipe; upper pinnae simple, lower pinnae three-foliate, each pinnule on a half to one inch petiole; pinnules ivy-leaved, three to five lobed from a cordate base, one to two inches wide, three-quarter to one and a half inches long, coriaceous, glabrous, very distinctly flabellately veined, and with wide indusium. Stipe, rachis and petioles stout, wiry, glabrous, black and shining. Resembles *P. hastata* (Thbg) Pr., but is much larger, less divided and less glaucous.

Chirinda Forest, Rhodesia (Swynnerton, 850).

110. PELLAEA PTEROIDES (Linn.) Prantl. (The Myrtle Fern.)

Plate 103. Nat. size.

Crown procumbent, paleaceous. Frond coriaceous, three-pinnate, triangular, nine to fifteen inches broad, twelve to eighteen inches long, on a naked, shining, nearly black stipe nine to twelve inches long. Lower pinnae largest, deltoid, simply pinnate toward the point, two-pinnate below. Other pinnae mostly simply pinnate, and decreasing to the simply pinnate point of the frond. Pinnules shortly stalked, glabrous, oblong, rounded or cordate at the base, rounded at the apex, a half to three-quarter inch long, two to five lines broad, crenate. Rachis shining, but woolly at the axils, or at first all along. Sori small, roundish, or crescent-shaped, on notches

¹ 109. PELLAEA SWYNNERTONIANA Sim. (Species nova.)

Tab. 101. Mag. nat. B Folii margo $\times 2$.

Folia rigida, bipinnata, deltoidea, 6—8" longa, 6" lata, stipiti robusto imposita; pinnae superiores simplices, inferiores trifoliatæ, pinnulis singulis petiolo $\frac{1}{2}$ —1" longo insidentibus; pinnulae hedero-foliatae, tri-quinque-lobatae, e basi cordata, 1—2" latae, $\frac{3}{4}$ —1 $\frac{1}{2}$ " longae, coriaceae, glabrae; nervi manifestissime flabellati; indusium latum; stipes, rhachis, petioli robusti, rigiduli, glabri, nigri, nitidi. Similis *P. hastatae* (Thbg) Pr., multo tamen maior, minus divisa minusque glauca.

Rhodesia, in Silva Chirinda (Swynnerton, 850).

in the margin closely placed all round the pinnule, but distinct, and consequently rather belonging to *Cheilanthes* than to *Pellaea*, though transferred to *Pellaea* by Prantl and retained there by Christensen. In our first edition, it was placed in *Cheilanthes*.

Pellaea pteroides (Linn.). Prantl, *Engl. Jahrb.* 3, 420, 1882; C. Chr. *Ind.* 482.

Cheilanthes pteroides. Swartz, *Syn.* 128; Schl. *Adum.* 48; Kunze, *Linnaea*, 10, 536: 23, 245; Pappe and Rawson, 33; Kuhn, *Fil. Afr.* 74; Hk. and Bkr, *Syn. Fil.* 131; Sim, *Ferns of S. Afr.*, 1st ed., 482.

Adiantum pteroides. Linn. *Sp.* 7942; Thunb. *Prod.* 173; Thunb. *Fl. Cap.* 736.

Adiantopsis. Moore, 1857.

South Africa and Java.

West.—In damp shady places among rocks near Cape Town, The Paarl, Table Mountain, Tulbagh, etc.; Swellendam (Holland).

A decidedly western fern, but recorded by Lady Barkly from Orange Free State, and said by Kuhn to have been found in Natal by Gueinzus, though not found there since. Both these are considered mistakes.

Genus 27. *DORYOPTERIS* J. Smith.

Fronds small, deltoid. Sori as in *Pellaea*. A small, badly defined genus of 38 species, mostly tropical, formerly included in *Pellaea*.

Synopsis of the species:

- 111. *D. concolor*. Frond roundish, deltoid, two-pinnatifid, not cut quite to the rachis.
- 112. *D. deltoidea*. Frond two inches long and broad, roundish, deltoid, two-pinnate, and cut quite to the rachis.
- 113. *D. robusta*. Frond ovate oblong, two inches long, one inch broad, coriaceous, three-pinnate; lobes of pinnules not at the base, but attached halfway up or more.

111. *DORYOPTERIS CONCOLOR* (L. and F.) Kuhn.

Plate 104. Nat. size. b Pinnule, enlarged.

Crown tufted, scaly. Frond glabrous on both sides, firmly herbaceous, roundish deltoid, varying from nearly entire to

bi-pinnatifid, but seldom cut quite to the rachis which has always a wide green margin. It varies considerably, and sometimes the barren fronds are small, round, and hardly lobed at all, while the fertile fronds on the same plant are cut nearly to the rachis, and the pinnae again deeply cut into pointed, lobed, pinnules. The pinnules on the lower side of the lower pinnae are much longer and more cut than the others. The fronds are one to four inches long and broad, and have a black, shining, wiry, and nearly naked rachis of equal length. The lower pinnae are nearly as large as the rest of the frond, thus making it more or less three-lobed. Sori continuous all along the margin, or in some cases very much interrupted, and resembling *Cheilanthes*. Indusium wide, membranaceous. Mid-rib and main veins black and shining; small veins distinctly visible, forked, but not uniting again. This is frequently known as the Oak Fern, but has no connection with the English Oak Fern (*Polypodium dryopteris*), nor with another species (*Polypodium phymatodes*), frequently grown here under the name of Oak Fern. From both these it is easily distinguished by the generic characters. This is the *Pellaea geraniifolia* of our first edition.

A much cut specimen from Matabeleland in Herb. Gub. has the Cheilanthoid fructification throughout, and is certainly *Cheilanthes Kirkii* Hk., but specimens from Cape Colony often have fronds or parts of fronds like this, while on others the indusium is continuous; and as it outgrows this condition, it is impossible to maintain the *C. Kirkii* as a distinct plant. *Pteris pedata* L., which is similar but has the veins uniting again freely, is the *Litobrochia* of Presl with which Pappe and Rawson seem to have confused this, but it is held as a distinct species by Baker, and is not found in S. Africa.

Doryopteris concolor (Langs. and Fisch.). Kuhn, *v. Deck. Reis.* 3³, 1879; C. Chr. *Ind.* 243.

Pellaea geraniifolia Fée. Hk. *Sp.* 2, 132; Hk. and Bkr, *Syn. Fil.* 146; Sim, *Ferns of S. Afr.* 1st ed. 92.

Pteris geraniifolia Raddi. Kze, *Linnaea*, 24, 271; Hk. *Ic. Plant.* tab. 915.

Pteris pedata. Kze, *Linnaea*, 10, 522; Pappe and Rawson, 25; Ecklon and Zeyher, No. 38 (not *P. pedata* Linn.).

Pteris Pohliana Presl. Kuhn, *Fil. Afr.* 88.

Pteris concolor. Langs. and Fisch. *Ic.* 19, tab. 21, 1810.

Cheilanthes Kirkii. Hk. *Ic. Fil.* 2, tab. 81; Hk. and Bkr, *Syn. Fil.* 132.

Throughout the tropics and a little beyond them; growing on dry banks in bush; not uncommon but rather local eastwards; not recorded from the west.

East.—Uitenhage (Drège); Bedford (Miss Cook); Amos Kloof, Grahamstown (Dr Atherstone); Boschberg (MacOwan); Kat River (E. and Z.).

Kaff.—Tamacha (E. and Z.); Komgha (Flanagan); Pondoland (Drège); near Peddie, Dohne, Perie, Mt Kemp, Frankfort (T. R. Sim); Kei Road (F. A. Rogers); Engcoba (McLoughlin, 81).

Natal.—From the coast to Maritzburg (Wood); Umpumulo (Buchanan); Howick (R. Schl. 6785); Buccleuch (W. Leighton); Besters and Brackwal (T. R. Sim).

Transvaal.—(Herb. Bolus); Marovuni (J. Burt-Davy, 233); Waterkloof, Pretoria (A. J. Aledy, 784); Barberton, 3000 ft (Thorncroft, 103); Pilgrim's Rest (L. Collins, 898); Rustenburg (R. Leendertz, 3377).

Rhodesia.—M'ngama's Poort (J. Fry); in the walls of the temple at Zimbabwe, June 1904 (B. H. Holland); Umtali (Mrs Bennett); Matopo Hills, 4800 ft (Eyles, 1044; Miss Gibbs, 291); Victoria Falls (Monro); Gwaai River (J. Sim).

112. DORYOPTERIS DELTOIDEA (Kze) Diels.

Plate 105. Fig. 1. Nat. size. Fig. 2, var. *laxa*, nat. size.

Crown tufted, abundantly set with rusty red scales. Frond widely deltoid, sub-coriaceous, glabrous, distinctly bi-pinnate; pinnae about three pairs, with lobed or pinnatifid pinnules, or the large lower ones on the lower side of the lower pinnae again pinnate. Frond one to one and a half inches long, one and a half to two inches broad, each lower pinna about as large as the rest of the frond above them, but much larger on the lower side than on the upper. Segments oblique, three lines long, one to two lines broad, bluntly triangular from about halfway down, below which they are narrowed with a curve into a broad base; the triangular part fertile, with a continuous, rather narrow indusium of the same texture as the frond, but having a thinner, scarious lobed margin.

Stipe and rachis nearly black, naked, shining; rachis slightly margined. Not unlike *P. concolor*, but distinctly pinnate throughout.

Doryopteris deltoidea (Kze). Diels, *Nat. Pfl.* 1⁴, 269, 1899; C. Chr. *Ind.* 244.

Pellaea deltoidea. Bkr. *Syn. Fil.* 146; Sim, *Ferns of S. Afr.*, 1st ed., 94.

Cheilanthes deltoidea. Kze, *Linnaea*, 10, 535; Hk. *Sp.* 2, 106, 147; Pappe and Rawson, 36; Kuhn, *Fil. Afr.* 70.

Kuhn also gives as a synonym to this species *Pellaea robusta* Hk., which I have maintained as a separate species.

West.—Little Namaqualand only; growing among fissures of the rocks near Silver Fontein (Drège); and collected there since by Rev. Mr Whitehead, and more recently by Sir H. Barkly; Lange Kloof, 400 ft (R. Schl. 8039); Hopefield, 150 ft (R. Schl. 5333); crevices between Dabaigabis and Gründoven, 4200 ft (Dr H. H. W. Pearson, 3176).

Cape Colony.—(Burchell, 2033, *Syn. Fil.*).

Var. LAXA, Sim (Plate 105, Fig. 2), much larger than the type; crown tufted, set with red lanceolate scales. Fronds quite deltoid, three inches long and broad, with two pairs of opposite, one-sided, deltoid pinnae, and a short terminal pinna, and with a naked, shining, brown stipe, three to five inches long. Pinnules similar to those of the type, but larger in all parts, more rounded, and with a distinctly cuneate, almost stalked base. Texture thinly herbaceous; indusium narrow. Collected by Mr Bolus in Namaqualand in 1883. It differs from *D. deltoidea* mostly in size, and may be a shade-grown form. It also resembles *Adiantopsis capensis*, but the indusium is quite continuous.

113. DORYOPTERIS ROBUSTA (Kze) Diels.

Plate 105. Fig. 3. Nat. size. b Pinnule, magnified.

Crown procumbent or shortly creeping, very stout, paleaceous, with rusty scales. Frond ovate oblong, bluntly pointed, glabrous, coriaceous, three-pinnate, one inch broad, two inches long, on a very stout, naked, channelled stipe, an inch long or more, with lanceolate red scales at the very base only. Pinnae

six to eight pairs, close and overlapping; the lower not larger than the upper side; deltoid, with a distinct green rachis, bearing three to four pairs of pinnules, the upper cuneate three-lobed, and the lower divided to the mid-rib into five to seven ovate or three-lobed segments, which are one line long, and not more than a half line broad when single. Sori mostly confined to the triangular part of the lobes, continuous, comparatively broad, and almost meeting above; same in texture as the frond. Kuhn makes this synonymous with *Pellaea deltoidea*, but Baker maintains both species. Both are found in Namaqualand, but the specimens I have seen are very distinct from one another and from everything else. Baker mentions its resemblance to the northern *Cryptogramme crispa* Br., which, however, has the fertile and barren fronds different, while here they are alike. Specimens of *D. deltoidea*, *D. robusta*, and *Pellaea namaquensis* are usually fragmentary and often unfit for identification between these three.

Doryopteris robusta (Kze). Diels, *Nat. Pfl.* 1⁴, 269, 1899; C. Chr. *Index*, 245.

Pellaea robusta. Hk. *Sp.* 2, 147; Hk. and Bkr, *Syn. Fil.* 149; Sim, *Ferns of S. Afr.*, 1st ed., 95.

Cryptogramme robusta. Pappe and Rawson, 32.

Allosorus robustus. Kunze, *Linnaea*, 10, 502.

West.—Between rocks near Goedeman's Kraal, Namaqualand (Drège); common throughout Namaqualand (Lady Barkly, Bolus); P'aus, 2300 ft (R. Schl. 11218).

Genus 28. *ADIANTOPSIS* Fée.

Involucres distinct, roundish, confined to the apex of a single veinlet. A small genus of 14 species, formerly included in Cheilanthes, and having the same habit and nature of habitat.

114. *ADIANTOPSIS* *CAPENSIS* (Thbg) Fée.

Plate 106. Fig. 1. Nat. size. B Pinna, enlarged. C Fertile margin, much enlarged.

Crown tufted, procumbent, densely paleaceous, with long rusty scales; frond herbaceous, glabrous, two-pinnatifid, ovate

or triangular, one to four inches broad, two to four inches long, on a dark brown polished stipe two to four inches long, and slightly scaly at the base. Pinnæ opposite, obtuse, deltoid, sessile, or shortly stalked, cut to or near to the mid-rib into two to five pairs of entire or lobed rounded oblique, more or less alternate and decurrent pinnules, which are serrate when barren, and not reflexed when fertile. Sometimes the lower pinnæ are again pinnate. Rachis shining black, round, or in the pinnæ more or less winged. Sori small, closely set all round the pinnules, but distinct. Involucre membranaceous, ciliated. This is *Cheilanthes capensis* of our first edition.

Kunze makes two varieties, viz.:

a. dentatum. Frond sub-coriaceous, stipe and rachis firm, pinnules and segments dentate, indusia sub-contiguous.

β. crenatum. Frond membranaceous, stipe and rachis slender, pinnules and segments sinuato-crenate, sub-emarginate, indusia remote.

Var. *crenatum* is the ordinary form. Var. *dentatum* is Burchell's 5602 and 1015.

Adiantopsis capensis (Thbg). Fée, *Gen.* 145, 1850-52; C. Chr. *Index*, 21.

Cheilanthes capensis. Swartz, *Syn.* 128; Schl. *Adum.* 48, tab. 28; Pappe and Rawson, 33; Kuhn, *Fil. Afr.* 70; Hk. and Bkr, *Syn. Fil.* 132; Sim, *Ferns of S. Afr.*, 1st ed., 81 (not *C. capensis* Ecklon).

Adiantum capense. Thunb. *Prod.* 173; Thunb. *Fl. Cap.* 736; Swartz, *Schrad. Jour.* 1800, 2, 85; Kze, *Linnaea*, 10, 530.

Hypolepis capensis. Hk. *Sp. Fil.* 2, 71, t. 77 c.

South Africa only; growing in shady localities in the southern district, but rare in Kaffraria and Natal. See note under *Pellaea lancifolia*, page 202.

West.—Common near Cape Town, Goukamma, near Knysna (Burchell, 5602); Tulbagh Kloof (Burchell, 1015); also Swellendam (Holland); Rondebosch (Bergius); Porterville (R. Schl. 4887); Concordia (R. Schl. 11338); Clan William and Stellenbosch (Ecklon); Namaqualand, and Ruigtevallei (Drège); Piquiemier's Kloof (R. Schl. 4951); Karreebergen (R. Schl. 8278); Richter's Veld, Anenous and Khamiesberg (Prof. Pearson, 6169, 6182, and 6633).

East.—Algoa Bay (Forbes); Van Staaden's River (Browning); Graaff-reinet (Bolus); Boschberg (MacOwan).

Kaff.—Chumie Forest, Alice (Mrs Young); Dordrecht Kloof (T. R. Sim).

Natal.—Eland's Kop, Mooi River, 5000 feet alt. (Buchanan); Wellington, Rosetta (T. R. Sim).

Transvaal.—(Lady Barkly).

Genus 29. *NOTHOLAENA* R. Brown.

Sori marginal, linear, almost or quite without indusium. Fronds two to three-pinnatifid. A small genus not naturally connected to any of the other non-indusiate genera, but closely related to *Cheilanthes*. In some of the species the margin is partly revolute over the sori, but there is no separate indusium. Some authors spell the name *Nothochlaena*.

Synopsis of the species :

- 115. *N. Rawsoni*. Frond linear-lanceolate, half inch wide.
- 116. *N. inaequalis*. Frond oblong, both surfaces woolly. Crown set with reddish scales, stipe almost naked.
- 117. *N. Buchanani*. Frond deltoid, stipe hairy; both surfaces woolly.
- 118. *N. Eckloniana*. Crown and stipe paleaceous or woolly. Frond oblong, upper surface naked, or nearly so.
- 119. *N. bipinnata*. Frond ovate, lower pinnae reduced, upper surface naked.

115. *NOTHOLAENA RAWSONI* Pappe.

Plate 107. Fig. 1. Nat. size.

Rhizome running, one line diameter, several inches long, woody, and clothed with lanceolate, adpressed, dark scales. Frond linear-lanceolate, six to nine inches long, one-half to three-quarter inch broad, with a naked or shaggy tomentose wiry stipe three inches long, and about twenty pairs of ovate, sub-coriaceous pinnae, which are slightly stalked below, sessile above, and divided to near the mid-rib into three to four pairs of close rounded pinnules. Pinnae alternate, half inch long, quarter inch broad, glabrous on the upper surface, densely tomentose or shaggy below, and when dry all in-rolled along the rachis into globules of red tomentum; rachis also red tomentose. Sori in the shag without indusium. Lower pinnae rather smaller than those about the middle of the frond.

South Africa only, and only once found.

N. Rawsoni Pappe. Pappe and Rawson, 43 (1858); Hk. *Sp.* 5, 110; Hk. *Icon. Fil.* cent. 2, 77; Hk. and Bkr, *Syn. Fil.* 370; Sim, *Ferns of S. Afr.* 1st ed. 206; C. Chr. *Ind.* 462.

Cheilanthes Rawsoni. Mett. *Msc.*; Kuhn, *Fil. Afr.* 75.

West.—Between Spectakel and Komaggas; Namaqualand (Rev. Mr Whitehead).

Specimens in Herb. Gub. are the original, and Lady Barkly says "not found since."

116. NOTHOLAENA INAEQUALIS Kze.

Plate 108. Fig. 2. Nat. size.

Crown procumbent, or forming a short rhizome, densely paleaceous. Frond oblong or oblong-deltoid, sub-coriaceous, four to six inches long, one to three inches broad, with a dark stipe three to six inches long, which is at first woolly, and afterwards naked, but furnished with a tuft of long narrow reddish scales at the base. Pinnæ opposite, the upper ovate-oblong and sessile, the lower shortly stalked, and unequally deltoid; all cut to the mid-rib into oblong obtuse pinnules, which are either entire, or in the lower ones again pinnatifid. Upper surface more or less woolly; under surface densely clothed with rufous woolly tomentum, which when young is nearly white. Margin fringed with hairs which are reflexed over the spores like an indusium.

N. inaequalis. Kze, *Fil.* 1, 146; Pappe and Rawson, 43; Hk. and Bkr, *Syn. Fil.* 371; Sim, *Ferns of S. Afr.*, 1st ed., 206; C. Chr. *Ind.* 461.

Cheilanthes inaequalis Mett. Kuhn, *Fil. Afr.* 73.

South Africa only; 2000 to 2500 feet alt.

Natal.—Dry rocks with a northern aspect, Inanda (Wood); Baloochi's Kraal, Inanda (McKen); Umpumulo (Buchanan).

Transvaal.—Magalisberg (Burke, Zeyher); Marovuni (Burt-Davy, 238); near Standerton (Rehmann, 6739).

Rhodesia.—On a hill four miles from Zimbabwe (B. H. Holland); Salisbury (J. F. Darling, B. H. Holland); Matopo Hills (Eyles, 1020); Mazoe, 5200 ft (Eyles, 339).

117. NOTHOLAENA BUCHANANI Baker.

Plate 108. Fig. 1. Nat. size.

Crown procumbent, paleaceous, with long linear red scales. Frond three-pinnatifid, deltoid, herbaceous or sub-coriaceous, one to six inches long, one to four inches broad, with a stipe one to four inches long, set with spreading hairs, or, when old, black and naked. Pinnae about six opposite pairs, oblong, obtuse, pinnatifid, the upper united, the lower unequally deltoid, cut quite to the mid-rib into distinct decurrent pinnatifid pinnules, largest on the lower side. Upper surface woolly; lower surface clothed with spreading woolly light brown tomentum or hairs. Sori abundant, easily seen, marginal. Generally this appears quite distinct from *N. inaequalis*, especially in small specimens; but I have seen specimens which were almost indistinguishable, and am doubtful whether they are not conditional forms of one species.

N. Buchanani Baker in Hk. and Bkr. *Syn. Fil.* 373, 1868; Sim, *Ferns of S. Afr.* 1st ed. 207; C. Chr. *Index*, 459.

Natal.—On damp rocks under shade, always with a southerly aspect, not common (Wood); Great and Little Noodsberg and Inanda (McKen); Umpumulo, 2000 to 3000 feet (Buchanan).

Kaffraria.—Port St John's (Flanagan, 2580); Toise River (Dr Brownlee). Transvaal.—Marovuni (Burt-Davy, 225).

Rhodesia.—Matopo Hills under overhanging rocks near the "View" (Miss Gibbs, 70).

118. NOTHOLAENA ECKLONIANA Kze.

Plate 107. Fig. 2. Nat. size.

Rhizome short, procumbent, hard, with lanceolate, chaffy, white or rufous scales. Frond sub-coriaceous, ovate-lanceolate, three-pinnatifid, two to eight inches long, one to two inches broad, with a stout, woolly, or paleaceous stipe, three to six inches long. Pinnae eight to fifteen opposite pairs, ovate-lanceolate, obtuse, pinnatifid, the lower ones largest, unequally deltoid, with several large, oblong, pinnatifid pinnules on the

lower side. Upper surface glabrous, or at first slightly woolly; lower surface covered with short tomentum, at first white, afterwards rufous brown. Some specimens have scales on the lower surface and on the stipe instead of tomentum, in which cases the scales are like those of *Ceterach cordata*, or sometimes more pointed. Sporeling plants under stones have often fronds deltoid and hairy with white scales, as in *N. Buchanani* Bkr, but afterwards change.

N. Marlothii Hiern, as shown in specimens from Okahandja (Dinter, 386) in Albany Museum Herbarium, differs in no respect from *N. Eckloniana* Kze, but is an extreme form of large size (one foot) with dense woolly white or rusty tomentum, not changing to brown. Such specimens are not uncommon. *N. Marlothii* is included in C. Chr. *Index Filicum Suppl.* 1906; 1912, 53.

Notholaena Eckloniana. Kze, *Linnaea*, 10, 501 (1836); Pappe and Rawson, 42; Hk. and Bkr, *Syn. Fil.* 371; Wood's *Natal Ferns*, 33; Sim, *Ferns of S. Afr.*, 1st ed., 208; C. Chr. *Ind.* 460.

Cheilanthes Eckloniana Mett. Kuhn, *Fil. Afr.* 71.

Nothochlaena Krebsiana. Presl.

South Africa only; growing on or under dry stones, in sunshine.

West.—Clan William (E. and Z.); Griqualand West (Moffat); Kimberley (Dr Marloth); Namaqualand (Drège).

East.—Karakamma (MacOwan); Cradock (Holland); near Middelburg Road, Uitenhage, Fish River Bush, Steynsburg, Naaupoort, etc. (T. R. Sim).

Kaff.—Beaufort, Katberg, Bolassi, Perie, Izeli, Peddie, Dohne Hill (T. R. Sim); also Komgha (Flanagan); Engcoba (A. G. McLoughlin, 112); Main (Mrs Young).

Natal.—Noodsberg and Richmond to Cathkin, 3000 to 5000 feet (Buchanan); The Dargle, Bishopstowe (McKen); Shafton (Mrs H. Hutton, 132); Tugela (Nelson).

Orange Free State.—Ficksburg (Quail); Tweespruit (Marriott); Bloemfontein (Prof. Potts); near Van Reenen (Dr Bews).

Transvaal.—Magalisberg (Burke); Trigardsfontein (Dr Rehmann); Houtboschberg, 6800 feet (R. Schl. 4704); Krugersdorp (T. J. Jenkins, 915); Ermelo (R. Leendertz, 2950); Heidelberg (R. Leendertz, 2666).

119. NOTHOLAENA BIPINNATA Sim. (New species.)¹

Plate 109. Fig. 2. Nat. size.

Frond ovate, two-pinnate, four to six inches long, two to three inches broad at the middle, with a stipe three inches long. Upper pinnae ligulate, entire, adnate, obtuse; two lines wide; other pinnae distinct, one to two inches long, one-third to two-thirds inch broad, cut to the mid-rib into entire blunt oblong lobes, of which the lower are often less than the others. Upper surface glabrous or slightly hairy, lower surface clothed with pointed brown scales or woolly tomentum. Lower pinnae rather reduced. Rachis at first woolly; glabrous when old. Rhizome procumbent, stout, densely paleaceous with long narrow brown scales.

The locality for this curious fern, which was named *Gymnogramme cordata* Schl., var. *bipinnata* in our first edition, and which at that time had only been seen in Mr Holland's collection, was not known with certainty, but it was thought to have been received from Namaqualand. Another nice specimen, however, from Bulawayo (Eyles and Johnson, 1020), has been seen in the Albany Museum Herbarium, and as it shows the sori well the plant is evidently a *Notholaena*, and a new one. Mr Holland's collection contained many Rhodesian

¹ 119. NOTHOLAENA BIPINNATA Sim. (Species nova.)

Tab. 109. Fig. 2. Mag. nat.

Folia ovata, bipinnata, 4—6" longa, 2—3" lata ad medium, stipes 3" longus; pinnae superiores ligulatae, integrae, adnatae, obtusae, $\frac{1}{3}$ " latae, reliquae distinctae, 1—2" longae, $\frac{1}{3}$ — $\frac{2}{3}$ " latae, sectae ad costam in lobos integros, obtusos, oblongos, quorum inferiores saepe minores quam ceteri; supra glabrae sive tenuiter pilosae, infra paleis fuscis, acuminatis, sive tomento lanuginoso vestitae; pinnae inferiores paulum abbreviatae; rhachis primo tomentosa, senescens glabra; rhizoma procumbens, robustum, dense paleaceum, paleis longis, angustis, fuscis obsitum.

Locus filicis huiusce singularis, cui nomen *Gymnogramme cordata* Schl., var. *bipinnata* in priore editione nostra inditum, quaeque eo tempore non nisi in coll. Hollandii visa erat, haud pro certo notus fuit; a Namaqualand autem accepta fuisse credebatur. Aliud tamen specimen pulchrum a Bulawayo (Eyles et Johnson, 1020) in herb. Albany Museum apparuit, quod quoniam soros luculente ostendit, manifeste patet *Notholaena*, eaque nova. Inerant coll. Hollandii filices multae Rhodesianae, unde veri simile est illius quoque specimen a Rhodesia potius quam a Namaqualand adlatum.

ferns, so the probability is that his specimen also was from Rhodesia instead of Namaqualand.

Genus 30. *CHEILANTHES* Sw.

Small herbaceous or sub-coriaceous ferns, having small round marginal sori on the points of the lobes, or crowded all round the edge of the frond, except at the sinuses. The sori are terminal on the veins, and at first quite separate, though afterwards more or less confluent; but the indusia are roundish and not continuous, but more or less confluent, formed of the edge of the frond which is only partly turned back. This distinguishes them from *Pellaea*, but some species bear fronds showing the characters of both genera on the same plant. From *Notholaena* they are more difficult to distinguish, as the indusium is formed of the reflexed margin of the frond, often hardly changed in texture, and sometimes only partly reflexed; while in *Notholaena*, which corresponds in habit, the sori are without indusia, though the margin is sometimes more or less reflexed. The separation of the ferns into indusiate and non-indusiate, which was followed in our first edition, is here, as in several other cases, felt to be a purely artificial arrangement, as any natural arrangement either unites these two genera, or brings them into juxtaposition. The *Cheilanthes* are widely distributed, and most of the species vary considerably in accordance with surroundings.

Synopsis of the species :

120. *C. depauperata*. Frond lanceolate, two-pinnate, four to twelve inches long, a quarter to half inch broad, glabrous above; pinnae deltoid, lobes linear, tomentose on the under surface.
121. *C. hirta*. Frond broadly lanceolate, three-pinnatifid, hairy; pinnae ovate-lanceolate; lower pinnae reduced; frond and segments plain.
 Var. *contracta*. Frond narrowly lanceolate, three-pinnatifid, hairy; frond and segments much infolded.
122. *C. parviloba*. Frond lanceolate, three-pinnatifid; pinnae lanceolate, glabrous; stipe hairy; pinnules deltoid.

123. *C. multifida*. Frond deltoid-oblong, usually twice as long as wide, three to four-pinnatifid, glabrous, with two to four membranous indusia to each lobe. Rachis dark brown, polished.
124. *C. induta*. Frond ovate-lanceolate, three-pinnatifid, glabrous above; segments hairy and tomentose on the under surface, involved, and with hardly a distinct indusium.
125. *C. Bolusii*. Frond triangular, about as wide as long, four-pinnatifid; pinnae unequally deltoid. Rachis dark brown or almost black, polished.
126. *C. farinosa*. Frond coated with white or yellow powder on the under surface.

120. CHEILANTHES DEPAUPERATA Baker.

Plate 94. Fig. 1. Nat. size. b Pinna, when dry. c Pinna, enlarged. d Pinna of wider form, nat. size.

Rhizome shortly running, with tufted crown, set with numerous brown scales. Stipe wiry, glabrous below, slightly viscose above, four inches long. Frond two-pinnate, six to eight inches long, half to three-quarter inch broad, with twenty to twenty-five deltoid or three to five foliate pinnae, sessile above, stalked below. Pinnules linear, one to two lines long, half line broad, with the edges inturned in lobes of same texture, without separate involucre, and the underside densely set with rufous tomentum, with a few scattered whitish hairs mixed. Upper surface nearly glabrous. Pinnules when dry all very much recurved downward like birds' claws; when fresh they are flat. General aspect is like one elongated pinna of *C. parviloba*, but tomentose below, and as in that species, the pinnules drop off, leaving the short petioles dry.

South Africa only, western region.

C. depauperata. Baker, *Annals of Botany*, 5, 210 (1891); Sim, *Ferns of S. Afr.*, 1st ed., 82; C. Chr. *Index*, 173.

In Herb. Gub. a specimen in the Barkly collection from Hex River and one from Namaqualand (Herb. MacOwan) belong to this species. Baker gives as locality "Central Karroo region (Sir H. Barkly, Bolus)," and places it after No. 15 in *Syn. Fil.* p. 134. R. Schlechter's 7804 (Heoch, 1500 ft, 1896) is the same.

Another specimen (named *C. hirta*, var. *parviloba*, smaller specimen only), which I cannot distinguish from this, has alternate pinnae one inch apart, one inch long, quarter inch broad, and with six to nine pairs of linear-lobed pinnules, half line or less broad, one to two lines long, all coated underneath with rusty scales and tomentum.

C. hirta, var. *cornuta* of the Herb. Gub., which seems to be Pappe and Rawson's *C. cornuta* Kze, must also be referred here, though approaching more nearly the ordinary compact form of *C. hirta*, to which this species as a whole stands in much the same relation as does *C. parviloba*; only that this is densely tomentose below. Baker includes *C. cornuta* Kze in *Pellaea involuta* Bkr, except Ecklon's plant described by Mettenius (*Cheil.*, No. 33), the identity of which he doubts. Pappe and Rawson's description would not exclude the present species, but Kunze remarks: "Species not to be compared with any, unless with the small contracted form of *Pellaea hastata*, but the rigidity of the fronds, sub-linear form, and spreading sori, easily distinguish it."

This refers rather to *C. involuta*, and I have therefore taken Baker's name for the present species. Baker describes the frond as four to six inches long, quarter to one-third of an inch broad with stipe three to four inches long, and omits mention of the tomentum, but, as shown above, more specimens are yet required to show the limits of the species. Christensen maintains *C. cornuta* Kze, *C. depauperata* Bkr and *Pellaea involuta*. I think *C. cornuta* might be dropped.

121. CHEILANTHES HIRTA Swartz.

Plate 110. Nat. size. b Fertile pinnule, enlarged. c Section of same.
d Glandular hairs from rachis.

Crown procumbent, with abundant rusty brown lanceolate scales. Frond three-pinnatifid, lanceolate, six to eighteen inches long, one to four inches broad, on a dark brown stipe three to six inches long, more or less scaly at the base, and like the rachis and veins, thickly set with soft spreading, jointed, glandular white hairs, which in old fronds become rusty. Pinnae opposite below, alternate above, plain (*i.e.* not

revolute), one to two inches long, half to three-quarter inch broad; lower pinnae more distant, and more or less reduced in size; all ovate or ovate-lanceolate, shortly stalked, and having about six pairs of nearly opposite, widely ovate, flat pinnules, rounded at the apex, cut halfway or more into about three pairs of rounded or slightly lobed segments. Sori three to ten to a segment, almost contiguous, but distinct, one to each veinlet, and having only one to three capsules in each, which are half covered by the rounded involucre formed of the reflexed and slightly crenate margin of the frond, hardly altered in texture. Frond abundantly set with white glandular hairs, especially on the upper surface, and the involucre is fringed with similar hairs. Texture softly herbaceous in shade, more or less coriaceous when exposed, but unless very dry, frond and pinnules are always alike spread out, or recurved only at the extreme edge.

Cheilanthes hirta. Swartz, *Syn.* 128, 329 (1806); Schl. *Adum.* 50, tab. 30; Kze, *Linnaea*, 10, 539: 23, 244; Pappe and Rawson, 35; Kuhn, *Fil. Afr.* 72; Hk. and Bkr, *Syn. Fil.* 136; Sim, *Ferns of S. Afr.*, 1st ed., 83; C. Chr. *Index*, 175.

C. hirta Sw., var. *laxa*. Kze, *Linnaea*, 10, 539; Kuhn, *Fil. Afr.* 72.

C. olivacea. Fée.

C. hirta Sw., var. *olivacea*. Sim, *Kaff. Ferns*, 27.

Adiantum caffrorum Sw. *Schrad. Jour.* 1800, 2, 85 (non Linn., Thunb., etc.).

Nothochlaena capensis. Sprengel, *Syst. Veg. Suppl.* 32.

Cheilanthes glandulosa. Pappe and Rawson (possibly a form of *C. parviloba*).

Cheilanthes refracta, P. and R. No. 94, founded on a Griqualand specimen, is also given as a synonym here by Lady Barkly, but according to their description must be something different. As it is maintained by Christensen, Pappe and Rawson's description is subjoined¹.

¹ "94. CHEILANTHES REFRACTA Nob. (N. sp.)

Frond two to three-pinnate, deltoid, rigid, perfectly smooth; pinnae alternate, remote, deltoid-ovate, patent, upper ones subsessile, middle and lower ones stalked; petioles more or less reflexed; pinnules lanceolate-oblong, sessile, confluent at the apex, and as well as the intermediate ones crenate; lowermost distant, pinnatifid. Stipes short, half round, channelled on the upper side, flexuose, and like the rachises glossy.

In Griqualand (Mr Robert Moffatt, 1857), *v.s.*" (*v.s.* = *vide siccam*, T. R. Sim.)

Throughout South Africa, extending to the Mascarenes.

McLea's No. 47 (Bulus, 17) from Pilgrim's Rest, Transvaal, is three feet long, nine inches broad, much divided, quite expanded, and not differing from the common form, except in size, and in being less hairy.

West. } —One of the most frequent and widely distributed ferns,
East. } growing mostly in the bush or under stones in kloofs
Kaff. } from the coast to near the top of the mountains, and also
Natal. } on kopjes in the dry Karroo districts, and in Namaqualand.

Orange Free State.—Bethulie (T. R. Sim); Bloemfontein (Potts, 480); Rietfontein Hills, Parijs (Potts, 566); near Van Reenen (Dr Bews).

Transvaal.—Houtbosch, 5000 feet (Schl. 4401); Schweizer-Reneke (Burt-Davy, 1670); Elim (Schinz); Pilgrim's Rest (McLea, 40; Bulus, 17); Lydenburg, Krugersdorp and Godwan River, Swaziland (T. J. Jenkins, 1006, 914 and 910); Waterval-Boven (F. A. Rogers, 990); Ermelo, Heidelberg and Standerton (R. Leendertz, 2959, 2665 and 4047); Barberton (Miss Williams, 793); Houtboschberg (W. Nelson, 464).

Rhodesia.—Umtali (Mrs Bennett); Matopo Hills, 5000 feet (Miss Gibbs, 90; Eyles, 76); near Bulawayo, 4500 ft (F. Eyles, 393).

Var. CONTRACTA Kze.

Plate III. Fig. 1. Nat. size. b Part of pinnule, magnified.

Frond more rigid and coriaceous, one to two inches broad, six to fifteen inches long, on a stipe three to six inches long, set with a tuft of long linear brown scales at the base. Pinnæ cut as in typical *C. hirta*, but short, dense, curved upward, and with the pinnules crowded and erecto-patent, or upturned on each side of the rachis, and with the lobes and segments more or less curved backward, and having the margin much infolded. Stipe, rachis, and lamina very hairy, or sometimes red-tomentose below, and with the involucre ciliated.

C. hirta Sw., var. *contracta*. Kze, *Linnaea*, 10, 539; Pappe and Rawson, 35; Sim, *Ferns of S. Afr.*, 1st ed., 85.

C. contracta. Mett. MSS.; Kuhn, *Fil. Afr.* 70.

This is as common as *C. hirta*, and takes its place on hard rocky exposed ground. The extremes look distinct, but another form, var. *intermedia* Kze (*Myriopteris intermedia* Fée), has the long narrow compact fronds of *contracta*,

together with the plain or only slightly reflexed pinnules of *hirta*; and every intermediate stage occurs between that and both the others.

Var. *contracta* extends as far north as Kuruman, Bechuanaland, and is one of the few ferns of the Karroo and Namaqualand. I have seen Transvaal specimens from Johannesburg, Heidelberg, Belfast and Koedoespoort.

122. CHEILANTHES PARVILOBA Sw.

Plate 112. Large frond. Nat. size. b Part of pinnule, enlarged.
c Capsule.

Plate 111. Fig. 2. Nat. size. b Pinnule, enlarged.

Crown procumbent, or with a simple or tufted rhizome two to three inches long, set with brown scales. Frond three-pinnatifid, six to eighteen inches long, one to five inches broad, lanceolate, with pinnae considerably reduced below, or sometimes ovate-lanceolate pointed, with the lower pinnae not much reduced. Pinnae twelve to twenty pairs, opposite below, alternate above, three-quarters to three inches long, one-half to three-quarter inch broad, linear-lanceolate acuminate, with six to ten pairs of alternate shining green glabrous pinnules, which are triangular, half inch or less long, and as much broad at the base; cut to the mid-rib into one to two pairs of ovate-toothed segments lying parallel to the rachis; above these the pinnule is contracted into an ovate-oblong lobe two lines long, one line broad, rounded at the apex, and with five to seven teeth on each side, each tooth slightly hooded at the point, the hood forming the indusium, unchanged in texture, not fringed with hairs, and not nearly covering the one or occasionally two capsules which go to a sorus. Stipe three to six inches long, scaly at the very base only, but set throughout, as well as the rigid rachis and mid-rib, with hairs like those of *C. hirta*, but harder, more bristly, more adpressed, and seldom glandular. Both surfaces of the lamina are destitute of hairs, but have sessile glands, hardly visible until magnified, but so viscid as to make specimens adhere to the paper in which they are

dried. When mature the pinnules fall off, and several years' leafless rachises are often on the plant. When dry the whole of the pinnules are reflexed, infolded backward, and bead-like, and the appearance is much changed. The figure of a magnified pinnule in *Handbook of Kaffrarian Ferns* (Plate XIV b), drawn from a frond in that condition, makes the reflexed lobes look like numerous rounded indusia, and is therefore misleading. This species was formerly placed as a variety of *C. hirta*, and is still so placed in *Syn. Fil.* and by Christensen, but is much more distinct than other ferns held as species there. It might as well be in *Notholaena* as here; but *C. hirta* is more decidedly a *Cheilanthes*.

Cheilanthes parviloba. Swartz, 128; Sim, *Ferns of S. Afr.*, 1st ed., 85.

Adiantum parvilobum. Sw. *Schrad. Jour.* 1800, 2, 85.

Cheilanthes hirta Sw., var. *parviloba*. Kze, *Linnaea*, 10, 539; Pappe and Rawson, 35; Moore's *Index*, 243; Kuhn, *Fil. Afr.* 72; Hk. and Bkr, *Syn. Fil.* 136; C. Chr. *Index*, 178.

Growing in dense masses on rocky exposed ground, or under stones in open situations.

West.—Tulbagh (E. and Z.); Olifant's River (Mund.); Lang Kloof (Holland); George (E. and Z.).

East.—Uitenhage (Atherstone); Fish River (T. R. Sim); Grahams-town, 2200 ft (Schlechter, 2726).

Kaff.—Between King William's Town and Peddie in several rocky places, and on similar ground elsewhere, but not common.

Natal.—Upland Bush (Buchanan); Ladysmith (T. R. Sim).

123. CHEILANTHES MULTIFIDA Sw.

Plate 113. Nat. size. Plate 91. Fig. 3. Pinnule, enlarged.

Crown procumbent, tufted. Frond oblong-deltoid, usually twice as long as wide, three to four-pinnatifid, usually five to eight inches long, and three inches broad, but occasionally twelve to fifteen inches long, and six inches broad, glabrous, and shining on both surfaces, firmly herbaceous, dark green above, lighter below. Stipe as long as the frond, paleaceous at the base, slightly hairy at first, and afterwards like the rachis black, shining, wiry, and glabrous; and flattened or channelled down the front. Pinnae deltoid, spreading, flat,

opposite below, alternate above; pinnules rather longer on the lower than on the upper side of the pinnae, cut to or near to the mid-rib into oblique ovate, three to five-lobed segments, each lobe much revolute at the point, but bearing a distinct, white membranous rounded indusium besides. The fertile pinnules have the margin much reflexed, and often more or less bead-like, but the barren frond is plain.

Cheilanthes multifida. Swartz, *Syn.* 129, 334, 1806; Schl. *Adum.* 49, tab. 29; Kunze, *Linnaea*, 10, 537; Pappe and Rawson, 33; Kuhn, *Fil. Afr.* 73; Hk. and Bkr, *Syn. Fil.* 138; Sim, *Ferns of S. Afr.*, 1st ed., 87; C. Chr. *Index*, 177.

Adiantum multifidum. Sw. *Schr. Jour.* 1800, 2, 85.

Cheilanthes capensis. Ecklon, *Un. It.* 168 (Kuhn); not *C. capensis* Sw.

Almost confined to tropical and sub-tropical South Africa, and growing in rocky places under small scrub, at 1000 to 4000 feet alt., and not uncommon all over the district. Much confused with *C. Bolusii*. A specimen from Okahandja (Dinter, 392) in Albany Museum Herbarium differs very considerably from the usual form in the ultimate pinnae being not cut to the rachis, and may be a different species.

West.—Table Mountain, Meiring's Poort (Lady Barkly); Bain's Kloof (R. Schl. 9130); Reitkloof Mts (Dr H. H. W. Pearson, 5726 and 6327); Olifant's River Mts (E. L. Stephens, 7316); Tulbagh, Zwarteberg, Caledon, Swellendam, Clan William, Dutoitskloof, etc.

East.—Amos Kloof, Grahamstown (Holland); Graaffreinet, and Oudeberg (Bolos); Somerset East (MacOwan); Winterberg.

Kaff.—Katberg, Stormberg (Eck.); S.-W. of King William's Town, Frankfort Hill, Perie, etc. (T. R. Sim); and in Transkei at Main (Mrs Young), and Intwanazana (Baur.).

Natal.—Inanda, Inchanga, Cathkin, Unsusi Falls (McKen); Field's Hill, Noodsberg, Umpumulo (Buch.).

Transvaal.—Mamotsinri (Burt-Davy, 207).

Rhodesia.—Matopo Hills, 5000 ft (Eyles, 1019; Miss Gibbs, 69).

Portuguese East Africa.—Zambesi (Kirk).

124. CHEILANTHES INDUTA Kze.

Plate 91. Fig. 1. Nat. size. b Pinnule, magnified.

Rhizome creeping; frond three-pinnatifid, bluntly ovate-lanceolate, four to six inches long, tapering from a base one and a half to two inches broad, and with a stout stipe of several inches, which is paleaceous when young, and after-

wards shining brown, or nearly black, and naked; lower pinnae shortly stalked, one inch long, and hardly so broad at the base, deltoid, and having about six pairs of oblong pinnules, cut to the mid-rib into about four pairs of sessile ovate-lobed segments, which are coriaceous, much revolute when fertile, glabrous on the upper surface, but on the underside set with short thin reddish tomentum, scattered among which are a few long white woolly scales. The upper part of the rachis and its branches is also tomentose, and has scattered scales or hairs. The segments are small, half-globular, bead-like, and having the margin inflexed and turned in all round the segment, with or without a small white indusium.

Very like *C. multifida* in general appearance, but characterised by the woolly under-surface of the frond, as well as by the indusium. Lady Barkly and Wood give the running rhizome as its distinguishing character, but in *C. multifida* the crown is always more or less procumbent, and often extended into a rhizome. The plant mentioned by Wood as gathered near Newcastle, Natal, by Buchanan, and believed by him to be *C. induta*, differs from the typical *multifida* only in being glandular, or very slightly tomentose, on the under surface, but has no scales, and has the involucre white and membranous, in addition to the inrolled edge. From *C. Bolusii* that plant differs in the outline of the frond, as well as in having the lamina more expanded: and it can only be referred to *C. multifida* Sw., var. *β. flexa* Kze.

When the indusium is absent, *C. induta* might be placed in *Notholaena*, but it is too closely related to *C. multifida* to be generically separated.

Cheilanthes induta. Kze, *Linn.* 10, 538 (1836); Pappe and Rawson, 36; Moore's *Index*, 244; Kuhn, *Fil. Afr.* 73; Hk. and Bkr, *Syn. Fil.* 138; Sim, *Ferns of S. Afr.*, 1st ed., 88; C. Chr. *Ind.* 175.

Myriopteris. Fée.

South Africa only, and only in Western Cape Province.

West.—Growing in rocky and shady places in the Sneeuwbergen (Drège); Springbok and Bowesdorp, Namaqualand (Sir H. Barkly); Koolifontein, 1912 (S. Burger, 962); common among rocks at Leeuwnfontein (Dr H. H. W. Pearson, 3223); Kradouw Krantz (Prof. Pearson, 5828); Khamiesberg, Beacon Hill, 2 miles S.E. of Leliefontein, 5200 ft (Prof. Pearson, 6374).

125. CHEILANTHES BOLUSII Baker.

Plate 106. Fig. 2. Nat. size. 2 b Pinnule, magnified.

Rhizome shortly creeping, with lanceolate brown scales, keeled, black. Stipe and rachis stout, dark brown or almost black, and shining, with a few lanceolate rusty brown scales at the very base. Frond triangular, about as wide as long, four-pinnatifid, three to six inches long, two to six inches broad, on a stipe four to eight inches long; pinnae alternate, rather distant, widely and unequally deltoid, erecto-patent, ascending, with the pinnules longer and more divided on the lower than on the upper side. Pinnules oblong, with three to six pairs of small, oblique, very much recurved, almost globular, bead-like segments, which are glabrous above, and somewhat glandular below, but have all the upper and side edges so much turned back, hoodlike, that little of the under surface can be seen. No separate indusium can be detected: the reflexed edge being coriaceous like the rest of the frond.

Cheilanthes Bolusii Baker in Hk. *Ic. Pl.* t. 1636 (1886); C. Chr. *Ind.* 172.

Mr Baker places it in section *Physapteris*, with the remark "near *C. induta* but 4-pinnatifid, with a black rachis and stipe, and small round bullate segments." He also connects it with the Australian *C. Sieberi* and the Indian *C. bullata*.

It is closely connected with *C. induta* and *C. multifida*, but distinguished from the former by having no tomentum or scales on the underside of the frond, and from the latter by the segments being further apart, more decurrent, smaller, and much more recurved.

Fig. 1636 *Icon. Plant.* shows a more expanded frond, with the pinnules largest on the upper side of the pinnae, though the description puts it the other way. Our figure is from part of the type returned from Kew Herb. to Mr Bolus after the loss of the remainder of his specimens in the wreck of the *Windsor Castle*, which was the only specimen available when our first edition was published. We have since then had many specimens of a species believed to be *C. Bolusii* and which shows a variation within itself, especially in connection with age, which has necessitated a slightly amended descrip-

tion. This plant I at first thought to be *C. multifida* Sw., var. *β. flexa* Kunze, but it is evidently distinct from *C. multifida*. Both species vary in size and with age and atmospheric condition, but are constant in the characters given in our synopsis. In both species young fronds are finely cut and very tender, the segment-margins being reflexed, rendering the segments distant and bead-like during drought or heat. Under moist conditions however these are open, flat and crowded, and when mature densely crowded, brown, and sometimes fully occupied with brown capsules under fringed scarious indusia, the frond then having a totally different appearance from the delicate green young fronds. In both species the indusium is intra-marginal, though in the revolute state caused by dry atmospheric conditions the green margin is reflexed over and almost or quite hides the scarious indusium.

The Transvaal and Rhodesian specimens are mostly *C. Bolusii*, the Cape and Natal specimens mostly *C. multifida*; but each occurs beyond these limits. For *C. Bolusii*, the following localities are noted:

West.—By the Breede River at Darling Bridge, 1873 (Bulus Herbarium, 2801); found also by L. Kitching (*Icon. Pl.*); Keureboom River in Long Kloof (Burchell, 5095).

Natal.—Highlands (R. Schlechter, 6842).

Transvaal.—Makapans Poort, 4800 ft, *immature* (R. Schl. 6487); Houtboschberg, 9000 ft, *mature* (Schl. 4459); Six Mile Spruit (C. M. v. Nieberk, 960); Heidelberg (R. Leendertz, 2661, 2663); Middelburg (J. T. Jenkins, 911); Belfast and Lydenburg (Miss Doidge).

Rhodesia.—Umtali (Holland); Bulawayo (Eyles and Johnson, 1019); Mazoe, 5000 ft (F. Eyles, 247); Ironmask Hill, 5000 ft (E. Eyles).

126. CHEILANTHES FARINOSA (Forsk) Klf.

Plate 114. Nat. size. B Pinnule, $\times 4$.

Crown tufted. Fronds deltoid or oblong-deltoid, two to three-pinnatifid, four to eighteen inches long, three to six inches wide, sub-coriaceous, glabrous, but coated on the under surface with white or yellowish powder. Pinnæ deltoid, pinnules largest on the lower side. Sori abundant, forming a

continuous line along the margin when mature. Indusium white, scarious. Stipe, rachis and mid-ribs wiry, polished, dark brown. Stipe set with long brown scales at the base.

Ch. farinosa (Forsk). Klf. *Enum.* 212, 1824; C. Chr. *Ind.* 174.

Pteris farinosa. Forsk, *Fl. Aeq. Arab.* 187 (1775).

Tropical America, Asia, Africa, etc.; in Africa it occurs in Abyssinia, Zambesia, Angola, Cameroon Mts, Bourbon, etc.

Rhodesia.—Matabeleland (Oates); Victoria Falls, common in the rain forest (Richards; Holland; J. Sim; Eyles, 121, 147; C. Wilde, 848; Miss Gibbs, 6; Galpin, 7053; Allen, 13; Engler; Rev. F. A. Rogers, 5545, 5013, etc.).

Genus 31. *HYPOLEPIS* Bernh.

Sori small, round, equal, situated in the sinus between two lobes, or where a sinus might be expected if further divided. Indusium membranaceous, small, round, equal, covering the capsules. Veins free. A small genus closely allied to *Cheilanthes*, and formerly included in it. The sori are placed at the base of the sinus, and terminate a side veinlet; while in *Cheilanthes* they terminate the principal veinlet, *i.e.* the one leading into a lobe. Most of the species belong to the southern tropics, and a few extend to New Zealand and South Africa.

127. *HYPOLEPIS SPARSISORA* (Schrad.) Kuhn.

Plate 117. Part of frond, nat. size. b Pinnule, enlarged.

Rhizome two to four yards long, half-inch diameter, subterranean, branching occasionally, clothed with brown scales, and sending up at intervals of about a foot erecto-patent, deltoid fronds, two to five feet broad, three to eight feet long, on a stout stipe two to three feet long, which is more or less rough with raised points, or when young set with abundant long spreading white hairs below. The fronds, which die down to the ground in winter, develop at first as three almost equal and diverging branches, but when the central one is fully developed, the frond is three to four-pinnate in the usual

way, with the first two side branches as opposite deltoid lower pinnae, two feet long, and one to two feet broad. Pinnae distant, and like the secondary pinnae, pinnules, and lobes, all opposite or nearly so. Ultimate pinnae one to two inches long, three-quarter inch broad, ovate-lanceolate, and bearing six to ten pairs of sessile ovate pinnules, which are cut nearly to the rachis into toothed segments bearing a sorus in the bottom of each sinus. Frond thinly herbaceous, when young bristling with longish spreading jointed glandular hairs on both surfaces, especially on the veins and rachis; but these fall off the stipe and rachis as the frond matures, leaving rough raised points, while on the veins they become less noticeable. This may account for *H. aspera* Presl, mentioned in *Syn. Fil.* and by Lady Barkly as a form, though the late Mr Marquard did have in cultivation a smaller and more rigid form found on Table Mountain. In several herbaria much-cut barren fronds of *Hemitelia capensis* from young plants are marked *H. anthriscifolia* Pr., var. *aspera*. Some Natal specimens in Herb. Gub. are almost glabrous.

Hypolepis sparsisora (Schrad.). Kuhn, *Fil. Afr.* 120; C. Chr. *Index*, 372.

Hypolepis anthriscifolia Presl. Pappe and Rawson, 37; Hk. *Sp.* 2, 66, tab. 95 A; Wood's *Natal Ferns*, 10; Hk. and Bkr, *Syn. Fil.* 129; Sim, *Ferns of S. Afr.* 1st ed. 76.

Cheilanthes anthriscifolia. Schl. *Adum.* 52 (tab. 32, ined.).

Dicksonia anthriscifolia. Kze, *Linn.* 10, 545 (?).

Cheilanthes sparsisora. Schrad. *Gött. Anz.* 1818, 918; Kze, *Linn.* 10, 542; Schl. *Adum.* 52.

Hypolepis Eckloniana. Fée.

Hypolepis aspera Presl. Pappe and Rawson, 38.

Cheilanthes aspera. Kaulf. *Linnaea*, 6, 186; Kze, *Linnaea*, 10, 544.

Cheilanthes commutata. Kze, *Linnaea*, 10, 542.

Hypolepis elata Presl is also stated (*Syn. Fil.* 129) to belong here, though Lady Barkly states that *Ch. elata* Kze, No. 97 of Rawson Herb., is *H. Bergiana*, and Kuhn gives the name as a synonym of that species.

In general appearance it is not unlike the common Bracken, but grows in dense masses, in wet sunny glades in the forest.

South Africa, and Mascarene Islands.

West.—Plettenberg's Bay (P. and R.); Kaatjes Kraal, Knysna (Burchell, 5277); Table Mountain (Mr Marquard); Devil's Mountain (Guthrie); Genadendal, etc. (P. and R.); George (R. Schl. 2339).

East.—Somerset East (Guthrie); Grahamstown (Holland); Boschberg (MacOwan); Zuurberg, etc.

Kaff.—Perie Forest, Mount Kemp, Frankfort, etc. (T. R. Sim); St John's (Flanagan, 2477).

Natal.—Great Noodsberg, Inanda, Field's Hill, Maritzburg, and Zwaartkop (McKen); Umbilo Falls, Umpumulo (Buchanan); Midlands (Wood); Buccleuch (W. Leighton); Sweetwaters (T. R. Sim).

Rhodesia.—Headwaters of the Zona, Chirinda Forest, 4000 ft (Swyn. 820).

128. *HYPOLEPIS BERGIANA* (Schlecht.) Hk.

Plate 115. Nat. size. b Pinnule.

Crown tufted, set with lanceolate brown scales. Frond triangular, three-pinnate or four-pinnatifid, herbaceous, four to eighteen inches long and broad, on a rusty brown stipe four to twelve inches in length, which is paleaceous at the base only, but thickly set throughout with very short spreading or recurved glandular jointed hairs. Rachis and mid-ribs tomentose with similar hairs, and both surfaces of the frond are villose with short white glandular hairs. Lower pinnae much largest, deltoid; secondary pinnae on the lower side larger than those on the upper side, and the same is the case with the pinnules. Pinnules ovate, a quarter to three-quarter inch long, cut to or near to the mid-rib into oblong, obtuse, entire, or lobed segments, bearing rounded sori along each side. The indusium is thin and membranaceous, and the sori are sometimes placed along the edges of the pinnules as in *Cheilanthes*, in which genus it was placed by Pappe and Rawson; but in *Cheilanthes* they are most abundant toward the points of the lobes and pinnules, while here they are most regular in or near the sinus, or where a sinus might be expected if the frond were further divided.

This plant has no rhizome, and therefore seems out of place in section *Eu-hypolepis*, characterised by wide-creeping rhizome, in which it is included in *Syn. Fil.*; but frequently in cultivation young plants spring up from adventitious buds

on the roots, especially where the roots come to the surface at the edge of a pot.

Hypolepis Bergiana (Schlechtendal). Hk. *Sp.* 2, 67, 1852; Hk. and Bkr, *Syn. Fil.* 130; Sim, *Ferns of S. Afr.*, 1st ed., 78; C. Chr. *Ind.* 370.
Cheilanthes Bergiana. Schl. *Adum.* 51 (tab. 31 ined.); Kunze, *Linnaea*, 10, 541; Pappe and Rawson, 34; Kuhn, *Fil. Afr.* 69.
Cheilanthes elata. Kze, *Linn.* 10, 542. } See synonyms of
Hypolepis elata Presl. Hk. *Sp. Fil.* 2, 67. } *H. anthriscifolia*.

Found only in South Africa, north to Zambesia; growing in moist but not wet places in the forest.

West.—Swellendam, George (P. and R.); Koratra (Drège); Knysna (Burchell, 5218 and 5417); Zwaart-rivier, 600 ft (R. Schl. 2375).

East.—Kat River (Holland); Bedford (Miss Cook); Uitenhage, etc.

Kaff.—Abundant all along the forest, and in bush at Peddie, Toise River, Dohne, etc.; also Komgha (Flanagan); and in Transkei at Bazija (Baur.); and Main (Mrs Young); Engcoba (McLoughlin); Zuurberg (Schl. 6606).

Natal.—Buckingham, Esidumbeni, Kruisfontein, Maritzburg (McKen), 2000 to 3000 feet; Umpumulo (Buchanan); Nkandhla (Marriott).

Transvaal.—Marovuni (Burt-Davy, 236).

Rhodesia.—Chimanimani Mts, 7000 ft (Swyn. 821).

129. HYPOLEPIS SCHIMPERI (Kze) Hk.

Plate 116. Nat. size. B Pinnule, enlarged.

Fronds tufted, glabrous, sub-coriaceous, deltoid, three to four inches long and broad, quadripinnatifid; ultimate segments linear, entire or toothed. Sori between the lobes, each in a sinus. Evidently an *Hypolepis*.

H. Schimperi (Kze). Hk. *Sp.* 2, 70 (1852); C. Chr. *Ind.* 372.

Cheilanthes Schimperi. Kze, *Farnk.* 1, 52; Hk. and Bkr, *Syn. Fil.*

133.

Abyssinia, Usuguru, Shiré Highlands and Rhodesia.

Rhodesia.—Mazoe and Salisbury, 1893 (J. F. Darling); Jumbo Mine (Holland); near Fort Salisbury, 1894 (H. M. Hole); Ironmask Hill, 5000 ft (E. Eyles); Mazoe, 4500—5000 ft (F. Eyles, 395).

C. ADIANTINAE.

Genus 32. *ADIANTUM* Linn.

A very natural group of ferns, having black wiry stems, and delicately herbaceous pinnules, which bear on their tips,

or in notches of the outer margin, the reniform or longish sori. Indusium membranaceous, opening inward, and bearing the capsules on its inner surface. Veins free in all our species. This is a large and widely distributed genus, having about 180 species, mostly tropical; almost all the species are favourites in cultivation, and some have numerous horticultural sports.

Key to the species :

§ Frond simple, reniform.

130. *A. reniforme*.

§§ Frond pinnate.

131. *A. caudatum*. Pinnae numerous, half to one inch long.

132. *A. lunulatum*. Pinnae fewer, much larger, stalked.

§§§ Frond sub-palmately divided into several pinnate pinnae.

133. *A. Oatesii*. Frond glabrous.

134. *A. hispidulum*. Frond densely pubescent.

§§§§ Frond two, three, four-pinnate.

135. *A. capillus-veneris*. Sori across the top of the lobes or pinnules, longish, nearly straight, not sunk, pinnules cuneate.

136. *A. Paradiseae*. See description.

137. *A. Poiretii*. Pinnules shortly cuneate or roundish, small; sori one to two in each, reniform, in a deep sinus.

138. *A. aethiopicum*. Pinnules rounded at the base, large; sori several in each, curved or reniform.

139. *A. sulphureum*. Frond coated with yellow dust on under surface.

130. ADIANTUM RENIFORME Linn., Var. ASARIFOLIUM Willd.

Plate 118. Fig. 1. Nat. size.

Crown tufted, stalks wiry, three to six inches long, shining, nearly black, with a few brown scales at the base. Frond reniform, one and a half to two inches broad, with a deep sinus, and the rounded lobes at the base almost meeting. Frond firm in texture, often plaited, glabrous, except at the top of the stalk, where there are scattered woolly hairs. Frond slightly lobed, each lobe all round the frond, except

at the base, bearing a sorus one to three lines long, half line broad, forming a crescent-shaped hollow on the margin. Veins distinct, flabellate from the stem, afterwards forking, three to eight venules going to each lobe.

Only known as African by some barren fronds received from Drakensberg by Rev. J. Buchanan "gathered beside a spring." Kuhn doubtfully gives Senegambia as another African locality. No further record has been received.

A. reniforme belongs to Madeira and Tenerife; var. *asarifolium* to Mauritius and Bourbon, and var. *crenatum* to Madagascar.

131. ADIANTUM CAUDATUM Linn.

Plate 118. Fig. 2. Nat. size.

Crown tufted, frond simply pinnate on a short stipe, lanceolate, one inch broad, twelve to eighteen inches long, with the pinnae toward the base rather reduced in size, and gradually much reduced and more scattered toward the point of the rachis, which generally is prolonged into a leafless tail, producing a bud at its apex, from which a young plant is developed when it reaches the ground. Texture at first very delicate, afterwards firmly herbaceous; colour light green. Stipe and rachis with abundant short soft brown hairs, especially at the base. Pinnae numerous, with a few scattered hairs on both sides, or at the margin only. Pinnae half inch long, quarter inch broad, shortly stalked, or sessile, one-sided, the lower edge entire, arching or straight, at a right angle from the rachis; the point and upper side rounded to where it suddenly drops parallel with the rachis. The upper side is cut halfway down into three to five emarginate or crenate-rounded lobes, which, when fertile, bear the sori on a straight line on their points. Sori not sunk. A form with winged petioles and stipes is mentioned in *Syn. Fil.*, but is not recorded here.

A. caudatum. Linn. *Mant.* 308, 1771; Hk. and Bkr. *Syn. Fil.* 115
Sim, *Ferns of S. Afr.* 1st ed. 69; C. Chr. *Ind.* 24.

South Asia, Tropical Africa, Mascarene Islands, and New Hebrides.

Transvaal.—Gathered in Transvaal by Mr Todd of Inanda, and a plant of it, recently found near Barberton, is growing in Mr John Wood's garden at Grahamstown; Avoca, Barberton (Galpin, 1244); Shilouvane, 2400 ft (Junod, 122).

Rhodesia.—Mazoe and Umtali (J. F. Darling); Umtali (Mrs Bennett, Mrs Meikle, Mrs Eickhoff, Holland); Victoria Falls, Kloofs of lower gorge (Miss Gibbs, 180; Holland; G. Richards; J. Sim; Allen, 17; Engler); Zambesi (Waller); Knife Edge, Zambesi, near Victoria Falls, 3000 ft (Rev. F. A. Rogers, 5052); Matopo Hills, Mtchabesi Valley (Miss Gibbs, 316); Sebakwe, in the shelter of old workings (F. Eyles, 389); very common (locally) on the western face of the long range of ironstone hills in Mazoe district, at from 4500 to 5000 ft alt. (Eyles).

Cape Colony is credited with it in *Syn. Fil.*, but I have heard of no locality there; probably "Cape Colony" at that time was nearly equivalent to "South Africa" now.

A. ROTUNDATUM Kze, described from a specimen in Maire's Herbarium labelled *Promontorium Bonae Spei*, seems to be a large glabrous form of *A. caudatum*, paleaceous only at the base of the stipe, and with reniform sori. It differs in texture and colour from *A. lunulatum*, as well as in the shape of the sori. This is

A. rotundatum. Kze, *Linnaea*, 10, 528; Pappe and Rawson, 52; Hk. *Sp. Fil.* 2, 53.

A. rhizophorum. Swartz, *Syn.*; Kuhn, *Fil. Afr.* 66.

A. caudatum, var. *b rhizophorum*. Hk. and Bkr, *Syn. Fil.* 115.

A. Edgeworthii. Hk. *Sp.* 2, 14; Hk. and Bkr, *Syn. Fil.* 472.

Lady Barkly, in a postscript to her revised list, writes: "We have received through Dr Shaw, from Wakkerstroom, Transvaal, an *Adiantum* which seems to be a connecting link between *A. caudatum* and *A. lunulatum*"; no doubt the same thing. It is still maintained as *A. rhizophorum* Sw. by Christensen as from South Africa and Timor Island, but we have seen nothing to answer to this.

132. *ADIANTUM LUNULATUM* Burm.

Plate 119. Nat. size.

Frond glabrous, nine to eighteen inches long, three inches wide, simply pinnate, with a dark brown, polished wiry stipe and often elongated and rooting at the point. Pinnae distinctly petiolate, deep green, thinly leathery, without scales; one to two inches long, half to one inch wide, obliquely oblong, the lower edge direct from the petiole, the point and upper edge rounded and somewhat crenate or lobed. Sori continuous, marginal.

A. lunulatum. Burm. *Fl. Ind.* 235, 1768; Hk. and Bkr. *Syn. Fil.* 114 (in part); C. Chr. *Ind.* 29.

Occurs in most tropical countries, and its distribution in Africa includes Angola, Guinea, Zambesia, Cape Verde Islands, etc. Baker mentions a form (*A. pteropus*) with winged petioles and stipes as having been gathered by Drs Kirk and Welwitsch in South Africa. We have not seen that form.

Rhodesia.—Mazoe (J. F. Darling); Ironmask Hill, 5000 ft (E. Eyles, 22); Victoria Falls, 3000 ft (G. Richards; B. H. Holland; Jas. Sim; Rev. F. A. Rogers, 5576, 5549; F. Eyles, 127); Umtali (Mrs Bennett); Zambesiland (Oates).

Mr Eyles states: "In the rain forest at Victoria Falls where the soil is constantly moist, relatively few individuals in certain spots in the forest, unlike *A. capillus-veneris* and other species which grow profusely wherever foothold can be got. This fern is also locally common at Mazoe, under the banks of the Mazoe River, found in a few spots; on the western face of the Ironmask Hill, plentiful from 4500 to 5000 ft. The conditions here are very different from those of the humid forest facing the Victoria Falls, but on the mountain side the fern grows under the partial shade of overhanging rocks, and doubtless the extremely steep hill behind and above retains moisture sufficient to sustain the plant over the long dry season."

A. lunulatum and *A. caudatum* have already been noted

as occurring with other S. African ferns in the carroid Indian province of Rajputana. (See page 50.)

133. ADIANTUM OATESII Baker.

Plate 120. Part of frond, nat. size. B Pinnule, enlarged.

Frond twelve to eighteen inches long and wide, divided in a sub-palmate manner into several pinnate pinnae, four to six inches long, each bearing numerous lobed and one-sided pinnules like those of *A. caudatum* but larger. The whole plant is glabrous, and of thin texture.

A. Oatesii. Baker in Oates, *Matabeleland*, Ed. 1, App. V. 369, 1881; C. Chr. *Ind.* 30.

South Africa only. ("Zambesi District, Ngamiland, Crocodile River." J. G. Baker in Miss Gibbs' list.)

Rhodesia.—Matabeleland (Oates); Lo Magundi (J. F. Darling); near Victoria Falls (Allen, 20; J. Sim; Rain forest, Miss Gibbs).

134. ADIANTUM HISPIDULUM Sw.

Baker's description (*Syn. Fil.* 126) is:

"St. 6—15 in. long, strong, erect, polished, dark chestnut-brown, scabrous; frond dichotomous, with the main divisions flabellately branched; central pinnae 6—9 in. long, $\frac{1}{2}$ —1 in. broad; pinnules $\frac{3}{4}$ — $\frac{3}{4}$ in. long, 2—4 lin. broad, dimidiate, sub-rhomboidal, rather broader on the side nearest the stem, the outer edge bluntly rounded or oblique; upper and outer margin finely toothed, lower ones slightly stalked; texture sub-coriaceous; rachises and both surfaces hispid; sori roundish, numerous, contiguous round the upper and outer edge. Hk. *Sp.* 2, p. 31; *A. pubescens* Schk.

Hab. Asia: Neilgherries and Ceylon eastward to Fiji, southward to N.S. Wales and New Zealand; Africa: Bourbon, Mauritius, Zambesiland, banks of Niger. Easily distinguished from the other species by its densely pubescent segments and rachises."

We have not yet had specimens of this, but on the strength of the above credit it to Rhodesia. It is a fairly hardy fern, not uncommon in cultivation.

135. *ADIANTUM CAPILLUS-VENERIS* Linn.

Plate 122. Var. *major*. B Zambesian cut form.

Plate 121. Var. *minor*.

Rhizome creeping on or near the surface of the ground, one to four inches long, one to four lines in diameter, fleshy, set with brown chaffy scales, and producing numerous fronds at short intervals. Fronds two to three-pinnate, deltoid, four to eight inches long, three to six inches broad, on a stipe three to eight inches long, which is set below with chaffy scales at first, afterwards glabrous, black, and wiry. Pinnæ deltoid, pinnate, two-pinnate, or occasionally three-pinnate, with fine black hair-like rachis and petioles. Pinnules a half to three-quarter inch long, and about as broad, glabrous, cuneate, or tapering down to the petiole, deeply lobed, and when barren toothed at the edge; of light green, delicate, and almost transparent texture. Sori longish or round, placed across the top of the lobes, and not much sunk into them.

A. Capillus-Veneris. Linn. *Sp.* 2, 1096 (1753); Pappe and Rawson, 32; Moore, *Ind.* 21; Kuhn, *Fil. Afr.* 62; Hk. and Bkr, *Syn. Fil.* 123; Sim, *Ferns of S. Afr.*, 1st ed., 70; C. Chr. *Ind.* 24.

A. capillus. Kunze, *Linnaea*, 10.

A. africanum. R. Br.; Lowe.

Throughout the tropics and sub-tropics, and throughout Africa; in moist places by streams.

West.—Rather rare; Table Mountain (Lady Barkly); Genadenthal (Breutel); Loeriesfontein, 2700 ft, & Richtersveld (Dr Pearson, 6096).

East.—Near Grahamstown (Holland); Algoa Bay (Forbes); Graaff-reinet (Bolus); Bedford, and Kat River; Bluekrantz River, 3700 ft (R. Schl. 6859, *cut form*).

Kaff.—Komgha (Flanagan); Main, Transkei (Mrs Young); in every stream near the lower edge of the forest from Thaba N'doda to Kei Road, Stutterheim, Toise River, etc., and often about waterfalls toward the coast (T. R. Sim); Engcoba (A. G. McLoughlin, 91).

Natal.—Common along the coast; frequent up to 2000 feet alt., afterwards more rare (Buch.); not uncommon throughout the Province near falls (T. R. Sim).

Orange Free State.—Ficksburg (Quail).

Transvaal.—Houtboschberg (W. Nelson, 490); Lydenburg (Dr F. Wilms, 749); Zoutpansberg (H. Junod, 117); Elandshoek (Rev. F. A. Rogers, 115); Paul Pieters Rust and Scheerpoort (R. Leendertz, 2332 (*major*) and 749).

Rhodesia.—Mazoe (J. F. Darling); abundant in every stream in the country (H. M. Hole); Victoria Falls (Allen, 11; Eyles, 113, 126; Rev. F. A. Rogers, 5017; Holland; Engler; Jas. Sim; C. Wilde, 866, *cut form*); Tatagura Valley, 4300 ft (E. Eyles).

Portuguese East Africa.—Umbelusi Poort (T. R. Sim); behind Beira (T. R. Sim).

Besides the usual form, the following varieties occur:

Var. *β. major* (Plate 122). Pinnules very broad, larger than the ordinary form, deeply lobed, rather rounded below, but tapering a little to the petiole; most of the pinnules except the terminal ones more or less one-sided. A cut form from Zambesia is shown on Plate 122, B.

Var. *γ. minor* (Plate 121). Fronds as large as in the type, but pinnules narrower, and more cuneate; sori long, often crossing the whole pinnule, and then straight. Frond nearly flat.

The normal form is intermediate between these two varieties, and frequently approaches them.

136. ADIANTUM PARADISEAE Baker.

(Extracted from *Gardener's Chronicle*, Nov. 16, 1889, II. 558.)

"General habit of *A. aethiopicum*, *cuneatum*, and *venustum*. Stipe and rachis slender, naked, glabrous, brown-black. Frond deltoid, tripinnate, glabrous, half a foot long and nearly as broad, lower pinnae largest, deltoid, unequal-sided, cut away on the lower side at the base, conspicuously petioled; ultimate segments rhomboidal, a quarter to a third of an inch long and broad, cuneate, and entire in the lower half or more, irregularly rounded, and sparingly crenate at the apex. Sori one to three to a segment, oblong, broadly shallowly reniform, one-twelfth to one-sixth of an inch long. Indusium broad, glabrous, persistent.—J. G. Baker.

"This new *Adiantum* has been sent to the *Gardeners' Chronicle* by Mr William Juby, for the last twenty-five years

gardener to J. E. Wood, Esq., of Grahamstown. It was found in the mountains in the district of Bedford by Miss Paradise, and is named after that lady at Mr Juby's request. Of the numerous new forms nearly allied to *A. aethiopicum*, *venustum*, and *cuneatum*, its nearest ally is the Himalayan *A. Wattii* Bkr. (*Journ. Linn. Soc.*, vol. 18, 381.)"

A specimen named *A. Paradiseae* Bkr in the Albany Museum Herbarium from Bedford Mts appears to be *A. capillus-veneris*, small and fertile, and plants shown me in 1892 by Mr Juby as being what he had sent to the *Gardeners' Chronicle* also had that appearance.

A. Wattii Bkr., referred to above by Baker, has been placed under *A. capillus-veneris* by Christensen, who still maintains *A. Paradiseae* Bkr, but I doubt its distinctness.

137. ADIANTUM POIRETII Wilkstr.

Plate 123. Fig. 1. Nat. size, fertile. b Pinna, barren.

Fig. 2. Variety, nat. size, and magnified.

Rhizome very long and slender, subterranean, slightly branching, and set with grey or afterwards nearly black lanceolate scales. Frond three-pinnate, ovate-deltoid, thinly herbaceous, light green, but not glaucous, six to nine inches long, three to five inches broad, with four to five pairs of alternate, rather distant pinnae, which are compactly deltoid, two-pinnate, or occasionally three-pinnate. Pinnules small, shortly stalked, widely cuneate, one to three lines broad and long, broadest at the top; entire or two lobed, each lobe bearing a crescent-shaped sorus sunk into a deep hollow. When not fertile the pinnules are larger, more rounded below, and finely serrated round the outer edge. Stipe three inches long, at first thickly set with chaffy scales, afterwards like the rachis and petioles, chestnut brown and shining, but very herbaceous in texture, and fragile.

On the pinnae the rachis is almost hid from below by the overlapping first pinnule on the upper side of each ultimate pinna.

A variety differs from the more usual form in having rather larger pinnules, with the sorus quite reniform, and

sunk so far into the lobe that it is quite surrounded by lamina, while the veins all curve over and terminate in the sorus. (Fig. 2.)

This species is difficult to cultivate satisfactorily, in which respect it differs much from *A. aethiopicum*, which is a great favourite, and always does well.

This is *A. thalictroides* Willd. of our first edition.

Some doubt may exist as to whether our plant be Willdenow's *A. thalictroides*, as Schlechtendal's description is not very clear, and his figure was one of those that were not issued owing to the non-completion of the book. Reference to Willdenow's Herbarium is required to certify this. Christensen finds the older name is *A. Poirerii* Wilks. Baker unites *A. thalictroides* with *A. aethiopicum*, but Kuhn keeps them distinct. However there is no doubt that our plant is a distinct species from the strong-growing *A. aethiopicum* of the Eastern forests.

A. Poirerii Wilkstr. *Vet. Akad. Hdl.* 1825, 443 (1826); C. Chr. *Index*, 32.

A. thalictroides. Willd. *Hb.* 20,101 (Schl.), 20,102 (Kuhn); Schl. *Adum.* 53 (t. 33 ined.); Kze, *Linnaea*, 10, 530; Pappe and Rawson, *App.* 52; Kuhn, *Fil. Afr.* 66; Sim, *Ferns of South Africa*, 1st ed., 72.

This is abundant near Cape Town, but almost absent elsewhere. It belongs to tropical Africa, India, and America.

West.—Table Mountain, Devil's Mountain, etc.; Swellendam (Holland); Wellington (M. Knobel, 964).

138. ADIANTUM AETHIOPICUM Linn.

Plate 124. Part of frond, nat. size.

Rhizome paleaceous, almost crown-like, branched and tufted, a half to two inches long, two lines diameter, but with very long slender running and almost frondless branches. Frond glabrous, three to four-pinnate, one to three feet long and broad, on a shining, metallic, black, wiry stipe, often two feet long, and having lanceolate, brown scales at the base only. Pinnae lax, alternate, arching, spreading, erecto-patent; lower pinnae largest, six to twelve inches long, three to six inches broad, with four to six pairs of secondary pinnae; the

upper simply pinnate; the lower two-pinnate. Pinnules three to six lines broad, three to five lines long, generally wider than long, rounded, lobed, and when barren slightly crenate on the upper side; the lower side straight or rounded, or more frequently slightly tapering to the petiole, but often almost reniform. Pinnules set obliquely on the petiole, which is one to two lines long, and like the branches of the rachis black, hair-like, and shining. Sori crescent-shaped, several in a pinnule, one in each lobe, one line or less broad, deeply sunk into the frond, or surmounted by a horn of green lamina on each side. Texture thin, colour light green or glaucous green; pinnules very easily broken off in mature fronds, or when dried.

Dr Wood supplies Natal specimens larger in all parts, and with firmer more coriaceous texture, with pinnules three-quarter to one inch broad, half inch long, and sori, though sometimes reniform, more frequently elongated, and sunk into the frond. Indusium sometimes quarter inch long.

A. aethiopicum is the finest and most easily cultivated of our *Adiantums*, but is not common in cultivation. It occurs in tropical and South Africa, Australia and New Zealand.

A. aethiopicum. Linn. *Syst. Nat.* ed. 10, 2, 1329 (1759); Schl. *Adum.* 53; Thunb. *Prod.* 173; Thunb. *Fl. Cap.* 736; Kunze, *Linnaea*, 10, 529; Pappe and Rawson, 33 (?); Hk. and Bkr, *Syn. Fil.* 123, in part; Kuhn, *Fil. Afr.* 62; Sim, *Ferns of S. Afr.*, 1st ed., 73; C. Chr. *Index Filicum*, 23.

Owing to *A. Poirerii* having been formerly included in *A. aethiopicum*, the separate distribution of this is rather uncertain, but I have seen no specimens from the western province, though Kuhn places here Browning's Nos. 121, 122, Novara Expedition, Simon's Bay.

East.—Bedford Forest (Miss Cook); Grahamstown, near Reservoir (Holland, 1866); Boschberg (MacOwan); Oudeberg, Graaffreinet, 4800 feet (Bulus).

Kaff.—Perie Mission Station, Poutz' Bush, Keiskama Hoek, Toise River, all above 2000 feet; Bankies, Sterkstroom, 5000 ft (E. D. Barker); Engcoba, 3000 ft (Flanagan, 2780).

Natal.—Common from Maritzburg to Drakensberg (McKen); Karkloof, Umpumulo, rare (Buch.); Buccleuch (W. Leighton); Zwaartkop, Bulwer, and Normandein (T. R. Sim).

Transvaal.—Rietvlei, Belfast (Burt-Davy, 7235); Letaba River (H. Junod, 2447); Marovuni (Burt-Davy, 215); Haenertsberg (Eastwood); Barberton (Miss Williams, 789); Mamotsinri (A. Junod, 215); Rosehaugh (J. M. Sim).

Rhodesia.—Mazoe River (Holland); Mazoe, 5100 ft (F. Eyles, 328; E. Eyles, 10); Mr Edmonds' farm, near Salisbury (Holland); Um-tali, in the hill districts (Mrs Bennett).

139. ADIANTUM SULPHUREUM Klf.

This is exactly like ordinary *A. aethiopicum*, but dusted all over the under side of the pinnules with yellow powder. The crown and young unfolding fronds are also more or less yellow with this waxy powder.

It is placed under *A. aethiopicum* L. by Baker in *Syn. Fil.*, and is maintained by Christensen as from Chili only, but our plants agree entirely with the American. If only for cultural purposes, it is best to retain the name *A. sulphureum*, or otherwise it might be placed as a variety of *A. aethiopicum* L.

Kaffraria.—Dordrecht (T. R. Sim); under rocks on hills near Cala, 4000 ft, 1896; well dusted on the under side when young; less so when mature (Flanagan, 2838).

Natal.—Boschfontein, Brackwal (T. R. Sim).

Orange Free State.—Near Harrismith, not uncommon (Dr J. M. Wood; W. Nelson, 904); near Van Reenen (Dr Bews).

D. PTERIDINAE.

Genus 33. *ACTINIOPTERIS* Link.

Frond flabellate, with narrow, radiating, simple or once forked segments. Sori linear, submarginal, one on each side the segment, opening face to face. This genus includes only the one distinct and curious little plant described below, and the list of synonyms shows that it has undergone a variety of generic names.

140. *ACTINIOPTERIS AUSTRALIS* (Linn. fil.) Link.

Plate 34. Fig. 2. Nat. size. c Section of pinnule, enlarged.

Crown sub-erect, tufted, with abundant, lanceolate, brown scales. Frond coriaceous, fan-shaped, one to two inches broad, divided to near the base into four to six divergent pinnules, which are again divided into two to three linear,

spreading segments, half line broad, toothed at the blunt apex. Stipe one to six inches long, slightly edged with green, and having scattered spreading scales. Fertile segments longer, narrower, and more pointed. Sori linear, submarginal on each side of the segments, covered by a thin indusium opening inward. It seems to vary considerably in size, as some plants have fronds six inches high with as many as twenty-five segments one inch long, while other fronds on same plants are only one inch high with quarter inch long segments. Other specimens have similar medium-sized fronds, but along with them stronger fronds, divided into about sixteen segments three inches long. A specimen in Herb. Gub. has on a three-inch stipe a frond of nine linear segments, three to four inches long, and one line broad, the fertile infolded, not toothed at the tip, but sharp pointed. That form is *Acrostichum australe* Linn.

Actiniopteris australis (Linn. fil.). Link. *Fil. Sp.* 80 (1841); C. Chr. *Ind.* 21.

Actiniopteris radiata. Link. *Sp.* 79; Hk. and Bkr, *Syn. Fil.* 246; Sim, *Ferns of S. Afr.* 1st ed. 163.

Blechnum radiatum. Presl, tab. 103; Pappe and Rawson, 16.

Acrostichum dichotomum. Forsk, *Fl. Aeg. Arab.* (1775) (oldest name).

Pteris dichotoma. Kuhn, *Fil. Afr.* 79.

Acrostichum radiatum. Koenig.

Asplenium radiatum Sw. Kze, *Linnaea*, 24, 259.

Acrostichum australe. L. fil. Suppl. 444 (1781).

South Asia, and throughout Africa, south to Transvaal.

West.—Griqualand (R. Moffatt); Kuruman (Rev. J. Brown).

Transvaal.—Magalisberg (Burke and Zeyher, 532; Todd, Zeyher, No. 1874); Limpopo (H. M. Barber); near Eurika City in the Sheba Mountains, Barberton (Dr C. M. Vowell, 1888); Spelonken (F. J. Menne (1906), 381).

Rhodesia.—Devil's Kantour, Tati (J. Fry, 1887); Salisbury (Darling); fairly common, Salisbury and Borrowdale (H. M. Hole); Umtali (Mrs Bennett); Victoria Falls (Allen, 91; Garbutt); Mazoe, 4400 to 4600 ft (F. Eyles, 259); Khami ruins near Bulawayo and at Sebakwe in old workings (Eyles); kloof three miles from Zimbabwe (B. H. Holland); Matopo Hills, kopjes, general; also at Victoria Falls veld (Miss Gibbs).

Portuguese East Africa.—Behind Beira, and on rocks at Messangerie (T. R. Sim).

Genus 34. *PTERIS* Linn.

Indusium marginal, continuous, opening inward, and bearing the capsules in an uninterrupted, narrow line, along its axil. Veins free or nearly so. This large genus contains plants of various habit, and has been split into several genera by some authors, while others keep it entire, or unite *Pellaea* and *Lonchitis* with it. Several species are widely distributed, and others are found all over the world.

Key to the species :

- 141. *P. longifolia*. Frond simply pinnate.
- 142. *P. cretica*. Pinnae linear, the lower with one or two linear pinnules on the lower side.
- 143. *P. dentata*. Two to three-pinnate, barren pinnules distinctly serrate.
- 144. *P. biaurita*. Frond two to three-pinnate, barren pinnules not toothed, or only very slightly. Veins usually free.
- 145. *P. brevisora*. Frond three-partite, *i.e.* having one central and two side pinnae, each with numerous pinnate pinnules.
- 146. *P. Buchananii*. Frond two to three-pinnate, barren pinnules distinctly serrate. Veins united in one line of areolae on each side of the mid-rib.
- 147. *P. atrovirens*. Like *P. biaurita*, but with prickly stems and anastomosing venation.

141. *PTERIS LONGIFOLIA* Linn.

Plate 125. Nat. size.

Rhizome procumbent or shortly creeping, paleaceous. Frond simply pinnate, lanceolate, one to three feet long, three to eight inches broad, glabrous, and with a glabrous, green, channelled rachis, and a short, round, herbaceous stipe, set with numerous, linear, white, spreading scales, toward the base. Pinnae about twenty pairs, three to four lines broad, two to four inches long about the middle of the frond, considerably reduced downward, and slightly reduced upward; and the frond rather abruptly terminating in a terminal pinna similar to the others but longer; all linear pointed, from a wide, rounded or cordate, sessile base, and serrate when not fertile. Indusium narrow, herbaceous in texture

like the frond, except the margin, which is scarious and entire. Veins free, slightly forked, parallel.

Pteris longifolia. Linn. *Sp.* 1531; Hk. *Sp.* 2, 157; Hk. and Bkr, *Syn. Fil.* 153; Kuhn, *Fil. Afr.* 83; Sim, *Ferns of S. Afr.*, 1st ed., 106; C. Chr. *Index*, 601.

Pteris costata. Bory.

Pteris ensifolia. Swartz.

Thunberg's *Pteris cuspidata* may have belonged to this, but is set down by Kuhn and by Christensen as barren fronds of *Angiopteris* (Marattia).

Throughout the tropics and a little beyond; nowhere common in S. Africa, but scattered, growing beside open running water.

East.—Alexandra Forest (Holland); Uitenhage, possibly naturalised (MacOwan).

Kaff.—Komgha (Flanagan).

Natal.—Hot springs at Inhlimbiti, 2500 ft alt.; Field's Hill; Weenen Thorns; Cathkin; Inanda (Buchanan); Verulam; Umlaas (Wood); Zwaartkop (T. R. Sim).

Transvaal.—Magalisberg (Burke); Macamac (McLea); Pretoria, Aapie's Poort (Dr Rehmann, 4047); Malmanie stream (Burt-Davy, 69); Selati Goldfields (Junod, 1040); Zeerust (Mrs Potts, 4247); Rustenburg (M. Collins, 981); Barberton (P. Oranje, 412); Woodbush and Waterval Onder (T. J. Jenkins, 975, 765); Waterval Boven (F. A. Rogers, 113); Scheerpoort (R. Leendertz, 748).

Rhodesia.—Umtali and Mazoe (J. F. Darling, Holland, Mrs Bennett, Jas. Sim); Matopo Hills, common (Miss Gibbs); Talagura River, Mazoe, 4300 ft (E. Eyles); Bulawayo (Eyles, 66).

Portuguese East Africa.—Umbelusi Poort (T. R. Sim).

142. *PTERIS CRETICA* Linn.

Plate 126. Small frond, nat. size. b Sporeling plant.

Rhizome shortly creeping, naked, subterranean. Fronds glabrous, simply pinnate, but with lower pinnae forked; six to twelve inches long, four to ten inches broad, on a glabrous, green, furrowed stipe, one foot or more long. Pinnae two to five opposite pairs, sessile, linear-lanceolate, pointed, sharply serrate when barren, with white teeth or teeth connected into a white margin. Lower pinnae largest, with one to two linear pinnules forking from them on the lower side. Upper three pinnae connected at the base, and slightly decurrent, the rest

of the rachis not winged. Fertile pinnae three to four lines broad, barren pinnae often broader. Indusium narrow, membranaceous, marginal, but not a continuation of the edge of the frond. Veins parallel, once forked.

Var. *stenophylla* has three to five pinnae only, all rising together, and is known as the five-finger fern, but does not adhere strictly to its character.

Pteris cretica. Linn. *Sp.* 7807; Schk. *Fil.* 85, tab. 90; Schl. *Adum.* 40; Thunb. *Prod.* 171; *Fl. Cap.* 732; Kze, *Acot. Afr.* 43; Pappe and Rawson, 26; Kuhn, *Fil. Afr.* 79; Hk. and Bkr, *Syn. Fil.* 154; Sim, *Ferns of S. Afr.*, 1st ed., 107; C. Chr. *Index*, 595.

Pteris serraria. Sw. *Schrad. Jour.* 1800.

Frequent in the tropics, and not uncommon in S. Africa, growing in open glades in the forest.

West.—Swellendam (Pappe and Rawson); Knysna (Burchell, 5571); Seven Oaks (Holland); Grootvader's Bosch (Thunberg); Hang-klip (Mund.); George, Koratra (Drège).

East.—Zwaartkops River (Rawson); Kat River, Winterberg (Pappe and Rawson); Bedford (Miss Cook); Boschberg (MacOwan).

Kaff.—Komgha (Flanagan); St Augustine's, Transkei (Baur.); Katberg (Rev. F. A. Rogers, 3880); Perie, Frankfort, Dohne, Cathcart, etc. (T. R. Sim); Engcoba (Flanagan, 2721); Cala (Royffe, 241).

Natal.—Abundant in upper districts (Wood); present in most forests (T. R. Sim).

Orange Free State.—Ficksburg (Quail).

Transvaal.—Magalisberg (Sanderson); Rietvlei, Belfast (Burt-Davy, 1237); Haenertsberg (Eastwood); Zeerust (T. J. Jenkins, 987); Woodbush (W. Nelson, 465); Pilgrim's Rest (L. Collins, 900); Rietfontein and Fonteinien, near Pretoria (R. Leendertz, 880 and 109); Barberton (Miss Williams, 788).

Rhodesia.—Umtali (Mrs Bennett); Mazoe (Holland); Borrowdale, near Salisbury (H. M. Hole); Ironmask Hill, 5000 ft (E. Eyles); Chirinda Forest, 3700 to 4000 ft (Swyn. 831).

A tasselled form from Upper Umkomaas is in the Natal Government Herbarium.

(*PTERIS SERRULATA* Linn. fil., a Chinese species, which somewhat resembles *P. cretica*, but has the rachis distinctly winged throughout, is mentioned in Hk. and Bkr *Syn. Fil.* as having been received from Natal, from R. W. Rawson, Esq.; but is only known in cultivation to Natal botanists.

P. serrulata Forsk. is according to Kuhn our *P. dentata*, and *P. serrulata* Pappe appears to be our *P. Buchanani*; both very distinct from *P. serrulata* L., but both Natal plants, and possibly the cross naming may account for the above locality. See Lady Barkly's list, page 194, no. 56.)

143. PTERIS DENTATA Forsk.

Plate 129. Frond reduced. b Barren pinnules, nat. size. c Fertile pinnules, nat. size. d Unusual form.

Crown erect or procumbent, paleaceous. Fronds of mature plants two to three-pinnate, deltoid, glabrous, two to four feet long, one and a half to three feet broad, on a strong, angular, slightly villose stipe, one to three feet long, and having a few scattered scales toward the base only. Pinnae eight to twelve opposite pairs, lanceolate, or simply pinnate, except the lower two to three pairs, which are deltoid, and have several similar but smaller pinnate pinnae on the lower, or on both sides, but longest on the lower side. Lowest pinnae often one and a half feet long, one foot broad at the base, with five to seven pairs of alternate pinnae; those above simply pinnate on the upper side and toward the point, but with one to four pinnate pinnae on the lower side. Pinnules linear, one to two lines broad, one to two inches long, with abruptly decurrent base. Terminal pinna not different, and not much larger than others. Barren pinnae, and the barren points of fertile pinnae, strongly toothed, and wider than the fertile parts. Involucre continuous along most of the pinnule, narrow, fringed. Veins all free and once forked, more distant than in *P. quadriaurita*.

This splendid fern is one of the greatest ornaments of our forest scenery. Its light green foliage contrasts well with the dark foliage of the trees above, and as the fronds rise on stalks one to two feet long, then spread horizontally, they generally show their fine outline well above the undergrowth. The amount of cutting varies exceedingly; sometimes the lower pinnae are simply pinnate, while in other cases the lower two or three pairs of pinnae are very large and bi-pinnate for two-thirds of their length. The sori sometimes extend only along part of the pinnules, leaving the upper half barren

and serrated; but more frequently on old fertile plants the fronds have every edge covered all along with sori. When this condition occurs the plants are three to four feet high and broad, with an upright habit, and, of course, the sori make the pinnules narrower and not serrated, so the appearance is altogether unlike the flat, serrated, and less divided younger barren plants.

Like *P. biaurita* this has a scale at the base of every pinnule on the upper surface of the mid-rib.

Pteris dentata. Forsk. *Fl. Aeq. Arab.* 186 (1775); C. Chr. *Index*, 596.

Pteris flabellata (originally *P. flabellulata*). Thunb. *Prod.* 172; *Flor.*

Cap. 733; Hk. and Bkr, *Syn. Fil.* 161; Sim, *Ferns of S. Afr.*, 1st ed., 110.

P. arguta (Aiton). Schl. *Adum.* 43; Kze, *Linnaea*, 10, 524; Pappe and Rawson, 26.

P. arguta Ait., var. *flabellata* (Thbg) Mett. Kuhn, *Fil. Afr.* 76.

P. serrulata. Forsk. *Fl. Aeq. Arab.* 187; Swartz, *Syn.* 108.

Africa and African Islands; common throughout South Africa.

West.—Tulbagh, Table Mountain, etc.

East.—Karakamma, Zuurberg, Grahamstown, Bedford, etc., abundant.

Kaff.—Abundant in all the forests, Bazija (Baur.); Komgha (Flanagan), etc.

Natal.—All over the colony.

Transvaal.—Magalisberg (Zeyher, Burke, Sanderson); Zeerust and Waterval Onder (T. J. Jenkins, 984 and 767); Zoutpansberg, 3900 ft (Schlechter, 4600); Rustenburg (M. Collins, 890); Rietfontein, Belfast (R. Leendertz, 881).

Rhodesia.—Penhalonga (Holland); Umtali (Mrs Bennett); Victoria Falls (Rogers, 5556; Jas. Sim).

(*P. TREMULA* R. Br., a New Zealand and Australian species, is mentioned by Buchanan and Wood as having been found by the latter at Umhloti, Natal. Mr Wood now writes that when he found this fern on his farm he thought it might have escaped from cultivation, and now he is sure of it.

Baker (*Syn. Fil.* 161) mentions having seen a specimen of it in Herb. Rawson, from the Cape, named *P. caffra* Pappe. Neither this name nor any Cape specimen of *P. tremula* is now in Herb. Gub., which includes Dr Pappe's collection, and

as the species is otherwise unknown in South Africa, except in cultivation, it is assumed to have been a mistake.)

144. *PTERIS BIAURITA* Linn.

Plate 127. Part of lower pinna. Nat. size.

Crown procumbent, or with a short rhizome; set with numerous short, brown, lanceolate scales. Frond two-pinnate or three-pinnatifid, glabrous, one to three feet long, one to two feet broad, on a nearly naked yellowish stipe one to two feet long. Pinnæ about ten pairs, six to twelve inches long, one to one and a half inches broad, cut to near the mid-rib into linear, obtuse, entire, or slightly serrate pinnules; and with an attenuated, narrow, pointed, terminal pinnule. Terminal pinna similar to the others, but longer. Lower pinnæ with two to four short similar pinnæ on the lower side. Indusium narrow, membranaceous. Sori usually in the lower half of the pinnules only, but the upper half is quite entire. Along the mid-rib on the upper surface, this bears a strong prickly-like scale at the base of every side rib. Also about six of these scales are on the vein in each pinnule. Texture thin, but firm. Veinlets numerous, distinct, in most cases free, usually forked. The pinnæ are not usually cut quite to the mid-rib, but so near that the lower veins from two neighbouring pinnæ do not unite. However it is not rare to find specimens with some veins united.

In our first edition the name *P. quadriaurita* was used for this, following the *Synopsis Filicum*, where *P. quadriaurita* Retz is included in section *Eupteris* (distinguished by having the veins free), and *P. biaurita* in section *Campteria* described thus: "*veins all free except that those of the last divisions but one are more or less connected by arching veins at the very base.*" These distinctions have proved to be not constant enough even for specific difference, and so the two are united by Christensen under *P. biaurita* L. (*P. quadriaurita* being indicated as a variety). Lady Barkly united them under *P. quadriaurita*.

There are evidently two forms of *P. quadriaurita*. All the Natal specimens I have seen are slightly serrate all

along the barren margins, while those from the Transvaal are quite entire, and thinner, but more leathery in texture. In Herb. Bolus, the latter variety is named by Baker *P. quadriaurita* var. *setifrons*.

P. biaurita. Linn. *Sp.* 2, 1076 (1753); C. Chr. *Index*, 592; Hk. and Bkr, *Syn. Fil.* 164.

P. quadriaurita Retz. Hk. *Sp.* 2, 179, tab. 134 β ; Hk. and Bkr, *Syn. Fil.* 158; Buchanan's List, No. 38; Wood's *Natal Ferns*, 15; Sim, *Ferns of S. Afr.*, 1st ed., 108.

P. catoptera. Kze, *Linnaea*, 18, 119; Pappe and Rawson, 26.

Found throughout the tropics; by streams, or in bush, but not plentiful south of Natal, where it is found from the coast to the upland mountains.

Kaffraria.—Engcoba Mountain, 1896, 4000 ft (H. G. Flanagan, 2779; A. G. McLoughlin, 98); Main, Transkei (Mrs Young).

Natal.—Frequent throughout the Province, Durban (T. J. Jenkins, 844); Buccleuch (W. Leighton); Zwaartkop, Bulwer, Impetyne Forest, Ngomi Forest, Nkandhla, Quideni, Ngoya, etc. (T. R. Sim).

Transvaal.—Marovuni (Burt-Davy, 226); Magalisberg (Zeyher); Drakensberg, near Macamac Goldfields (J. H. McLea, 41); Houtboschberg (W. Nelson, 481); Shilouvane (A. Junod, 2388); Waterval Onder (F. A. Rogers); Rosehaugh (J. M. Sim); Haenertsberg (Mrs Pott, 4627).

Rhodesia.—Victoria Falls (G. Richards; Miss Gibbs; Eyles, 94; Rogers, 5048; Allen, 181); near Salisbury (Holland); Umtali (Mrs Bennett; Rogers, 5048); Lo Magundi (J. F. Darling); Matopo Hills, 4700 ft (Eyles, 149; Miss Gibbs); Mazoe, common in the marshes (Eyles); Chirinda Forest, 4000 ft (Swyn. 872).

Portuguese East Africa.—Behind Beira; Inhambane; Estatuene (T. R. Sim).

145. *PTERIS BREVISORA* Baker.

Plate 128. Nat. size.

Crown sub-erect set with long thin scales; stipe strong, one to three feet long, more or less paleaceous below. Frond three-partite, *i.e.* having one central pinna one to two feet long, six to eight inches wide, with numerous pinnate pinnules three to four inches long, three-quarter to one inch wide, and two nearly similar side pinnae similarly divided, or with the lower pinnules again compound. Segments half inch long, one-eighth inch wide, quite distinct, blunt, slightly crenate.

Sori two to four lines long in the specimens seen, placed on the side of the segment, and absent from its rounded apex. Involucre rather wide. Texture of frond thin. Mid-rib has a green scale at the base of each pinnule, on the upper surface. Very similar but apparently quite distinct from *P. biaurita*.

This belongs to the section Tripartitae, in which the lowest pinnae are much larger than the others, often nearly equalling the central portion of the tripinnate frond.

In dealing with *P. longipes* D. Don, Baker states ("New Ferns," *Annals of Botany*, Vol. v, 1891): "Further material shows *P. brevisora* Baker (No. 39, *Syn. Fil.*), which has now been found in Zambesia, to be only a variety of this species with shorter sori." But Christensen maintains *P. longipes* D. Don from tropical Asia, and *P. brevisora* Bkr from West tropical Africa.

P. brevisora. Baker, *Syn. Fil.* 162, 1867; C. Chr. *Index*, 594.

Rhodesia.—Common in forest; Chirinda Forest, 3700 to 4000 ft alt., June 1906 (Swynnerton, 854, 871).

146. *PTERIS BUCHANANI* Sim.

Plate 130. Upper side of lower pinna, nat. size.

Rhizome creeping. Fronds two to three-pinnate, glabrous, two to four feet long, one and a half to three feet broad, more or less tripartite, on a stipe one to three feet long. Pinnae stalked, numerous, lanceolate, and cut nearly, but not quite to the rachis, into linear pinnules, one to two inches long, two lines broad, sharply toothed where not fertile, and not narrower where fertile than above. Lower pinnae much the largest, having several pinnate pinnae on each side, but largest on the lower side. Lower pinnules sometimes distinct, and again pinnatifid or lobed; others more or less connected along the mid-rib, so that the lower veinlets, of one pinnule unite with those of its neighbours, forming regular areolae along the mid-rib. Texture herbaceous; colour green. Involucre half line broad, white and membranaceous, distinctly intramarginal, not reaching the point of the pinnules. In young plants the anastomosing venation is quite distinct, and the frond is roundly, five-lobed, or three-partite in

general outline, but old fertile fronds, except in form, become more like those of *P. dentata*, and the pinnules are often cut quite to the mid-rib, or so near that the veins do not unite. It then resembles *P. dentata* closely. Baker's division *Campteria*, to which this species belongs, is characterised by the veins uniting only along the mid-rib; whereas in his division *Litobrochia* they unite freely throughout; but this character does not hold rigidly, and it is evident that this species is a form of *P. (Litobrochia) marginata* Bory, quoted by Baker (*Syn. Fil.* 172) as *Kaffrarian*, and *P. serrulata* Pappe is stated by Lady Barkly to be the same thing.

P. Buchananii. Sim, *Ferns of South Africa*, 1st edition, 111; Baker MSS. in Buchanan's List, No. 42 and in Lady Barkly's List, No. 56; C. Chr. *Index*, 594.

West.—Knysna (Lady Barkly).

East.—Tzitzikamma Forest (Rawson Herb.).

Kaff.—Transkei near Main (Mrs Young); Evelyn Valley, Perie.

Natal.—Intshanga, Karkloof, and Entumeni (Buchanan); Biggarsberg (Todd).

Transvaal.—Included in Burt-Davy's Check-list.

147. *PTERIS ATROVIRENS* Willd.

Baker's description of this (*Synopsis Filicum*) is:

"St. 1 ft. long, polished, more or less prickly; frond 1—2 ft. long; terminal pinna 6—9 in. long, 2—3 in. broad, cut down within a short distance of the rachis into numerous linear lobes 1—1½ inch long, ¼—⅜ inch broad, which are slightly toothed when barren; lateral pinnae in numerous opposite pairs, the lowest sometimes 1 ft. long, the lobes similar to those of the terminal one, the lowest pair forked, with a similar smaller pinnule on the under side; both surfaces naked; rachis of the pinnules beneath sometimes, but not always, furnished with a row of weak prickles; texture herbaceous; veins fine and inconspicuous; sori not reaching to the point of the segments. *P. spinulifera* Schum.; Hk. *Sp.* 2, 221.

Hab. Guinea Coast and Angola. Habit of *P. quadriaurita*, but with prickly stems and anastomosing venation."

Not known to me, but included in Eyles' list of Rhodesian plants as found at Victoria Falls by Engler. Baker includes it in his section *Litobrochia* of *Pteris*, which might bring it into our genus *Histiopteris*, but Christensen retains it in *Pteris*.

Genus 35. *LONCHITIS* Linn.

A genus consisting of two species, closely allied to *Pteris*, and only distinguished by having the sori confined to the sinuses; while from *Hypolepis* and *Cheilanthes* it is distinguished by its anastomosing venation. Four or five species are known from tropical Africa and Madagascar, and one from tropical America.

148. *LONCHITIS PUBESCENS* Willd.

Plate 131. Lower pinna of nearly barren frond, nat. size.

Plate 132. Part of fertile frond, nat. size.

Root stock sub-erect or procumbent, densely clothed with brown shining woolly tomentum, or shag. Roots very strong, wiry. Fronds three to four feet long or more, two to three feet broad, two to three-pinnatifid, thinly herbaceous in texture, and having a stout hairy stipe two to three feet long, and paleaceous at the base.

Frond very various in cutting, but generally with the upper pinnae more or less connected by a wing along the side of the rachis. This wing increases in breadth upward, and often disappears in the lower half of the frond, where the pinnae are shortly stalked or sessile, or more or less connected with the rachis above them. Pinnae lanceolate from a wide base, the lower twelve to eighteen inches long, two to six inches broad, cut nearly, but not quite to the rachis, into ovate-deltoid segments, which when nearly barren are entire, with the sori between the upper pinnules; but when abundantly fertile cut halfway to the mid-rib into rounded lobes, and bearing sori at the bottom of the sinus between each of these lobes. Involucre crescent-shaped or reniform between the lobes, but occasionally more or less elongated between the pinnules. Veins uniting into numerous irregular areolae, but with a line of larger and more elongated areolae along each mid-rib. Whole frond finely villose, especially on the rachis, mid-rib, and veins of the under-surface. Exceedingly variable in cutting, and in the amount of hairs on the frond; and one form formerly held as a species under the name of *L.*

glabra Bory is still mentioned as a variety in *Syn. Fil.*, and is maintained by Christensen as from S. Africa and Reunion, but the specimens I have seen do not seem to have characters for two forms, and Sanderson's specimens in Herb. Gub. named *L. glabra* are as hairy as others.

Kuhn gives three species, viz.:

1. *Pteris glabra*. Cape, Natal, and Bourbon.
2. *Pteris natalensis* Kuhn=*L. natalensis* P. and R. Natal, and Johanna Island.
3. *Pteris pubescens* Kuhn=*L. pubescens* Willd.=*L. hirsuta* Bory. Mascarene Islands only.

Schlechtendal's otherwise good figure shows sori without indusia, though the indusium is described in the text.

Lonchitis pubescens Willd. Hk. *Sp. Fil.* 2, 56; Hk. and Bkr. *Syn. Fil.* 128; Wood's *Natal Ferns*, 9; Sim, *Ferns of South Africa*, 1st ed., 75; C. Chr. *Index*, 409.

Lonchitis natalensis. Hk. *Sp. Fil.* 2, 57, t. 89b; Pappe and Rawson, 38.

Lonchitis glabra Bory. Schl. *Adum.* 47, t. 27; Kunze, *Linnaea*, 10, 528; Kunze, *Suppl.* to Schk., t. 66; Pappe and Rawson, 38; Hk. *Sp. Fil.* 2, 57; C. Chr. *Index*, 409.

Pteris. Kuhn as above.

Africa, African Islands, and South America; growing in wet bush, coast, or midland districts of South Africa.

West.—Knysna (Lady Barkly); George (Holland; Burchell, 5814); George (R. Schlechter, 2338, distributed as *Hypolepis* sp.).

East.—Tzitzikamma (P. and R.).

Kaff.—Perie Forest (T. R. Sim); Pondoland (Drège); Evelyn Valley, 1894 (J. Leighton); Port St John's (Flanagan, 2474).

Natal.—Kranzkloof, Inanda, Umbilo, Field's Hill, Great Noodsberg (McKen); Umpumulo (Buchanan); Nkandhla (Marriott); Buccleuch (Leighton); Sweetwaters (T. R. Sim).

Transvaal.—Haenertsberg (Eastwood; Mrs Pott, 4673).

Genus 36. *HISTIOPTERIS* (Agardh.) J. Smith.

Indusium continuous; veins anastomosing freely without free included veinlets. Habit of *Pteris*, and in our first edition included in it. Only two species, of which one is from the Philippine Islands and the other is represented in South Africa and elsewhere.

149. HISTIOPTERIS INCISA (Thunb.) J. Sm.

Plate 133. Part of frond, nat. size.

Rhizome slender, widely creeping underground. Frond glabrous, glaucous, more or less deciduous, two to three pinnate, one to three feet long, nine to eighteen inches broad, on a naked, herbaceous, glaucous stipe, six to twelve inches long. Pinnae opposite, lanceolate, sessile; in young plants lobed or pinnatifid, but in mature plants cut into distinct, lanceolate, or ovate pinnules, which have a wide adnate base, and are often more or less irregularly lobed or pinnatifid below, or on lower pinnae usually again fully pinnate. Barren frond, and barren tips of fertile pinnules, slightly crenate, but not toothed. Texture thick, but brittle. Involucre continuous, narrow; veins sometimes anastomosing freely, especially on the young plants; often quite free in old fertile plants, and Burchell's 7240, as sent from Kew to Herb. Gub., has all the veins free. This species is easily recognised by its spreading rhizome, glaucous colour, and entire (*i.e.* not toothed) pinnules, but the fronds vary a good deal in cutting.

Histiopteris incisa (Thbg). J. Smith, *Hist. Fil.* 295 (1875); C. Chr. *Index*, 352.

Pteris incisa. Thunberg, *Prod.* 171; *Fl. Cap.* 733; Schl. *Adum.* 44, tab. 25; Kze, *Linnaea*, 10, 44; Pappe and Rawson, 26; Kuhn, *Fil. Afr.* 82; Hk. and Bkr, *Syn. Fil.* 172; Sim, *Ferns of South Africa*, 1st ed. 112.

Pteris vespertilionis. Labill.

Litobrochia incisa. Presl.

Widely scattered in the tropics; growing in damp ground.

West.—Hangklip (Drège); Campsbay (Ecklon); Table Mountain at Newlands, Wynberg, etc., Hottentot's Holland, Swellendam (Holland); Zuurbraak, Swellendam (Burchell, 7240).

East.—Tzitzikamma.

Natal.—Noodsberg, Kranzkloof, Inanda (McKen); Umpumulo (Buchanan); Buccleuch (W. Leighton); Winter's Kloof (T. R. Sim).

Genus 37. *PTERIDIUM* Gleditsch.

Indusium sometimes double; veins free. This genus contains only the common Bracken, in our first edition included

in *Pteris*. The generic distinction given by the indusium is not always evident or easily seen, but the general habit, and especially the very long underground rhizomes, help to indicate a generic difference.

150. *PTERIDIUM AQUILINUM* (Linn.) Kuhn.

Plate 134. Frond and rhizome much reduced. b Fertile pinnule, nat. size. c Pinnules from young seedling plant, nat. size.

Rhizome subterranean, stout, creeping, several yards long, slightly branched, and with few roots. Frond three-pinnate, one to three feet long, one to two feet broad, on a stout, naked stipe one foot long. Pinnae in opposite pairs, sessile, all alike in shape, tapering from a wide base, the lowest sometimes longest, but more frequently rather shorter than the next pair. Upper pinnae pinnatifid or simply pinnate, generally cut almost to the rachis into close, linear, bluntly pointed pinnules, fertile throughout; lower pinnae similar at the point, but towards the base having distinct pinnae cut in a similar manner, which increase in size downward, and are about equal in the upper and lower side of the pinna. Pinnae set nearly horizontal, so that each pair overlaps those under. Involucre continuous round the entire pinnule, intramarginal, much fringed at the edge. Sometimes it has an indusium under as well as over the capsules, which is the characteristic of the section *Paesia* of *Pteris* in which this species has formerly been placed. Fronds coriaceous, glabrous above except when quite young, but villose below in the S. African form, which was separated by Thunberg under the name *P. capensis* on this account. Veins forked, but free.

The Bracken, as this is called, is the most cosmopolitan, and, in many parts of the world, the most common fern; but with us, though not uncommon, it is confined to certain localities. Engler uses it as the characteristic plant of one of his sub-regions in tropical East Africa. It has a very long underground rhizome, from which the fronds rise singly at considerable distances, and this makes it a difficult fern to introduce from the wild state into the rockery. If taken when a seedling, however—before the rhizome has begun to

get long—it is not only very much prettier at first, but more easily managed ever after. When found in the sporeling state, as it often is soon after a bush fire, the fronds are quite delicate in texture, yellowish green, with crenated pinnules, and grow in a tuft, from which afterwards the rhizome starts to run. It is in that state not easily recognised as Bracken, and looks like *Hypolepis sparsisora*.

Pteridium aquilinum (L.). Kuhn, *v. Deck. Reisen*, 3³ Bot. 11 (1879); C. Chr. *Ind.* 591.

Pteris aquilina. Linn. 1753; Hk. and Bkr, *Syn. Fil.* 163; Sim, *Ferns of S. Afr.* 1st ed. 114.

Pteris lanuginosa. Willd.

Pteris aquilina L., var. *lanuginosa*. Hk. *Sp.* 2, 196; Kuhn, *Fil. Afr.* 76.

Pteris capensis. Thunb. *Prod.* 172; *Fl. Cap.* 733; Schl. *Adum.* 45, tab. 25; Kze, *Linnaea*, 10, 527.

Pteris lanuginosa, var. *β. capensis*. Agardh.

Allosorus capensis. Pappe and Rawson, 32.

Allosorus hottentottus. Presl.

Pteris cordifolia. Kze, *Linnaea*, 18, 120.

Allosorus cordifolius Presl. Pappe and Rawson, 32.

Lady Barkly in mistake places *A. capensis* and *A. cordifolia* under *Pellaea hastata* Link (= *P. viridis* (Forsk.) Prantl).

Cosmopolitan; not uncommon, but rather local in South Africa. Recorded from Humpata, Angola, by Prof. Pearson.

West.—Abundant all round Table Mountain, Paarlberg, Hex River, Worcester, Knysna, etc.

East.—Zuurberg, Albany, Graaffreinet, Somerset East, Kat River, etc.

Kaff.—All along the forest range, mostly above the forest, and most abundant and vigorous where bush fires have lately cleared the ground; almost absent from the low grass veldt; Komgha (Flanagan); Umgazi River, Pondoland (Flanagan, 2606).

Natal.—All over the Province.

Orange Free State.—Rouxville (Harper); near Van Reenen (Dr Bews).

Transvaal.—Magalisberg (Sanderson); Athol and Barberton (Burt-Davy, 1899 and 256); Shilouvane (Junod, 892); Heidelberg, Belfast, Fountain Grove, Rietfontein (R. Leendertz, 2569, 2775, 110, 900); Johannesburg (A. Pehrsson, 430); Waterval Boven (F. A. Rogers, 991); Bokfontein (T. J. Jenkins, 768); Rustenburg Kloof (M. Collins, 101); Haenertsberg (Mrs Pott, 4626); Rosehaugh (J. M. Sim).

Rhodesia.—Umtali (J. F. Darling); Salisbury (H. M. Hole); near Mount Hampden, a quite glabrous variety (Holland); Matopo

Hills, 5000 ft (Eyles, 79); Mazoe, 4300 ft (E. Eyles); Victoria Falls (J. Sim, Engler); Chirinda, 2800 ft (Swyn. 401); Singwekwe, Mt Pene (Swyn. 6029); Melsetter District, "The common bracken of the open slopes, and especially grassy glens" (Swyn.). Portuguese East Africa.—Estatuene, and Messengerie (T. R. Sim).

***** **Vittarieae.**

Genus 38. *MONOGRAMMA* Schk.

Sori linear, close to the mid-rib on one or both sides. Frond simple, with one vein only. Small grass-like or rush-like plants, the simplest in structure of all ferns. About fifteen species, all tropical.

151. *MONOGRAMMA GRAMINEA* (Poir.) Schk.

Plate 159. Fig. 2. Nat. size.

Rhizome several inches long, half line broad, creeping, branching occasionally, and densely set with short brown hair-like scales. Fronds very numerous, one to three inches long, quarter line broad, tapering to less at the base, shortly pointed, and having a distinct mid-rib throughout. The sori consist of a short line of capsules near each side of the mid-rib towards the point of the frond. This is a small grass-like plant, epiphytal on trees, credited to the Cape, but which is not in any Cape Herbarium, and only mentioned by Kuhn from the Cape on the authority of Miller *ex* Hooker (*Sp. Fil.* 5, 122). It occurs in Mauritius, Bourbon, and Seychelles, and the above description and figure are from a Mauritius specimen kindly forwarded to me from Kew.

M. graminea (Poir.) Schk. Hk. and Bkr, *Syn. Fil.* 375; Kuhn, *Fil.*

Afr. 54; Sim, *Ferns of South Africa*, 1st ed., 217; C. Chr. *Ind.* 430.

M. linearis Kaulf. Hk. *Sp. Fil.* 5, 122.

Pteris. Poir. *Enc.* 5, 708 (1804).

We think it likely that small plants of *Vittaria isoetifolia* have been the origin of the Cape locality for this. The habit is similar, but the *Vittaria* is very much stronger in all parts, and never occurs with the frond so narrow as this. The description and figure are however retained here with a view to drawing collectors' attention to what would be easily overlooked.

Genus 39. *VITTARIA* J. Sm.

Sori sunk into the frond in a long line near each margin and without indusium. Frond simple, grass-like, with several veins anastomosing in young barren fronds, or united by the capsule-bearing marginal veins. A small tropical genus mostly epiphytal.

152. *VITTARIA ISOETIFOLIA* Bory.

Plate 149. Fig. 1. Nat. size.

Rhizome procumbent, stout, short, epiphytal, densely set with linear black scales. Frond two to twenty inches long, two lines broad, pendulous, thickly sub-coriaceous, glabrous, dark green, grass-like, with a blunt apex, prominent mid-rib, and narrowed very gradually into the firmer short green stipe. Sori in a line near each margin, often extending the whole length of the frond, sunk into its substance without any raised edges. Veins obscure, nearly parallel, free, or united to the soriferous marginal vein, or in the rather wider and more herbaceous barren fronds of young plants forming several areolae. Possibly young plants of this gave rise to the Cape locality for *Monogramma graminea* Schk.

The separation and synonymy of the species of *Vittaria* are exceedingly difficult and confused, though elaborately monographed by Fée. Baker includes *V. isoetifolia* in *V. elongata* Sw., and separates that into a separate section *Eu-vittaria*, having "*sori sunk into a two-lipped marginal groove*," while *V. lineata* Sw. and *V. scolopendrina* Thw. he places in section *Taeniopsis*, having "*sori in a slightly intramarginal line, with the unaltered edge of the frond produced beyond and often rolled over it*"; and he includes all three as African, *V. lineata* Sw. being his name for the South African plant. Christensen confines *V. lineata* (L.) to trop. America, but maintains *V. isoetifolia* Bory and *V. scolopendrina* Bory, and indicates both as being represented in South Africa.

Vittaria isoetifolia. Bory, *Voy.* 2, 325 (1804); Kuhn, *Fil. Afr.* 55; Burchell, No. 5838; C. Chr. *Ind.* 654.

Vittaria lineata Sw. Schl. *Adum.* 33; Kze, *Linnaea*, 10, 572; Pappe

and Rawson, 38; Hk. *Sp.* 5, 180; Hk. and Bkr, *Syn. Fil.* 396; Sim, *Ferns of S. Afr.* 1st ed. 216.

Vittaria tenera Fée. Hk. *Sp.* 5, 179.

Vittaria sarmentosa Fée. Hk. *Sp.* 5, 180.

Pteropsis angustifolia. Pappe and Rawson, 43.

Pteropsis Kuhnii. Pappe MS. in Herb. Gub.

Taeniopsis. J. Smith.

Africa and its islands; growing on trees and rocks in damp places, mostly near the mountain tops in South Africa; rare.

West.—Swellendam (Mund); George (Drège; Burchell, 5838); Genadendal (Rev. Kölbing); Table Mountain, above Klaassenbosch, 2300 feet (Bulus, 4907).

East.—Amos Kloof, Grahamstown (Holland); formerly in Fern Kloof, still in Grobbellar's Kloof (Dr Atherstone).

Kaff.—Perie, Mount Kemp, Stutterheim, etc.; frequent in moist forests.

Natal.—Most parts of the colony, not common (Wood); sparsely from coast to Drakensberg (Buchanan); Noodsberg, Fort Buckingham, Inanda, Kranzklloof, Maritzburg, and Coast Bush Bluff (McKen); Buccleuch (Leighton).

Rhodesia.—Chimanimani Mountains, 7000 ft (Swyn. 802).

Portuguese East Africa.—Behind Beira; Magenja da Costa and Messengerie (T. R. Sim).

153. VITTARIA SCOLOPENDRINA (Bory) Thw.

Plate 186. Nat. size.

Rhizome procumbent, wiry, simple or branched, rooting into humus, and clothed with linear black scales. Fronds numerous, two to three feet long, herbaceous, glabrous, half-inch wide at the middle, tapering to the slender wiry stipe, and also tapering somewhat to the bluntly pointed apex. Midrib distinct; two other parallel veins are present on each side but less evident. Margin entire. Sorus linear, slightly intramarginal. A grasslike fern with long pendulous fronds. Found in New Guinea, Philippine and Malayan Isles, Neilgherries, Ceylon, Seychelles and Mozambique.

Portuguese East Africa.—Overhanging streams south of Inhambane; also near Arenja, Magenja da Costa (T. R. Sim, 5781).

***** Polypodieae.

Genus 40. *POLYPODIUM* Linn.

Sori separate, scattered or irregular, round or nearly round, without indusium. Fronds jointed to the rhizome.

A very large genus, containing nearly 800 species. The earlier botanists included under *Polypodium* all ferns with round dorsal sori, whether they had an indusium or not; but since then the genus even as above restricted has been divided by some botanists into many genera, distinguished by the venation.

Key to the species :

§ Frond pinnatifid, pinnate or two-pinnatifid, or occasionally simple.

154. *P. parvulum*. Fronds pinnate, half inch wide, naked or deciduously hairy.

155. *P. vulgare*. Fronds without scales; veins free. Fronds one to two inches wide, pinnate.

156. *P. polypodioides*. Frond clothed with peltate scales, pinnatifid or pinnate.

157. *P. ensiforme*. Frond without scales, and with a line of large areolae on each side of the mid-rib, from which veinlets run to the margin, or again anastomose. The large areolae containing one free veinlet. Frond simple to pinnate, firm.

158. *P. phymatodes*. Frond without scales, veinlets anastomosing freely, and the larger areolae containing smaller areolae besides free veins. Frond simple to pinnatifid, large, thinly coriaceous.

§§ Frond simple (except 162 β).

159. *P. lineare*. Frond one-half to one foot long, without scales. Veins anastomosing freely and irregularly. Sori sunk, placed in a medial row on each side of the mid-rib.

a. Frond herbaceous; rhizome long.

Var. β. *simplex*. Frond larger, thinner, veins more distinct.

Var. γ. *Schraderi*. Frond small, coriaceous; rhizome short, tufted.

160. *P. Pappi*. Frond one to two feet long, without scales. Sori superficial, scattered, or sometimes in an irregular line near the mid-rib.

161. *P. lanceolatum*. Frond set with peltate scales, simple, lanceolate.

Var. β. *sinuatum*. Frond sinuate or pinnatifid.

162. *P. lycopodioides*. Fronds dimorphous, naked, with a line of large medial areolae containing the sori in one regular line in free veinlets. Veinlets outside the areolae anastomosing irregularly.

Var. β . *Mackenii*. Larger, with a wider, flattened, paleaceous, epiphytal rhizome, and larger thinner fronds.

163. *P. loxogramme*. Frond lanceolate. Sori oblong or linear, large. Veins anastomosing.

164. *P. Billardieri*. Frond strap-shaped, small. Veins free; sori oval.

165. *P. punctatum*. Frond coriaceous, one to four feet long, without pubescence. Sori very numerous, scattered, minute.

154. POLYPODIUM PARVULUM Bory.

This species is unknown to us, but is included by Baker from Bourbon, Mauritius and Zambesia, and by Christensen as "Africa austr. Ins. Mascar." Baker's description (*Synopsis Filicum*, 326) is:

"Rhizome stout, short-creeping, clothed with linear scales; frond 4—6 inches long, $\frac{1}{2}$ inch broad, tapering gradually downwards into a very short stem, cut down to the rachis into entire erecto-patent pinnae one line broad; texture subcoriaceous; rachis and both sides naked or deciduously hairy; veinlets immersed, simple; sori 2—6 to a pinna, medial."

155. POLYPODIUM VULGARE Linn.

Plate 135. Nat. size.

Rhizome three to twelve inches long, two to four lines diameter, branched, and clothed with light yellow somewhat deciduous scales. Fronds jointed to the rachis, firmly herbaceous, simply pinnate, glabrous, six to twelve inches long, one and a half to two inches broad, with a naked stipe of two to four inches. Pinnae oblong, one inch long, quarter inch broad, rounded or shortly pointed, widened both ways at the adnate base so that the pinnae meet below, though apart above. Sori abundant, large, set in a row near each side of the mid-ribs. Veins free; veinlets pinnate.

I have seen specimens two feet long and nine inches wide, and Kunze mentions two forms.

This is a widely distributed fern, known as the English

Polypody ; growing on rocks or dry turf banks ; it occurs in Europe, Asia, Africa and America.

Polypodium vulgare Linn. Kze, *Linn.* 10, 499 ; Pappe and Rawson, 39 ; Wood's *Natal Ferns*, 31 ; Hk. and Bkr, *Syn. Fil.* 334 ; Sim, *Ferns of South Africa*, 1st ed., 193 ; C. Chr. *Ind.* 574.

Polypodium australe. Fée, *Gen.* 236.

(*Polypodium* (*Grammitis*) *australe* Mett. is an Australian and South American species with free veins and undivided fronds ; credited by Kuhn to "Prom. Bon. Spei" (Poeppig), but evidently a mistake caused by above cross-names.)

West.—Table Mountain (Drège) ; George (Rawson) ; Langebergen, near Zuurbraak, 3000 ft (R. Schl. 2149).

East.—Bellerne, Bedford (Holland) ; Boschberg (MacOwan) ; Howison's Poort, Grahamstown (Dr Atherstone) ; Oudeberg (Bolos, 701) ; Winterberg (Eck.).

Kaff.—Kat River (Eck.) ; Manubi (Bowker) ; Perie, 4000 feet.

Natal.—Sources of Mooi River, Lyndoch, The Dargle (McKen) ; Boston, Norton's, Riet Vlei, 4000 feet only (Buchanan) ; up country, rare (Wood, Plant 311).

Transvaal.—Rustenburg (Collins in Transvaal Museum Herbarium, 778).

156. POLYPODIUM POLYPODIOIDES (Linn.) Hitchcock.

Plate 136. Nat. size. b Peltate scale of frond, magnified.

c Scale of rhizome, magnified. d Unusual form.

Rhizome very long, slender, woody, closely attached to tree trunks or on moss, and clothed with lanceolate, adpressed, dark scales. Fronds scattered, glabrous on the upper surface, simply pinnate or pinnatifid, rather widest at the base, subcoriaceous, involved when dry, oblong deltoid, three to six inches long, one to two inches broad, with a hard stipe two to three inches long, which, like the underside of the frond, is clothed with small, ovate, pointed, peltate scales. Pinnae oblong or linear, one-half to one inch long, two lines broad, with a widened adnate base, or sometimes not cut quite to the mid-rib ; entire or irregularly crenate, with a rounded apex. Sori in a line on each side of the pinna, almost marginal. Veins anastomosing or free, but not easily seen.

This is one of those curious plants known as Resurrection

plants, on account of the fronds curling up so as to show only the scaly underside of the frond during drought, and again expanding fresh and green when moist weather returns.

A specimen in Herb. Gub. has the frond larger, lower pinnae separate, an inch long, and with one or two distinct pinnules on the lower side (fig. d).

Polypodium polypodioides (Linn.). Hitchcock, *Rep. Mo. Bot. Gard.* 4, 156 (1893); C. Chr. *Ind.* 555.

Polypodium incanum Sw. *Schrad. Jour.* 1800, 2, 25; Kunze, *Linnaea*, 9, 41; Kuhn, *Fil. Afr.* 147; Hk. and Bkr, *Syn. Fil.* 346; Sim, *Ferns of South Africa*, 1st ed., 194.

Marginaria minima. Bory.

Polypodium Ecklonii. Kze, *Linnaea*, 10, 498; Pappe and Rawson, 39.

Acrostichum polypodioides. Linn. *Sp.* 2, 1068 (1753).

Tropical America and Africa; epiphytal on trees, and often far up among the branches.

West.—Knysna (Lady Barkly); Olifantshoek (E. and Z.).

East.—Uitenhage, Bushman's River (E. and Z.); Bedford (Holland);

Grahamstown (Bolos, 1726); Kagaberg (MacOwan).

Kaff.—Beaufort (E. and Z.); Transkei (Drège); Komgha (Flanagan); abundant in Perie, Alice, Dohne, and all the larger forests.

Natal.—Common in upper and midland districts (Wood); Van Reenen's Pass (Dr Rehmann, 7209); Maritzburg, Kranskop, Umpumulo, and common in upland bush (Buchanan); Lidgetton (A. Roberts, 870); Buccleuch (W. Leighton).

Transvaal.—Macamac (McLea); Houtboschberg (W. Nelson, 463; R. Schlechter, 4451); Barberton, 1907 (J. Thorncroft, 96); Woodbush (Mrs Pott, 4668).

Rhodesia.—On a tree in the Temple of Zimbabwe, June 1904 (Holland); Chirinda Forest, 3700—4000 ft. (Swynnerton, 809).

Portuguese East Africa.—Moramballa (Kirk); below Estatuene (T. R. Sim).

157. POLYPODIUM ENSIFORME Thbg.

Plate 137. Nat. size.

Rhizome stout, creeping, branching, rooting, epiphytal, densely paleaceous toward the point, with laciniated, lanceolate, ferruginous scales. Frond glabrous, thickly coriaceous, very various, simply pinnate, ovate-acuminate, four to nine inches long, three to six inches broad, with a channelled rachis six to nine inches long, and sometimes varying to

trifid, or even simple and lanceolate, four to six inches long, three-quarters to one inch broad, with a short glabrous stipe. In the less divided fronds the pinnae are shorter, more rounded at the apex, and confluent below, but in the largest condition, which occurs on the same plant, the four to six pairs of pinnae are quite separate, linear, one to four inches long, three lines broad, sharply pointed, entire or widely crenate, and with a widened and often decurrent adnate base. Lower pinnae longest, others gradually less; terminal pinna four to five inches long, lanceolate, sinuate-crenate, pointed. Sori very large, in a straight line on each side of the mid-rib, one to each crenature of the margin, and sunk into the frond. Veins immersed but easily seen, the primary veins forming one line of large areolae along each side of the mid-rib; outside this, veins run to the margin, or sometimes again anastomose, while inside the large areolae one free single vein (sometimes with a loop on it) reaches as far as the centre, and there carries the sorus.

Polypodium ensiforme. Thunb. *Prod.* 172; *Fl. Cap.* 735; Schl. *Adum.* 19; Kze, *Linn.* 10, 500; Kuhn, *Fil. Afr.* 147; Hk. and Bkr, *Syn. Fil.* 341; Sim, *Ferns of S. Afr.*, 1st ed., 195; C. Chr. *Ind.* 525. *Marginaria ensiformis* Presl. Pappe and Rawson, 39. *Gontophlebium*. Fée, *Genera*.

South Africa only.

West.—Grootvadersbosch (Thunb.); Stofpad (Mund and Maire); Swellendam (Lady Barkly); Knysna (Ecklon; Pappe; T. H. Rex, 826); Millwood Gold Fields (Holland); Genadendal (Zeyher); Dokamma (Drège).

East.—Kowie (Kresfelder).

Kaff.—Not found.

Natal.—Tugela (Gueinzus; Krauss, 299).

158. POLYPODIUM PHYMATODES Linn.

Plate 138. Nat. size.

Rhizome rather stout, firm, procumbent, at first paleaceous with linear dark scales. Frond varying very much, pinnatifid or ovate, sub-coriaceous, glabrous, one-half to two feet long,

six to twelve inches broad, with a naked stipe, not winged, six to twelve inches long. Pinnae four to six pairs, sub-opposite, entire, three to five inches long, three-quarters to one inch broad, tapering above to a point, and connected by a wing a half inch broad along each side of the rachis; the sinus between the pinnae rounded at the base, and as wide as the pinnae. Lower pinnae generally longest; terminal pinna similar to the others, not much longer. Barren frond often narrower, more lanceolate, less deeply cut, and with wider and shorter pointed pinnae; or occasionally small fronds are almost simple. Veins easily seen but not conspicuous, except the mid-rib and pinnae mid-ribs. Veinlets anastomosing freely throughout, and with numerous free veinlets inside the areolae. Larger areolae containing the smaller ones, but with similar (*i.e.* not stronger) veins, are also traceable, and the sori are immersed in the centre of these. Sori round or oblong, sometimes in one row on each side of the mid-rib, and about two lines from it; at other times in about three irregular lines; the sori nearest the margin being smaller. On the same frond occur round sori and others three to five lines long, but the latter are exceptional. Pappe and Rawson's description of the frond may apply, but is not characteristic. It is distinctly almond-scented.

Polypodium phymatodes. Linn. *Sp.* 7860; Kuhn, *Fil. Afr.* 151; Hk. and Bkr, *Syn. Fil.* 364; Sim, *Ferns of S. Afr.*, 1st ed., 196; C. Chr. *Ind.* 553.

Phymatodes vulgaris. Presl, tab. 196; Pappe and Rawson, 40.

Drynaria vulgaris. J. Smith.

Tropics of Asia, Australia, Africa and islands. "Prom. Bon. Spei" (Drège *fide* Kuhn).

Natal.—In the bush around Durban (McKen); coast bush only, often on trees (Buchanan); Inanda (Wood); sea dunes, Durban to Umgini; Port Shepstone; and at Umlalazi coast, Zululand (T. R. Sim). Rhodesia.—Umtali (Mrs Bennett); on a tree in a kloof near Zimbabye (B. H. Holland); Lusitu River, 2500 ft (Swyn. 661, 884—amongst the stones of dry river beds).

Portuguese East Africa.—Abundant in the sandy coast scrub in many places; Inharrime, Zuvalla, Quissico, etc. (T. R. Sim); Zambesia (Kirk).

159. POLYPODIUM LINEARE Thunb.

Plate 139. Nat. size. Plate 140. Var. *Schraderi*.

Rhizome several inches long, slender, woody, glaucous, paleaceous, with dark or brown shining membranaceous pointed scales. Fronds herbaceous, lanceolate, entire, four to twelve inches long, three-quarters to one and a half inches broad at the middle, and tapering to a point, and also tapering slowly to the short stipe. Fronds quite naked, or with a few scales below on the mid-rib when young. Sori large, sunk, mostly in the upper part of the frond, in a row on each side of the mid-rib, and halfway between it and the margin. Veins show very distinctly as a fine network on the upper surface, and when seen through have regular areolae along the mid-rib containing free veinlets, and more or less irregular areolae between these and the margin. Fertile frond often longer, and rather narrower than the barren.

Buchanan doubted if this and *P. normale* Don were both to be found in South Africa, but included *P. Schraderi* Mett. as a species; and Wood evidently followed in excluding *P. lineare* Thbg. I regard *P. lineare* as a common forest fern (in Kaffraria at least), and *P. Schraderi* Mett. as a mere conditional variety of it, and not very common; while *P. Pappi* (= *P. normale* Don) seems quite distinct in all the specimens I have seen.

Polypodium lineare. Thunberg, *Fl. Jap.* 335 (1784); Kuhn, *Fil. Afr.* 148; Hk. and Bkr, 354; Sim, *Ferns of S. Afr.*, 1st ed., 197; C. Chr. *Ind.* 540.

Polypodium Gueinzii. Mett. *Polyp.* No. 161, tab. III., f. 18, 19.

Tropical Asia and Africa.

West.—Knysna (T. H. Rex, 824).

Kaff.—Bazija (Baur); common in the Perie and other forests; growing in shade; Engcoba (A. G. McLoughlin, 83).

Natal.—(Gueinzii); forest near York (McKen); not known to Buchanan or Wood, but evidently included in their *P. Schraderi*.

Transvaal.—Belfast (R. Leendertz, 2779); Houtboschberg (J. Burt-Davy, 1241); Haenertsberg (Mrs Pott, 4669).

Var. β . SIMPLEX (Sw.). Fronds larger and more thinly herbaceous, one and a half feet long, two inches broad. Veins

more distinct. Placed as a variety of *P. lineare* by Baker (*Syn. Fil.*), but maintained by Christensen as a species under the name *P. excavatum* Bory, from tropical Africa, Madagascar, India and Japan.

Polypodium simplex Sw. Kuhn, *Fil. Afr.* 153.

P. lineare Thbg, var. β *simplex*. Hk. and Bkr, *Syn. Fil.* 354; Sim, *Ferns of S. Afr.*, 1st ed., 198.

P. excavatum Bory. C. Chr. *Ind.* 525.

Polypodium loriforme Wall. Hk. *Sp.* 5, 57 (in part, Kuhn).

Var. γ . SCHRADERI (Mett.).

Plate 140. Nat. size.

Rhizome slender, short, and tufted, with black linear scales. Frond thick and leathery in texture, three to five inches long, half inch broad, with the margin reflexed, and narrowed gradually to the base, but almost without stipe. Veins not distinctly visible without looking through, but the upper surface dotted all over with small holes like pin punctures. Sori more numerous than in the type. This form grows on rocks in sunshine, and in their extremes this and the type look very distinct, but gradually approach, evidently in accordance with the conditions of growth. Christensen maintains this as a species, from South Africa only.

P. Schraderi. Mett. *Polyph.* No. 179, t. II., f. 2; Hk. and Bkr, *Syn. Fil.* 354; Kuhn, *Fil. Afr.* 152; Wood's *Natal Ferns*, 32; Sim, *Ferns of S. Afr.*, 1st ed., 199; C. Chr. *Ind.* 562.

Polypodium elongatum Schrad. Schl. *Adum.* 16, tab. 7; Kze, *Linnaea*, 10, 499.

Phymatodes elongata Presl. Pappe and Rawson, 41.

Cape and Natal only. (Natal localities and some of the others include *P. lineare* Thbg, as well as var. *Schraderi*.)

West.—Knysna (Lady Barkly; T. H. Rex, 825); George (Mund and Maire); Olifant's River (Rev. Hesse).

East.—Blockhouse Kloof, Grahamstown (Atherstone); Bontjes River (Drège); Graaffreinet (Bulus, 819).

Kaff.—Shiloh (Rev. R. Baur); Perie, Toise River.

Natal.—All over the colony (McKen Buchanan, Wood); Van Reenen (R. Schl. 6917, in part).

Transvaal.—Marovuni (Burt-Davy, 288); Barberton (T. Williams, 129); Pretoria (Mrs Potts).

160. POLYPODIUM PAPPEI Mett.

Plate 141. Fig. 1. Nat. size.

Rhizome slender, woody, running, branching, and rooting freely, clothed with lanceolate, pointed, deciduous, dark scales. Frond entire, thin, sub-coriaceous, glabrous, naked, lanceolate, one to two and a half feet long, one to three inches broad, tapering to a point, and tapering very slowly to a slightly margined naked stipe three to six inches long. Mid-rib conspicuous, furrowed above, other veins rather obscure and irregular, but in large specimens having primary veins from the mid-rib to the margin at about every half inch distance, between which numerous areolae are formed, mostly including single or dichotomous free veinlets. In smaller fronds there are no primary veins, but numerous irregular areolae. The sori appear sometimes to have indusia present, through the central capsules blackening while the outer remain green. This optical delusion is revealed by a magnifying glass. The sori are superficial and sometimes in a row near the mid-rib, but more frequently scattered irregularly near the mid-rib, and not having any regular position on the veins. This latter condition in Hk. and Bkr *Syn. Fil.* is named *P. normale* Don, var. β *P. longifrons* Wall., and in our first edition we placed *P. Pappei* under *P. normale* Don, but Christensen restores *P. Pappei* Mett. for the South African plant and also maintains *P. normale* Don as from China, tropical Asia, New Guinea and Madagascar.

Kuhn omits *P. normale*, but includes *P. Pappei* Mett., and I cannot distinguish a Natal specimen in Herb. Gub. named "*Phymatodes concinna*, No. 6, N. sp." (Pappe).

Kaffraria.—(Rawson, *vide* Kuhn).

Natal.—Maritzburg, Richmond, and York (McKen); Seven Mile Bush, Upper Umkomaas (Buchanan); Upper districts (Wood); Zwaartkop (T. R. Sim).

161. POLYPODIUM LANCEOLATUM Linn.

Plate 142. Nat. size, small.

Plate 143. Var. *sinuatum*. Nat. size.

Rhizome very long, epiphytal, slender and wiry, slightly branched, clothed in adpressed, lanceolate, dark scales. Fronds simple, linear-lanceolate, coriaceous, entire, rather obtuse, but tapering to both ends, especially to the base, four to twelve inches long, half inch broad, with a paleaceous, or sometimes naked, wiry stipe, one to six inches long. The upper surface of the frond is often almost glabrous, and the underside and stipe are more or less paleaceous with minute peltate scales, which are black in the centre and lighter outside. Sori large, mostly in the upper part of the frond, and sunk into it in a row on each side of the mid-rib. Veins obscure, forming areolae with free veinlets; margin often inflexed. The scales on the frond are similar to those of *P. polypodioides*, but vary very much in number, and the size of the frond also varies. In strong growing forest plants the fronds are six to twelve inches long, with a wiry stalk, and only a few scattered scales; but in rock-grown plants, exposed to sunshine, the fronds are only two to three inches long, with short stalks, and are densely covered with scales.

Schlechtendal mentions vars. *latifolium* and *angustifolium*, but they are not distinct with us.

Polypodium lanceolatum Linn. Hk. and Bkr, *Syn. Fil.* 356; Kuhn, *Fil. Afr.* 147; Sim, *Ferns of S. Afr.*, 1st ed., 201; C. Chr. *Ind.* 537. *Polypodium lepidotum* Willd. Hk. *Sp.* 5, 56; Schl. *Adum.* 17, tab. 8; Kze, *Linnaea*, 10, 497.

Pleopeltis ensifolia Carm. Hk. *Ex. Fil.* pl. 62.

Pleopeltis lepidota Presl. Pappe and Rawson, 40.

A small specimen in Herb. Gub. is named "*Polypodium Zeyheri* Sieb., No. 261."

Tropical and sub-tropical America, India, Africa and islands. Usually epiphytal.

West.—Table Mountain (Bergius); Paradise, Swellendam, George (Rawson); Grootvadersbosch (Drège); Knysna (Pappe).

East.—Karakamma, Bontjes River, Uitenhage, Winterberg (Drège); Albany.

Kaff.—Chumie, Kat River (Drège); Komgha (Flanagan); Bazija (Baur); Perie, Frankfort, Dohne, Toise River, etc. (T. R. Sim).

Natal.—Maritzburg to Drakensberg, common (Buchanan); Inanda (Wood).

Orange Free State.—Near Van Reenen (Dr Bews; R. Schl. 6936, 6914).

Transvaal.—Marovuni (Burt-Davy, 230); Barberton (J. Thorncroft, 129); Johannesburg (A. Pehrsson, 265); Houtboschberg (W. Nelson, 475); Embabaa, Swaziland (Burt-Davy, 2796).

Rhodesia.—Melsetter, 6000 ft (Swyn. 811); Chipete Forest, 3800 ft (Swyn. 812); Chimanimani (Swyn. 813); Mt Pene, 7000 ft (Swyn. 6008, 6019).

Portuguese East Africa.—Moramballa Mts (Kirk, Waller).

Var. β . SINUATUM Sim (in *Ferns of S. Afr.*, 1st ed., 202).

Plate 143. Nat. size.

Frond waved at the margin or irregularly pinnatifid, and in strong plants sometimes two or more of the lobes are an inch or more long. The sori are sunk into the frond, and show themselves through as raised projections on the upper side; and there are sometimes a few scales on the upper as well as on the under surface. Like the type this varies in size in accordance with exposure, but it is constant in its sinuate lobed character where it occurs, and has seldom an ordinary frond. Sometimes it is not unlike *P. polypodioides*, and the peltate scales and the rhizome are similar to that species. Evidently something similar is found elsewhere, for Baker in *Ann. Bot.* vol. V. 1891, in reference to the Columbian *P. leucosporum* Klot., writes: "I now regard this as an abnormal, more or less deeply pinnatifid, form of *P. lanceolatum*."

East.—Tzitzikamma (Dr Atherstone); Fordyce Tree (Holland); Boschberg (MacOwan).

Kaff.—Above Perie Mission Station, and above Evelyn Valley.

Natal.—Seven Mile Bush, Upper Umkomaas, and on the heights near York (Buchanan); Ngomi Forest, and Zwaartkop (T. R. Sim).

Transvaal.—Houtboschberg, 6300 ft (Schlechter, 4452).

162. POLYPODIUM LYCOPODIODES Linn.

Plate 144. Fig. 1. Nat. size. Fig. 2. Var. *Mackenii* Bkr. Nat. size.

Rhizome epiphytal, widely creeping, rather slender, one to two lines diameter, clothed with lanceolate, brown, pointed

scales, which become afterwards nearly white. Fronds lanceolate, glabrous, coriaceous, three to five inches long, one-half to three-quarter inch broad, tapering slowly to the base, and slightly decurrent on the short petiole. Mid-rib distinct; other veins obscure, but forming large medial areolae, containing a free vein, which arises from the top of a smaller costal areola, and on which the sorus is terminal. One or more small irregular areolae lie outside the large ones. Sori in a single row on each side of the mid-rib, large, medial, round, and extending from the apex to the base of the frond. Barren frond wider and more rounded than the fertile.

Polypodium lycopodioides. Linn. *Sp.* 2, 1082 (1753); Kze, *Linnaea*, 13, 132; Hk. and Bkr, *Syn. Fil.* 357; Kuhn, *Fil. Afr.* 149; Sim, *Ferns of S. Afr.*, 1st ed., 202; C. Chr. *Ind.* 542.

Pleopeltis lycopodioides Presl. Pappe and Rawson, 40.

Tropical America, Africa and islands; growing as an epiphyte on trees and rocks.

Natal.—Coast to Inanda (Wood); Kruisfontein, Tongaat, Umbilo, Umhlatuzana (McKen); coast, common (Buchanan); Durban, 20 ft (R. Schl. 2965).

Var. β . MACKENII Sim.

Plate 144. Fig. 2. Nat. size.

Rhizome epiphytal, flattened, and closely adherent to the tree stems, a quarter to half inch broad, and covered with spreading lanceolate, hair-pointed, brownish, persistent scales, which afterwards become lighter in colour. Frond herbaceous or sub-coriaceous, glabrous, ovate-oblong, four to eight inches long, one to one and a half inches broad, rather obtuse at the apex, and the base rounded to the short stipe or slightly decurrent. Fertile fronds narrower. Veins and sori as in the type, but the free vein in the medial areolae is often branched several times, with branches free, or forming small areolae. When in active growth the rhizome sometimes extends a foot or more before fronds appear.

This was described as a species by Baker in *Synopsis Filicum* and is maintained by Christensen, but is only a form

or luxuriant condition of *P. lycopodioides*, and this is admitted by Baker in *Syn. Fil.*

Polypodium lycopodioides Linn., var. *Mackenii*, Sim, *Ferns of S. Afr.*, 1st ed., 203.

P. Mackenii. Baker, *Syn. Fil.* 357; C. Chr. *Ind.* 542.

Natal.—In a ravine, village of Verulam, and at Nonoti (McKen); coast districts (T. R. Sim).

163. POLYPODIUM LOXOGRAMME Mett.

Plate 146. Nat. size. b Sporeling plant.

Rhizome creeping, slender, six to twelve inches long, not wiry, but clothed with pointed, adpressed, small, dark scales. Fronds simple, entire, glabrous, thickly sub-coriaceous, or when dry flaccid, four to twelve inches long, one-half to one inch broad, lanceolate, pointed, tapering gradually down to the base, where there is only a winged mid-rib but seldom a distinct stipe. Veins hidden, anastomosing. Sori oblong, oblique, as in *Asplenium*, immersed, medial.

It generally grows among moss on stones in deep shade, often pendent. Roots furnished with black tomentum.

This has the habit and appearance of *Polypodium lineare*, but the fronds are more succulent, and the sori elongated and sunk.

Polypodium loxogramme. Mett. *Polyp.* No. 216 (1857); Kuhn, *Fil. Afr.* 148; C. Chr. *Ind.* 541.

Gymnogramme lanceolata. Hk. *Sp.* 5, 157; Hk. and Bkr, *Syn. Fil.* 387; Wood's *Natal Ferns*, 35; Sim, *Ferns of S. Africa*, 1st ed. 216.

Grammitis lanceolata. Sw.

Asia, Polynesia, and Africa.

Kaff.—Bazija (Baur); frequent in the forests, Perie, Frankfort, etc.

Natal.—Common from Noodsberg to the Drakensberg (McKen); Umpumulo, Greytown, etc., 3000 to 4000 feet (Buchanan); upper and midland districts (Wood).

Transvaal.—(McLea); Marovuni (Burt-Davy, 280).

Rhodesia.—Umtali (Mrs Bennett); Chirinda, 3080 ft; Mt Pene, 7000 ft (Swyn. 814, 6020).

164. POLYPODIUM BILLARDIERI (Willd.). C. Chr. *Ind.* 513.

Unknown to us, but included by Christensen as from

"Africa australis, New Guinea, Australia, Amer. antarct., Ins. antarct.," and he gives as synonyms *Grammitis Billardieri* Willd., *Grammitis australis* R. Br., *Polypodium australe* Mett., Hk. and Bkr, *Syn. Fil.*, in which latter work it is included in the section *Grammitis*, having veins free, fronds entire, sori oblong; and the following description is given:

"Rhizome creeping, forming a dense mass; fronds 1—6 inches long, 2—6 lines broad, the small ones spatulate, the larger ligulate, bluntish at the point, tapering gradually downwards into the short stem; texture coriaceous; stipe and both sides naked or slightly ciliated, the edge not bordered; veins oblique, often forked; sori close, copious, oval or oblong, in rows nearer the mid-rib than the edge."

165. *POLYPODIUM PUNCTATUM* (Linn.) Sw.

Plate 145. Fig. 2. Part of frond, fertile, nat. size. 2 B Plant, much reduced.

Rhizome short, branching or tufted, half inch diameter, green, with deciduous black scales, but often lost in abundant black woolly rootlets. Frond one to four feet long, two to three inches broad, lanceolate, pointed, entire, rigid, coriaceous, glabrous on both surfaces, with a very few small scattered black scales on all parts of the lower surface. There is no distinct stipe, as the very prominent mid-rib is widely winged to the base. Venation rather obscure, but main veins run straight from the mid-rib to the margin about an inch apart; these are connected by four to six arching veins, which again are connected by small veinlets forming numerous irregular small areolae, each containing several free veinlets. Sori abundant all over the upper part of the frond, minute, irregular, but absent from the larger veins, and thus placed in more or less arching lines between them.

A crested form is common in cultivation.

Polypodium punctatum (Linn.) Swartz. Kuhn, *Fil. Afr.* 151; C. Chr. *Ind.* 557.

Acrostichum punctatum. Linn. *Sp.* 7769.

Polypodium irioides Lam. Hk. and Bkr, *Syn. Fil.* 360; Sim, *Ferns of S. Africa*, 1st ed. 204.

Phymatodes irioides Presl. Pappe and Rawson, 40.

Tropical India, Australia, Africa and its islands; growing on the ground, or epiphytal on trees.

Kaff.—Mouth of St John's River (Sir H. Barkly; Flanagan, 2469; Dr Kolbe); Umzimvubu (Drège).

Natal.—Coast districts to Inanda (Wood); common to 500 feet alt. (Buchanan); Palmiet River, near Clare (McKen); Durban (R. Schl. 3161, distributed as *Acrostichum* sp.).

Rhodesia.—Umtali (Mrs Bennett).

Portuguese East Africa.—Macequece (Holland); Zambesiland (Kirk).

Genus 41. *CYCLOPHORUS* Desv.

Sori numerous, densely placed all along the upper part of the frond, and nearly covered by the stellate tomentum. A small genus, formerly included in *Polypodium*, and containing about 63 species.

166. *CYCLOPHORUS AFRICANUS* (Kze) C. Chr.

Plate 145. Fig. 1. Frond, nat. size. 1 B Plant on tree stem, much reduced.

Rhizome epiphytal, running, branching, three to six inches long, one to two lines diameter, green, but covered with spreading, ovate-lanceolate, light brown, ciliated scales, one-third inch long, which are persistent after the old fronds have fallen. Fronds two to eighteen inches long, one-half to one inch broad, alternate on the rhizome, to which they are articulated, pendent, linear-lanceolate, often falcate, thick and coriaceous in texture; the margin revolute; both surfaces at first densely covered with rufous stellate pubescence, which is permanent on the underside, though afterwards white, while from the upper surface it almost entirely disappears where exposed. Veins obscure, but in long, regular, nearly equal areolae, with few free veins. Sori numerous, densely placed all over the upper part of the frond, and nearly covered by the tomentum.

Kunze made vars. *major* and *minor* of this, but both grow together with every intermediate.

Polypodium fissum Baker, which Baker mentions in *New Ferns*, page 90, as being found in the Zambesi highlands, appears to be too near *C. africanus*, the main difference being

that it has ferruginous tomentum on the under surface of the frond, while that of *C. africanus* is said by him to be nearly white. But as mentioned above, that of *C. africanus* is at first rufous and afterwards nearly white, at least in some localities. Christensen does not maintain *C. fissum*.

Baker also mentions (*Syn. Fil.*, page 513) concerning *C. africanus*:

"The tropical specimens have an oblanceolate more densely matted frond than those of the Cape, and the scales of the rhizome narrower and firmer, and are separated by Mett. and Kuhn (*Fil. Afr.* p. 152) as a species under the name *P. Schimperianum*."

C. Schimperianus (Mett.) C. Chr. *Ind.* 200, is maintained by Christensen, who also includes as doubtful *C. Karasekii* Christ., *Geogr. d. Farne*, 112, 1910 (nomen) from South Africa.

Cyclophorus africanus (Kze). C. Chr. *Index*, 197.

Polypodium Africanum. Mett. *Polyp.* 268; Hk. and Bkr, *Syn. Fil.* 351; Kuhn, *Fil. Afr.* 145; Sim, *Ferns of S. Africa*, 1st ed., 203.

Niphobolus Africanus. Kze, *Linnaea*, 10, 501; Suppl. to Schk. *Fil.*, tab. 33; Pappe and Rawson, 41.

Gyrosorium. Presl.

Tropical and sub-tropical Africa; generally on trees.

Kaff.—Cove Rock, East London (Murray, Kitton); Iquibica (Miss Crowe); Cape Morgan Forest, Kei Mouth (Flanagan); Yellowwoods Falls, on Cycads (T. R. Sim); Umtata (Drège).

Natal.—Coast, rare (Wood); Dacomb's Kop, Oakford; Umhloti; Umkomanzi; sources of Mooi (McKen); Tookey's Drift, Tugela (Buchanan); Zwaartkop (T. R. Sim).

Rhodesia.—Umtali (Holland, Mrs Bennett); Mazoe, 4500 ft (F. Eyles, 388); Chirinda Forest, 3700—4000 ft (Swyn. 425); Chipete Forest, 3800 ft (Swyn. 425 a, with ferruginous tomentum).

***** Acrosticheae.

Genus 42. *ELAPHOGLOSSUM* Schott.

Sori congested in a mass spread all over the under surface of distinct fertile fronds, not in dots nor lines, nor confined to the veins, and without indusium. Fronds simple; veins free. A considerable genus, containing about 280 mostly tropical species, and included in *Acrostichum* in Hk. and Bkr, *Synopsis Filicum*, and in our first edition.

Synopsis of the species :

167. *E. conforme*. Frond coriaceous, without scales, four to six inches long, one inch broad, rounded at the apex.
 Var. *latifolium*. Frond one-half to two feet long, two to four inches broad, bluntly pointed.
168. *E. petiolatum*. Frond six to fifteen inches long, widest at the middle, firmly herbaceous, bearing at first scattered deciduous scales but not fringed. Fertile frond as long.
 Var. *rupestre*. Frond one to three inches long.
169. *E. hybridum*. Frond herbaceous, lanceolate, fringed with scales. Fertile frond three inches long, including stipe, club-shaped.
170. *E. Aubertii*. Frond one to two feet long, thinly herbaceous, linear-lanceolate, fringed with scales. Fertile frond oblong, on a stipe eight to twelve inches long.
171. *E. lineare*. Frond six to eight inches long, two inches wide. Fertile frond much smaller.
172. *E. spathulatum*. Frond set with hair-like scales on both surfaces. Plant much smaller than the other species.

167. ELAPHOGLOSSUM CONFORME (Sw.) Schott.

Plate 147. Nat. size. Plate 148. Var. *latifolium*.

Rhizome creeping, woody, clothed with lanceolate, pointed, large, loose, wavy scales. Fronds ligulate, rounded at the apex, rounded or tapering to the stipe, four to six inches long, one inch broad, thickly coriaceous, quite glabrous on both surfaces, very light green; mid-rib almost white; the margin entire but undulated; the stipe three to six inches long, quite glabrous, nearly white. Fertile frond about equal to the barren and similar in shape. Sori filling the whole of the under surface except the mid-rib and the cartilaginous margin. Veins obscure, once forked.

Very much confusion has existed between this and the next species. *E. petiolatum* has been repeatedly named *Acrostichum conforme* Sw.; and the two forms of *E. petiolatum* have been named *A. viscosum* and *A. conforme*. We find *E. petiolatum* a quite distinct species, and easily distinguished from this; but it was with great hesitation that we made *A. conforme* and *A. latifolium* distinct species in our first edition, and we have now placed the latter as a variety of the former. Kuhn makes an evident mistake somewhere

in making the two former synonymous and including both Kunze's *A. conforme* and *A. angustatum*, while he omits *A. viscosum* from South Africa, and thus makes only one species of this group.

Lady Barkly also grouped all under *A. conforme*. Schlechtendal's *A. angustatum* is evidently this species, though with a longer stipe.

E. petiolatum grows more or less throughout S. Africa, but I have only seen *E. conforme* from Western Province, and var. *latifolium* from Natal and Rhodesia. Buchanan and Wood used the name *A. conforme* for *A. petiolatum*.

Elaphoglossum conforme (Sw.). Schott, *Gen. ad. t.* 14 (1834); C. Chr. *Ind.* 304.

Acrostichum conforme Swartz. Hk. *Sp.* 5, 198; Hk. and Bkr, *Syn. Fil.* 401; Kuhn, *Fil. Afr.* 43; Sim, *Ferns of S. Afr.* 1st ed. 219 (not Schlechtendal, Kunze, Buchanan, nor Wood).

Acrostichum angustatum. Schl. *Adum.* 14, tab. 5; Kze, *Linnaea*, 10, 494.

Olfersia angustata. Pappe and Rawson, 44.

Baker and Kuhn place *Vittaria acrostichoides* Hk. and Gr. 186 (Kze, *Linn.* 10, 528; P. and R. 53) as an abnormal form of this with the sori in two sub-marginal lines.

Widely distributed in the tropics.

West.—Knysna (Eck.); Swellendam (Zeyher); Voorman's Bosch, Table Mountain (Bulus); Hottentot's Holland, Caledon (P. and R.); George (Holland); Noord Hoek, Simonstown (Lady Barkly); Grootvadersbosch (Zeyher).

Var. LATIFOLIUM Sim.

Plate 148. Nat. size.

Rhizome stout, woody, creeping, thickly clothed with wavy, pointed, dark scales. Barren fronds very various, lanceolate or ovate-lanceolate, widest below the middle, rounded or tapering to the stipe, and narrowed above to a blunt point; half to two feet long, two to four inches broad, with a naked light-coloured stipe two to eight inches long. Frond quite glabrous, thickly coriaceous, with hidden veins, and entire cartilaginous undulated edges. Mid-rib prominent. Fertile frond rather smaller and narrower, the

under surface covered with sori except the mid-rib and edges. Very near the type, and some Table Mountain specimens of that species approach this very closely. Christensen maintains as distinct and from tropical America only the *A. latifolium* (Sw.) J. Sm. with which we connected this in our first edition.

Natal.—On rocks, usually in deep shade; confined to a limited line of country, stretching from Kranskloof through inner Inanda and Noodsberg to Umpumulo, 1500 to 2500 feet (Buchanan); hanging from rocks in crowded masses in midland districts (Wood).

Rhodesia.—Mount Pene, 7000 ft (Swyn. 6009).

168. ELAPHOGLOSSUM PETIOLATUM (Sw.) Urban.

Plate 149. Fig. 2. Nat. size, small.

Plate 150. Fig. 2. Var. *rupestre*.

Rhizome slender, woody, creeping, clothed in large, ovate, pointed, nearly black scales. Barren fronds lanceolate, acuminate, widest at the middle, and tapering slowly to a long acute point and to the stipe; herbaceous or thinly sub-coriaceous in texture, dark green, and when young bearing scattered, ovate, membranaceous, deciduous scales, on the under surface and stipe. Barren frond six to fifteen inches long, half to one and a half inches broad, with a firm stipe two to nine inches long, and when old nearly naked. Fertile fronds equalling the barren in height, but with shorter and narrower laminae, and longer stipe; under surface occupied throughout with sori.

This was formerly confused with *E. conforme*, which see.

E. petiolatum (Sw.). Urban, *Symb. Ant.* 4, 61 (1903); C. Chr. *Ind.* 313.

Acrostichum petiolatum. Sw. *Prod.* 128 (1788).

A. viscosum Sw. Hk. *Sp.* 5, 220; Hk. and Bkr, *Syn. Fil.* 406;

McKen's *Natal Ferns*, 109; Sim, *Ferns of S. Afr.* 1st ed. 221.

A. conforme. Schl. *Adum.* 14; Kunze, *Linnaea*, 10, 495 (with a form *angustum* from same root); Buchanan's List, No. 117.

Olfersia conformis. Pappe and Rawson, 44.

Widely distributed in the tropics and sub-tropics.

West.—Devil's Mountain and Table Mountain (Bergius); Dutoitskloof, Genadendal (Kunze); Caledon, Swellendam (P. and R.).

East.—Amos Kloof, Grahamstown (Holland).

Kaff.—Common in bush above 1000 feet; Perie, Chumie, Frankfort, Stutterheim, Toise River, etc. (T. R. Sim).

Natal.—Kranzkloof, and through Inanda, Noodsberg to Umpumulo, and from this line to the Drakensberg; common, 1500 to 4000 ft (Buchanan, as *A. conforme* Sw.).

Transvaal.—Pilgrim's Rest (J. H. McLea, 54; Bolus, 1730); Marovuni, rare (Burtt-Davy, 290); Haenertsberg (Eastwood); Woodbush (Eastwood).

Rhodesia.—Chimanimani Mts, 7000 ft (Swyn. 810).

Var. RUPESTRE Sim.

Plate 150. Fig. 2. Nat. size.

Rhizome widely creeping, at first densely set with ovate, pointed, dark scales, afterwards naked. Frond one to three inches long, half to three-quarter inch broad, narrowly oval, bluntly pointed, or rounded at the apex, tapering to the stipe, sub-coriaceous; both surfaces as well as the short stipe bearing numerous deciduous, ovate, membranaceous, brown scales, which soon fall off the upper surface, leaving it leathery, dark green, glabrous, and lined by the parallel veins. Fertile frond rather narrower. The extreme form which grows on exposed rocks above 4000 feet alt., looks very distinct from forest-grown forms of *A. petiolatum*, but every intermediate occurs at lower altitudes.

Acrostichum viscosum Sw., var. *rupestre* Sim, *Ferns of S. Afr.*, 1st ed., 222.

West.—Table Mountain (Bolus, 3899, in part); Zwaarteberg, Caledon (Ecklon).

Kaff.—Dohne Hill, Perie, etc. (T. R. Sim).

Natal.—Zwaartkop Mountain (T. R. Sim).

Orange Free State.—Near Van Reenen (Dr Bews; R. Schl. 6917, in part).

Transvaal.—Pilgrim's Rest (J. H. McLea).

169. ELAPHOGLOSSUM HYBRIDUM (Bory) Moore.

Plate 151. Fig. 1. a Barren frond, nat. size. b Fertile frond, nat. size.

Crown procumbent or with a short rhizome, woody, densely paleaceous, with long linear, nearly black, wavy scales. Barren

frond lanceolate, firmly herbaceous, brittle, thin, deep green, entire, but undulated at the margin; more or less pointed at the apex, rounded below, four to twelve inches long, with a firm stipe three to eight inches long. Frond almost naked on both surfaces, but fringed all round the edge with small linear, deciduous, black scales, while the mid-rib on the under side, as well as the stipe, are furnished at first with lanceolate, black, spreading or deflexed, deciduous scales one to one and a half lines long, which are easily rubbed off, and are often nearly absent from old plants. Fertile frond quite different, and much smaller than the barren, one to one and a half inches long, quarter to three-eighths inch broad, flattened when nearly mature, afterwards involute, narrower, and recurved, all soriferous, and with a more or less paleaceous stipe one to three inches long. Veins forked, parallel.

Old barren fronds, from which the scales have fallen, resemble *E. petiolatum* in texture and general appearance; but the fertile frond is quite distinct.

Elaphoglossum hybridum (Bory). Moore's *Index*, 358 (1857); C. Chr. *Ind.* 308.

Acrostichum hybridum Bory. Hk. and Bkr, *Syn. Fil.* 403; Kuhn, *Fil. Afr.* 45; Wood's *Natal Ferns*, 37; Sim, *Ferns of S. Afr.* 1st ed. 222.

Tropical America, Africa, and African islands; growing on damp shaded rocks in wooded ravines.

West.—Paarde Kraal, Knysna (Burchell, 5152; Kuhn).

Kaff.—Abundant in a ravine below Bailey's Grave, Perie (T. R. Sim); also sent by Mr Ely from locality uncertain; Engcoba (McLoughlin, 106).

Natal.—Great Noodsberg, near Peel's, Umlaas, and rare at Maritzburg (McKen); Karkloof, 3000 to 5000 feet, and Drakensberg (Buchanan); Benvie, York (Marriott).

170. ELAPHOGLOSSUM AUBERTII (Desv.) Moore.

Plate 152. Nat. size.

Rhizome short, firm, densely clothed in rather adpressed linear brown scales. Barren frond linear-lanceolate, entire, tapering gradually to the point and to the base, thinly herbaceous, reddish green, one to two feet long, three-quarters to

one inch broad, with a herbaceous stipe three to six inches long. Stipe set with numerous, spreading or reflexed, lanceolate, brown scales; mid-rib with scattered similar scales; both surfaces with occasional smaller scales, and the margins sparsely fringed with small linear brown scales, all more or less deciduous. Veins fine, prominent in the thin lamina, rather distant, simple or forked, not reaching the margin. Fertile frond three inches long, half inch broad, narrowed quickly to the point and to the base, fully occupied with sori, and having a paleaceous stipe eight to twelve inches long.

Elaphoglossum Aubertii (Desv.). Moore's *Index*, 5 (1857); C. Chr. *Ind.* 303.

Acrostichum Aubertii Desv. Hk. and Bkr, *Syn. Fil.* 406; Kuhn, *Fil. Afr.* 43; Sim, *Ferns of S. Afr.* 1st ed. 223.

South America, tropical and sub-tropical South Africa; growing on damp rocks and trees in deep shade.

Natal.—Peel's, Umlaas; Townhill Bush, Maritzburg (McKen); Karloof (Buchanan); Little Noodsberg (Wood); Buccleuch (W. Leighton); Benvie, York (Marriott).

Rhodesia.—Umtali (B. H. Holland, who sends very paleaceous specimens apparently of this, with crenate margin, and one frond has a side lobe one inch long, two lines wide, which may be a freak).

Portuguese East Africa.—Mount Zomba, Zambesia (Kirk).

171. ELAPHOGLOSSUM LINEARE (Fée) Moore.

Plate 151. Nat. size.

Rhizome short, creeping, densely clothed with linear brown scales. Barren frond widely linear, six to eight inches long, one-quarter to one-third inch wide, tapering to both ends, thinly herbaceous, with a firm green stipe one to two inches long. Fertile frond two inches long, one-quarter inch wide on a two-inch stipe. Stipe set with occasional lanceolate, nearly black scales, mid-rib on both surfaces with occasional similar scales, and on the under surface a few scales are scattered. Veins fine, mostly simple, not reaching the margin, and ending in a dot plainly visible on the upper surface. The Rhodesian plants from which the above description is taken are very similar to *E. Aubertii*, and it is possible that further acquaintance will show that they are only rock-grown and exposed dwarf plants of that species. But they agree with the Brazilian

Acr. lineare Fée, and for the present this species is included here, pending further information. Baker (*Syn. Fil.*), under *A. lineare* Fée, mentions a similar plant from Bourbon, which differs only by its more distinct raised veins, and adds: "This is very likely a narrow fronded variety of *A. Aubertii*, with which it agrees in clothing and texture."

E. lineare (Fée). Moore, *Index*, 11 (1857); C. Chr. *Ind.* 310.

Acrostichum lineare. Fée, *Acrost.* 47, t. 15 (1845); Hk. and Bkr, *Syn. Fil.* 406.

Rhodesia.—Mt Pene (Swynnerton, 6014).

172. ELAPHOGLOSSUM SPATHULATUM (Bory) Moore.

Plate 150. Fig. 1. Nat. size.

Crown tufted, paleaceous. Barren fronds obovate cuneate, rounded at the apex, sub-coriaceous, entire, one to two inches long, quarter to half inch broad, and tapering gradually to the slender but firm one to two inch stipe, which is set with soft, spreading, almost hair-like, brown scales, as also is the frond on both surfaces, especially round the margin. Fertile frond different, almost circular, with a crenate margin, half inch long and broad; the under surface filled with sori except at the margin, the upper surface hairy like the two-inch stipe. The two halves of the fertile frond fold more or less together over the sori, sometimes quite close. Veins indistinct.

E. spathulatum (Bory). Moore, *Index*, 14 (1857); C. Chr. *Ind.* 316.

Acrostichum spathulatum Bory. Hk. and Bkr, *Syn. Fil.* 408; Kuhn, *Fil. Afr.* 47; Sim, *Ferns of S. Afr.*, 1st ed., 224.

A. piloselloides. Presl.

Tropical America, Ceylon, South Africa, and Mascarenes.

Natal.—On moist rocks open to the south, from Seven Mile Bush through Nottingham to Karkloof, 4000 to 5000 feet (Buchanan); Lyndoch (McKen); Ingoma, Zululand (Gerrard); Bushman's River in Giant Castle Game Reserve, 7000 ft (T. R. Sim); Bamboo Mtn, Polela (Miss Doidge).

Genus 43. *ACROSTICHUM* Linné.

Sori spread all over the under surface of the frond, not in dots nor lines, not confined to the veins, and without indusia. Fronds (in our species) pinnate. Veins anastomosing freely.

A small genus of three or four species, according to Christensen, but Baker and other authors made it an immense genus, including our genera *Elaphoglossum*, *Stenochlaena* and *Leptochilus*, besides the species now retained in it, and in our first edition we followed that course.

173. *ACROSTICHUM AUREUM* Linn.

Plate 153. Upper part of frond, nat. size.

Crown erect, very large. Fronds pinnate, rigid, coriaceous, glabrous, three to six feet long, one foot broad, with a rigid naked stipe one to two feet long. Pinnae oblong-lanceolate, the lower shortly stalked and barren, six to fifteen inches long, one to two inches broad; the upper fertile, almost sessile, four to six inches long, three-quarters to one inch broad, with a recurved margin all rounded and obtuse, or mucronate at the apex, rounded or shortly cuneate at the base, and with the margin entire. Mid-rib conspicuous; veinlets often obscure, anastomosing freely into small irregular areolae, but without any main veins, or any free veinlets. Fertile pinnae wholly occupied with sori except the mid-rib.

Acrostichum aureum. Linn. *Sp.* 2, 1069 (1753); Hk. and Bkr, *Syn.*

Fil. 423; Sim, *Ferns of S. Afr.*, 1st ed., 226; C. Chr. *Ind.* 5.

Chrysodium aureum Mett. Kuhn, *Fil. Afr.* 50.

Acrostichum inaequale Willd. Pappe and Rawson, 44; Kunze, *Linnaea*, 21, 207.

Acrostichum maritimum. Gueinzus MS.

Tropics generally; often confined to margins of tidal lagoons just above flood level; including, in Africa, Zambesia, Angola, Guinea Coast, South Africa and Mascarenes.

East.—Algoa Bay (Stanger *vide* Kuhn).

Natal.—At the edge of high water at Cato's Creek (McKen); all round the Bay of Natal, and near Umhlali (Buchanan); coast, in marshes and estuaries (Wood); river at Crook's Siding; Illovo River, etc. (T. R. Sim).

Transvaal.—Near Magalisberg (Sanderson).

Portuguese East Africa.—Lourenzo Marques, Inhambane, Quelimane (T. R. Sim).

Genus 44. *PLATYCERIUM* Desvaux.

Plant epiphytal, the barren fronds few, flat and thalloid, and adpressed to what the plant grows on, rounded or cordate at the base; the fertile fronds rising from the sinus, and fresh plants starting from roots at the margin of the mature barren frond. Fertile fronds coriaceous, simple or dichotomously branched, bearing the sori in patches on the back of the bifurcations or upper part of the frond. Veins anastomosing more or less in the fertile frond, and freely in the barren frond. There are only about twelve species, of which three are from Madagascar only.

South-east Asia, Australia, tropical Africa, and South America.

174. *PLATYCERIUM BIFURCATUM* (Cav.) C. Chr.

Plate 154. Plant, much reduced. B Venation of barren frond,
nat. size.

Barren fronds few, three to nine inches wide, rounded, conspicuously veined, those from overlapping plants forming a large thalloid mass one to three feet in diameter. Fertile fronds several together, ascending, two to four feet long, up to three times dichotomously branched, leathery, glabrous above, white-pubescent below. Ultimate segments half to one inch wide, four to eight inches long, rounded at the point. Sori in brown woolly masses on the lower surfaces of the ultimate segments, or meeting and extending downward where they unite. On immature plants, less divided or simple lanceolate fertile fronds occur without sori.

P. bifurcatum (Cav.). C. Chr. *Ind.* 496.

Acrostichum bifurcatum. Cav. *Ann. Nat. Hist.* 1, 105.

Platycerium alcorni Gaud. Hk. and Bkr, *Syn. Fil.* 425; Sim,
Trans. S. A. Ph. Soc. XVI. 3, 293.

Australia, New Caledonia, Lord Howe Island, and tropical Africa; always epiphytal on trees and often high up, and fully exposed to sunshine. It is possible that *P. stemaria* Beauv. does not differ specifically.

Rhodesia.—Umtali (Mrs Bennett; Miss Schultz, who brought down plants now growing in the Botanic Garden, Durban).

Portuguese East Africa.—Macequece (Holland); Portuguese back country behind Beira, and abundant in Magenja da Costa (T. R. Sim).

175. *PLATYCERIUM ANGOLENSE* Welw.

Plate 155. Plant, much reduced.

Barren fronds two to three feet long, twelve to eighteen inches wide, overlapping to make a huge thalloid mass, the lower part of each frond spongy, the upper part membranaceous and conspicuously reticulated. Fertile fronds half to two feet long, nine to fifteen inches wide, firmly coriaceous, cuneate below, irregularly rounded above, undivided, somewhat waved, often oblique, and having the sori in one mass all over the upper portion of the under surface. Epiphytal on trees.

P. angolense Welw. Baker, *Syn. Fil.* 425, under *P. aethiopicum* Hk.; C. Chr. *Ind.* 496.

Portuguese East Africa.—Sofala, Beira, and Magenja da Costa (T. R. Sim).

Baker also mentions it from Angola, collected by Dr Welwitsch.

SUB-ORDER IV. PARKERIACEAE.

Genus 45. *CERATOPTERIS* Brong.

Plant floating in still water, brittle. Capsules sessile, subglobose, with an irregular ring. Sori round, scattered on veins parallel to the mid-rib, and covered by the reflexed margin. One species only.

176. *CERATOPTERIS THALICTROIDES* (L.) Brong.

Plate 109. Fig. 3. Portion of fertile frond. B same, opened out.

A very curious fern, floating in still tropical water, the barren fronds lying on the water and varying from simple with wide segments when young, up to two to three-pinnate, with narrow segments when mature, succulent and fragile,

broken pieces forming adventitious buds and starting fresh plants. Fertile fronds erect, two-pinnate, with linear segments, the margin folded round over the scattered sori.

C. thalictroides (Linn.). Brongn. *Bull. Soc. Philom.* 1821; Hk. and Bkr, *Syn. Fil.* 174; C. Chr. *Ind.* 169.

Acrostichum thalictroides. Linn. *Sp.* 2, 1070 (1753).

Tropics and sub-tropics of America, Asia, Australia, Africa and Madagascar; floating in quiet waters.

Portuguese East Africa.—Moveene, near Lourenço Marques (T. R. Sim); also Magenja da Costa and Messengerie in Zambesia (T. R. Sim).

SUB-ORDER V. GLEICHENIACEAE.

Genus 46. *GLEICHENIA* Smith.

Rhizomes widely creeping, slender. Fronds distant, dichotomous, or repeatedly dichotomous, the ultimate branches with pinnately arranged pinnules. Sori on the back of the pinnules, composed of few capsules, without indusium. Capsules sessile, with a very wide, complete ring, and opening vertically by the separation of two joints of the ring.

These beautiful ferns are distinguished at a glance by the dichotomous branching of the fronds, which occurs in no other South African genus. In the centre of each fork is a bud, and sometimes the one at the first fork develops late in the season into a strong branch, also dichotomously branching, thus giving the frond a somewhat pinnate appearance. The *Gleichenias* are quite distinct in appearance, and equal in beauty most ferns, but, unfortunately, do not readily adapt themselves to cultivation, and are seldom seen away from their native habitats. They are distributed through most of the Southern Hemisphere. There are about 80 species.

Key to the species:

§ Pinnules nearly as broad as long. Sorus at the apex of a veinlet (*Eu-gleichenia*.)

177. *G. polypodioides*.

§§ Pinnules much longer than broad. Sorus medial on a veinlet.
(*Mertensia*.)

178. *G. umbraculifera*. Pinnules occurring on all the dichotomous branches.

179. *G. linearis*. Pinnules on the terminal pinnae, but absent from the lower dichotomous branches, where each fork is subtended by a pair of small pinnated pinnae.

177. *GLEICHENIA POLYPODIOIDES* (Linn.) Smith.

Plate 156. Nat. size. b Part of pinna, magnified. c Capsule, much magnified.

Rhizome very long, often four to six feet, much branched, slender, about one line diameter, when old, brown and polished, like stout copper wire, but when young covered with star-like tufts of black hairs. The rhizome mostly runs along the surface of the soil, rooting down into it, but is sometimes scandent or sub-scandent, or hanging in masses over the top of a rock. Fronds one to three feet long, on brown polished stalks, which are either hairy at the base only, when quite young, and afterwards glabrous, or else woolly-tomentose, especially at the forks. Frond dichotomously branched several times, the ultimate branches, as well as all the branches down to the first fork, set with numerous pinnately arranged pinnae, one to four inches long, two to three lines broad, divided down to the rachis into closely set, bluntly-pointed pinnules, one line broad, one to one and a half lines long. The central buds in the lower dichotomous forks frequently develop into branches, again repeatedly dichotomous, but without pinnae along the main rachis. Fronds are green on the upper, and more or less glaucous on the under surface. In young plants the pinnules are frequently four to five lines long, but as the plant gets older the pinnules become shorter and more rounded. The sori are sunk, pit-like, into the substance of the frond, one in the upper axil of each fertile pinnule, at the end of a veinlet, and contain three to four large capsules each, which fall off soon after midsummer.

Schlechtendal makes two varieties, viz.:

a. *vulgaris*. Pinnules green on underside.

β. *argentea*. Pinnules glaucous on underside.

Kunze makes three species, viz.:

11. *G. polypodioides* Sm.
12. *G. glauca* Sw., with varieties $\left\{ \begin{array}{l} \text{A. } normalis. \\ \text{B. } nudiuscula. \end{array} \right.$
13. *G. argentea* Klf.

He remarks, however, that *G. polypodioides* appears to belong to *G. glauca*, and that *G. argentea* is intermediate between them. Later authorities maintain *G. argentea* as a variety of *G. polypodioides*, and omit *G. glauca*; but Baker recognises only one form. Some specimens have longer pinules, some are more glaucous, and some have the rachis quite set with woolly, ferruginous shag, while others are naked; but all these conditions can be found in one clump, and are caused by surrounding circumstances: and though in dried specimens they may appear distinct forms, still in growth they cannot be separated.

Gleichenia polypodioides (Linn.). Smith, *Mem. Ac. Turin* 5, 419; Schl. *Adum.* 11; Thunb. *Prod.* 173; Thunb. *Flor. Cap.* 377; Schk. *Fil.* 150, t. 149; Kunze in *Linnaea*, 10, 489; Pappe and Rawson, 10; Wood's *Natal Ferns*, 3; Kuhn, *Fil. Afr.* 167; Hk. and Bkr., *Syn. Fil.* 11; Sim, *Ferns of S. Afr.*, 1st ed., 43; C. Chr. *Ind.* 323.

Gleichenia glauca Sw. (*non* Hooker). Kunze, *Linnaea*, 10, 489.

Gleichenia polypodioides, var. *B. glauca*. Hk. *Sp.* 1, 3; Pappe and Rawson, 10.

Gleichenia argentea. Kaulf. *Enum. Fil.*; Kunze, *Linnaea*, 10, 490; Pappe and Rawson, 10.

Onoclea polypodioides. Linn. *Syst. Veg.*

Known only in South Africa; nowhere common, but occasional on damp rocks in Cape Colony, more frequent in Natal, and found north to Angola.

West.—Table Mountain, Genadendal, Tulbagh (Pappe); Cederbergen (Drège); Krom River (Kze); Zondereinde, Knysna (T. H. Rex, 835).

East.—S.W. side of Van Staadensberg (Burchell, 4712); Van Staaden's River (E. and Z.); Tzitzikamma (Atherstone); Fern Kloof, and Howison's Poort, Grahamstown.

Kaff.—Perie Mountain, above Kabula, Glen Gray (Barker); Engcoba (Flanagan, 2691; McLoughlin, 107).

Natal.—Inanda, Noodsberg, and through mid-Natal (Wood); Umpumulo (Buch.); Umlaas and Maritzburg (McKen); Lidgetton (A. Roberts); Shafton, Howick (Mrs H. Hutton, 136); Buccleuch (W. Leighton); Hillcrest and Zwaartkop (T. R. Sim).

Orange Free State.—Rouxville District, Ficksburg (Quail).

Transvaal.—Mamotsinri (Burt-Davy, 213); Rustenburg (M. Collins, 777); Rosehaugh (J. M. Sim).

Rhodesia.—Mazoe, 5200 ft, locally plentiful (E. Eyles, 11; F. Eyles, 341); Gwaai River (J. Sim); Chimanimani Mts, 6500 ft (Swynnerton, 676).

178. *GLEICHENIA UMBRACULIFERA* (Kze) Moore.

Plate 157. Nat. size. b Pinnules, with sori.

Rhizome mostly underground, several yards in length, two to three lines in diameter, at first set with brown scales, afterwards bare and shining. Fronds two to four feet high, more or less fan-shaped, sometimes only once forked, in other cases repeatedly dichotomous, and with the central bud developed into branches, which are again repeatedly dichotomous. The terminal pinnae are three to six inches long, one to one and a half inches broad, tapering to the point, and divided to the rachis into numerous close pinnules, one half to one inch long, and one line broad. These pinnules are also produced all along every branch down to the first fork (except the first length of a developed central bud), and usually the lower pinnules of a branch are smaller than the others. Stem, rachis, and buds densely covered with light brown, woolly tomentum, which soon gets rubbed off the exposed parts, leaving them brown and shining. Pinnules glaucous on the underside, linear, undivided, and bearing six to ten sori each, which are not sunk into the frond, but consist each of four to five capsules, surrounding a raised receptacle.

Gleichenia umbraculifera (Kze) Moore. Hk. *Syn. Fil.* 13; Kuhn, *Fil. Afr.* 168; Wood's *Natal Ferns*, 4; Sim, *Ferns of S. Afr.*, 1st ed., 44; C. Chr. *Ind.* 324.

Mertensia umbraculifera. Kunze, *Linnaea*, 18, 114; Pappe and Rawson, 10.

Found only in South Africa, from Kaffraria northward; growing in dense masses on steep grassy banks, often fully exposed to the sun, from 2000 feet alt. upwards. Never found inside thick bush, but often just above it.

Kaff.—Mount Bazija, Transkei (Baur); Kubusie (A. E. Murray); Perie Mountain, near Bailey's Grave, and above Perie Mission

Station; Dohne Hill above Stutterheim, and frequent in upper streams of Toise River; Engcoba (Flanagan, 2691; McLoughlin, 107).

Natal.—Great and Little Noodsberg (Wood); Greytown, Maritzburg, Richmond (McKen); abounds on Drakensberg at Cathkin; Um-pumulo (Buch.); Lidgetton (A. Roberts, 869); Benvie (Marriott); Shafton (Mrs H. Hutton, 136); Zwaartkop, Clan, Bulwer, etc. (T. R. Sim).

Transvaal.—Near Lydenburg (Dr W. G. Atherstone); Pilgrim's Rest (W. Roe); Mamotsinri (Burt-Davy, 209); Barberton, 5500 ft (G. Thornecroft, 365; E. E. Galpin, 1268); Woodbush (Eastwood, 141); Rosehaugh (J. M. Sim).

Rhodesia.—Melsetter, 6000 ft, a common fern in the kloofs (Swyn. 613); Lusitu Hills (Swyn. 1497).

179. GLEICHENIA LINEARIS (Burm.) Clarke.

Plate 158. Nat. size. b Part of pinnule, with sori.

Frond repeatedly dichotomous, and often with the central buds developed; but the branches are all without pinnules, except the terminal ones, which are six to fifteen inches long, one to three inches broad, tapering both to the base and to the point, and cut throughout, almost to the rachis, into linear pinnules one line broad, one to one and a half inches long, undivided, with a wide base, and a blunt or notched, or frequently one-sided point. The lowest pinnule on the lower side is generally elongated, and sometimes lobed, while at each forking of the branches arise a pair of small pinnae, two to four inches long, one half to one inch broad, divided into pinnules like the terminal pinnae, or lobed or sinuated, especially towards the base, but with the lowest lobe also enlarged.

Sori of six to eight capsules, surrounding a raised receptacle, placed near the middle of a vein. The frond is glaucous on the under surface, and quite glabrous throughout on the Natal specimens, though abroad it is described as being sometimes densely tomentose, as well as changeable in cutting, but characterised by the small pinnae at the base of branches without pinnules.

Gleichenia linearis (Burm.) Clarke, *Trans. Linn. Soc.* (1880); C. Chr. *Ind.* 322.

Polypodium linearis. Burm. *Fl. Ind.* 235 (1768).

Gleichenia dichotoma Willd. Kuhn, *Fil. Afr.* 167; Hk. and Bkr, *Syn. Fil.* 15; Sim, *Ferns of S. Afr.* 1st ed. 45.

Mertensia dichotoma. Kunze, *Linnaea*, 24, 247; Schk. *Fil.* tab. 148.

Mesosorus. Hassk.

Found throughout the tropics.

Natal.—Discovered by Gueinzus (*vide* Kuhn), and re-discovered in 1874 by Rev. J. Buchanan, at Umpumulo, “on moist open slope, facing south, in bush near the top of a hill, two miles W. by S. of the mission station, about 2500 feet”; near Inchanga (Dr J. M. Wood).

Transvaal.—Mauchsberg to Sabie Valley (Burt-Davy, 468); Haenertsberg (Eastwood); Rosehaugh (J. M. Sim); Woodbush (Mrs Pott, 4624).

Rhodesia.—Umtali (Mrs Bennett, who states that it prefers shady banks overhanging water).

SUB-ORDER VI. SCHIZAEACEAE.

Genus 47. *SCHIZAEA* Smith.

Barren frond grass-like; fertile frond grass-like, with the small pinnate fertile segment at the top, the upper surface of the pinnules bearing the sessile capsules.

A most curious and distinct genus, not at all fernlike, and having only a few species; but they are widely distributed.

Synopsis of the species :

180. *S. tenella*. Barren fronds shorter than the fertile, which are slender, and have fertile segments less than a half inch long, bearing five to eight pairs of short pinnules.

181. *S. pectinata*. Barren fronds equal in height to the fertile, which have fertile segment more than a half inch long, and having ten to fifteen pairs of pinnules.

180. *SCHIZAEA TENELLA* Kaulf.

Plate 160. Fig. 1. Nat. size. b Large fertile segment.

Rhizome tufted or shortly running, black, naked, wiry. Barren fronds two to three inches long, quarter line broad, flattened, pointed, twisted, coriaceous, narrowed below into a short, rigid, black, round stipe. Fertile fronds four to six inches long, rigid, wiry, black below, green upward, glabrous, and bearing at the summit the sub-erect fertile segment, which

is a quarter to a half inch long, and has five to eight pinnules on each side, one to one and a half lines long, folded together upward, and bearing the capsules on their inner surfaces. Sometimes the pinnules are forked, and plants found above Evelyn Valley had up to twelve points on each side.

Schizaea tenella Kaulf. Schl. *Adum.* 13; Kunze, *Linn.* 10, 439; Pappe and Rawson, 46; Hk. and Bkr, *Syn. Fil.* 428; Kuhn, *Fil. Afr.* 171; Sim, *Ferns of S. Afr.*, 1st ed., 229; C. Chr. *Ind.* 617.

South Africa only; growing in shallow running water.

West.—Hottentot's Holland (Zeyher); Genadendal (Rev. C. R. Kölbing); George (three to twelve inches long); Clanwilliam (C. Leipold).

East.—Amos Kloof, Grahamstown (Holland); Van Staaden's River (Bolus, 1542).

Kaff.—Above Perie Mission Station, and at Evelyn Valley, 4000 feet alt.; Engcoba Mountain, 1896 (Flanagan, 2755).

Natal.—Inyangwine, Umtwalumi (McKen); near Umbilo Falls (Sanderson).

181. SCHIZAEA PECTINATA (Linn.) Sw.

Plate 159. Fig. 1. Nat. size. b Section of stipe.

Rhizome shortly running or tufted, black, with numerous fronds, which are rigid, coriaceous, four to twelve inches high, one-half to one line broad, with a distinct mid-rib, and narrow, thick, revolute margins, and toward the base narrowed into a wiry, round, black stipe. Fertile segment horizontal, one-half to three-quarter inch long, three-eighths to one-half inch deep, with ten to fifteen linear or forked pinnae on each side, folded together upwards, on the inner surface of which the capsules are placed in two lines. The fertile segment is as large on short plants as on long, and the fronds on one plant are all of equal height.

S. pectinata (Linn.). Sw. *Schrad. Journ.* (1801); Thunb. *Prod.* 172; Thunb. *Fl. Cap.* 734; Schl. *Adum.* 13; Kze, *Linnaea*, 10, 493; Pappe and Rawson, 45; Kuhn, *Fil. Afr.* 171; Hk. and Bkr, *Syn. Fil.* 429; Sim, *Ferns of S. Afr.*, 1st ed., 230; C. Chr. *Ind.* 617.

West.—Top of Table Mountain (Thunberg); Kerstenbosch (Bergius); Drakenstein (Thbg); Cango (Mund and Maire); Cape Flats

(Rawson); Swellendam (Holland); Platteklip (Zeyher); Stellenbosch (E. and Z.); Houtsbay, 200 ft (R. Schlechter, 1014); Ruyterbosch (Miss L. Britten, 142).

East.—Near Grahamstown (Atherstone); Van Staaden's River, Somerset East (MacOwan); Port Elizabeth (W. Kemsley, 253); Walmer (Miss Doidge).

Kaffraria.—Port St John's, 1896 (Flanagan, 2529).

Natal.—(Gueinzus, *vide* Kuhn); Inanda (Wood); near Umbilo Falls (Wood).

Genus 48. *LYGODIUM* Swartz.

Stems slender, scandent, bearing alternate fronds, which, by being dichotomous near the base, appear like two opposite fronds. Capsules in spikes along the edge of ordinary or modified fronds or part fronds, each capsule separately in the axil of an almost marginal infolded involucre, the involucre of each capsule imbricating over that next above. Widely diffused through Asia, America, Africa and Australia.

Synopsis of the species :

182. *L. scandens*. Each pinna simply pinnate.

183. *L. Kerstenii*. Each pinna two-pinnate or more divided.

184. *L. Brycei*. Like *L. Kerstenii*, but sterile fronds sub-rigid, coriaceous, shining, with the rachis brown.

182. *LYGODIUM SCANDENS* (Linn.) Sw.

Plate 161. Barren pinna, nat. size. Plate 162. Fertile pinna, nat. size. B Fertile segment, enlarged.

Underground stem long, black, wiry, slender, repeatedly branched, rooted abundantly, and clothed with shining black lanceolate scales. Scandent stems slender, hard, wiry, glabrous, unbranched, many feet in length, and producing alternate glabrous fronds three to six inches apart. Primary petiole two lines long, ending in an abortive scaly bud, and bearing two divaricate pinnae, each three to six inches long, and simply pinnate. Pinnules jointed on to the short petioles, variable in form, one to one and a half inches long, half to one inch wide below, rounded, cordate, or lobed at the base, and tapering to a rounded apex. Margin crenulate, and in the fertile fronds bearing several irregular segments one to six

lines long, one to three lines wide, several or all of which are modified into capsule-bearing spikes. Terminal pinnule usually forked. Involucres caducous.

This species, which occurs in Eastern Asia, Eastern Australia, Australasia and tropical Africa, has several forms; our plant differs considerably from the form most common in cultivation.

In the report of the Natal Botanic Garden and Herbarium, 1909—1910, reference is made under the name *L. volubile* Sw. to specimens sent from Zululand. *L. volubile* Sw. is a tropical American species very closely allied to *L. scandens*, and evidently these Zululand specimens belonged to *L. scandens* which Dr Wood had previously included in his *Handbook of the Flora of Natal*, 1907.

L. scandens (Linn.). Sw. *Schrad. Jour.* (1801); Hk. and Bkr, *Syn. Fil.* 437 (in part); C. Chr. *Ind.* 413.

Ophioglossum scandens. Linn. *Sp.* 2, 1063 (1753).

Natal.—Zululand (R. D. Lyle, Jan. 1899; Wood, 7335; Natal Govt Herb., 7982 and 7752); Maputa, Amatongaland, 1902 (Sehof; Gryspeert).

183. LYGODIUM KERSTENII Kuhn. "Climbing Fern."

Plate 163. Nat. size. B Fertile segment, enlarged.

Stem wiry, scandent. Frond glabrous, or more or less villose, dichotomously branched at the base, each pinna bipinnate or more divided; pinnules not articulated, one to three inches long, crenate, lobed along the margin, trifid or with large lobes at the base. Lower pinnules three to five-lobed, the central lobe largest. Fertile fronds scarcely different from the barren, except that they bear the short narrow spikes all along the margin.

Mr Holland's specimens are the barren base fronds from non-climbing stems, and consequently, as occurs throughout the genus, larger and more flabellate than those which occur on the climbing stems. Mrs Bennett sends similar specimens, which she states have not got beyond that state during three years' cultivation, but she also sends beautiful scandent specimens, fully fertile, from the natural habitat. Swynnerton states: "A handsome climbing fern, which often completely

enshrouds patches of dense bush or wooded glens." His specimens are pubescent, especially the rachis and mid-rib on both surfaces.

L. Kerstenii. Kuhn, *Fil. Deck.* 28 (1867); Hk. and Bkr, *Syn. Fil.* 525; C. Chr. *Ind.* 412.

L. subalatum Bojer. Kuhn, *Fil. Afr.* 170 (1868); Hk. and Bkr, *Syn. Fil.* 438.

East tropical Africa, Madagascar and Comoro Islands.

Transvaal.—Barberton (Miss Doidge).

Rhodesia.—Waterfall at Penahalonga (Holland); Umtali (Mrs Bennett); Gwaai River (Jas. Sim); Melsetter District (Swynnerton).

184. *LYGODIUM BRYCEI* Baker. (*Kew Bulletin*, 1901, page 138.)

"Near *L. Kerstenii* Kuhn; differs by the sterile fronds being sub-rigid, coriaceous, shining, with a brown rachis. Frond much cut, large, with the primary pinnae oblong-deltoid, sub-rigid, coriaceous, both sides green, shining, slightly hairy, 6—8 inches long. Pinnules deltoid, petiolate, pinnate below, cordate pinnatifid above; segments ascending, contiguous, oblong-obtuse; rachis slender, round, not jointed, brown; veins free, contiguous, evident. Fertile segments not seen.

Rhodesia, Mashonaland, near the Portuguese boundary, drift of Renie River, alt. 2500 ft. Right Hon. J. Bryce."

Not seen by us, but from the description it appears to be too near *L. Kerstenii*.

Genus 49. *MOHRIA* Sw.

Capsules marginal or almost marginal on ordinary fronds. The genus contains only three closely allied species which resemble *Cheilanthes*, but have the capsules of this sub-order, and are confined to Africa and its islands.

185. *MOHRIA CAFFRORUM* Desv.

Plate 160. Fig. 2. Nat. size. 3 Capsule.

Crown erect or sub-erect, paleaceous. Fronds numerous, two-pinnate or three-pinnatifid, firmly herbaceous, bluntly lanceolate, six to eighteen inches long, one to three inches broad, with a paleaceous stipe three to six inches long. Pinnae distant below, closer above, ovate-obtuse, one inch long, half inch broad, with four to seven pairs of ovate pinnules, which are pinnatifid and toothed when barren, but almost entire and

more confluent when fertile. Rachis and under surface more or less paleaceous. This fern seems altogether out of place here, as its habit and general appearance would place it in Cheilanthes, but the capsules which are very large and marginal belong to this sub-order. The upper half of the frond is the part which becomes fertile, and as the edges turn in over the capsules, it becomes more rounded and looks different. It is strongly fragrant, and known as the scented fern; and Pappe and Rawson mention that the dry fronds are pulverised, and with fat made into a cooling ointment for burns and scalds. They give the vernacular name as Brandboschjes.

The size and scaliness of the plant vary exceedingly. Forest-grown specimens have fronds sometimes two feet long, four inches broad, and almost destitute of scales; and there is every gradation from this, down to the dwarf rock-grown specimens with fronds three inches long, three-quarter inch broad, and densely covered with reddish scales. This latter seems to agree in every respect with the description and figure of *Mohria vestita* Bkr (*Icones Plant.*, Plate 1696), from Kili-manjaro.

Another form, *M. achilleaefolia* Lowe, which is very much cut and has the fertile pinnae as much cut, is represented in Dr Atherstone's collection without locality.

Mohria caffrorum (Linn.) Desv. Kuhn, *Fil. Afr.* 171; Hk. and Bkr, *Syn. Fil.* 436; Sim, *Ferns of S. Afr.*, 1st ed., 233; C. Chr. *Ind.* 429.

Polypodium caffrorum. Linn. *Mant.* 307 (1771).

Adiantum caffrorum Linn. Thunb. *Prod.* 173; Thunb. *Fl. Cap.* 736 (not of Swartz).

Osmunda thurifraga Commers. Bory.

Mohria thurifraga Swartz. Schl. *Adum.* 12; Kze, *Linn.* 10, 492; Pappe and Rawson, 46.

Mohria crenata. Desv.

Tropical and sub-tropical Africa and African Islands; generally in damp places in the outskirts of the forests.

West.—Table Mountain, Devil's Mountain, and Lion's Mountain (Bergius); Hangklip (Mund and Maire); Tulbagh, Caledon, Dutoitskloof (Kunze); George (R. Schlechter, 2340; distributed

- as *Cheilanthes*, cf. *multifidens*); Sir Lowry's Pass (R. Schl. 4812); Sneeuwkop (Dr Pearson, 5829).
 East.—Fish River (Thunberg); Somerset East (Bolus); Bushman's River (Zeyher).
 Kaff.—Katberg (Bolus, 330); Komgha (Flanagan); Main, Transkei (Mrs Young); common in Perie, Stutterheim, Chumie, and other forests.
 Natal.—Common (Wood, Buchanan, McKen); Buccleuch (Leighton); Nkandhla (Marriott).
 Orange Free State.—Ficksburg (Quail); Tweespruit (Marriott); Van Reenen (Dr Bews).
 Transvaal.—Magalisberg (Zeyher; R. Leendertz, 3705); near Johannesburg (D. Crawford); Rietvlei, Belfast: Barberton: Marovuni (Burt-Davy, 1936, 328, 232); Woodbush (W. Nelson, 473); Krugersdorp (T. J. Jenkins, 917); Pilgrim's Rest (L. Collins, 892); Waterkloof, Pretoria (A. J. T. Janse, 106); Haenertsberg (Mrs Pott, 4621).
 Rhodesia.—Umtali (Darling; Mrs Bennett); Mazoe (E. Eyles, 27); Bulawayo (Eyles, 1042); Melsetter, 6000 ft (Swyn. 611); Matopo Hills, 4800 ft (Eyles, 128; Miss Gibbs, 235).
 Portuguese East Africa.—Estatuene (T. R. Sim).

186. MOHRIA LEPIGERA Baker.

Fronde larger and more firmly cut than *M. caffrorum*, and densely set with large white scales, so much so that young fronds are completely invested in them.

M. lepigera. Baker, *Ann. Bot.* 5, 498 (1891).

Nothochlaena lepigera. Baker, *Jour. Bot.* 1884, 53.

Rhodesia.—Chimanimani Mts, 7000 ft (Swyn. 611 a).

Portuguese East Africa.—Mount Dzomba, Zambesia, 6000—7000 ft (Sir John Kirk).

Genus 50. *ANEIMIA* Sw.

Fertile part of frond distinct, without lamina, much branched, rising from the base of a pinnate, leafy, barren frond. A very distinct genus with about 60 species, mostly belonging to South America and the West Indies.

Synopsis of the species:

187. *A. Drègeana*. Barren frond simply pinnate, villose.
 188. *A. tomentosa*. Barren frond two-pinnate or two-pinnatifid, tapering toward the base, densely hairy.
 189. *A. anthriscifolia*. Barren frond three-pinnate, deltoid, fibrillose.

187. ANEIMIA DRÈGEANA Kze.

Plate 166. Fig. 1. Nat. size.

Crown erect or sub-erect, the undeveloped fronds clothed in lanceolate scales. Stipe four to eight inches long, villose, somewhat paleaceous below, bearing one barren and two fertile fronds or divisions. Barren frond almost sessile, six to twelve inches long, one and a half to two inches broad, simply pinnate, broadly lanceolate, and bearing six to ten pairs of alternate, ovate, blunt, toothed, thinly sub-coriaceous, sessile pinnae, one inch long, one and a half inches broad. Lower pinnae somewhat auricled on the upper side; upper pinnae with a shortly cuneate sub-equal base. Fertile spike three inches long, half inch broad, on a three to four-inch petiole; its pinnae repeatedly divided into short linear segments, covered on the inner surface with capsules. Veins sub-flabellate, free. Stipe and rachis villose, under surface and veins on upper surface of barren frond slightly villose. The fertile spikes may be regarded as two transformed and fertile lower pinnae, and Wood remarks that he has two fronds, natural sports, "one of which with a large barren frond bears two small ones, which are fertile at the base and barren and leafy at the apex; the other one is a barren frond with the lowest pinna on each side again twice pinnate."

Kunze made two varieties of this species, but they are not distinct.

Aneimia Drègeana. Kze, *Linnaea*, 10, 493; Pappe and Rawson, 46; Kuhn, *Fil. Afr.* 171; Hk. and Bkr, *Syn. Fil.* 431; Sim, *Ferns of S. Afr.*, 1st ed., 231; C. Chr. *Ind.* 52.

South Africa only; in rather dry bush.

Kaff.—Outskirts of forest below Evelyn Valley (Leighton; T. R. Sim), not uncommon at Kei mouth (Flanagan); between the Omsamwobo and Omsamcaba (Drège).

Natal.—Banks of Palmiet, and other streams behind the Berea, Inanda, Maritzburg, Noodsberg (McKen); Umpumulo (Buchanan); collected also by Gueinzus and Krauss (370); Howick, 3100 ft (R. Schl. 5786); Nkandhla (Marriott).

Transvaal.—Marovuni (Burt-Davy, 222); Barberton (J. Thorncroft, 101; P. Oranjie, 362).

188. ANEIMIA TOMENTOSA (Sav.) Sw.

Plate 165. Nat. size.

Stipe nine inches long, firm, channelled, and bearing one barren and two fertile divisions. Barren frond two-pinnate, nine inches long, four inches broad, tapering from the base upward, and having about twelve pairs of alternate spreading pinnae, which are one to two and a half inches long, three-quarters to one inch broad, sessile or almost so, and cut to the mid-rib into about five pairs of rather distant, alternate, oblique pinnules, half inch long, and hardly so broad, which are somewhat decurrent on the lower side, and mostly have a wide connection with the rachis, and are more or less confluent upward. Upper pinnae cut only halfway to the rachis. Fertile spikes shortly stalked, narrow, and cut almost similarly to the barren frond, but without lamina, and with the narrow pinnae ascending. Whole plant set with short reddish tomentum.

A. tomentosa (Sav.) Sw. Hk. and Bkr, *Syn. Fil.* 434; Kuhn, *Fil. Afr.* 171; Sim, *Ferns of S. Afr.*, 1st ed., 232; C. Chr. *Ind.* 55.

A. Schimperiana. Presl.

Osmunda tomentosa. Sav. in *Lam. Enc.* 4, 652 (1797).

South America, tropical Africa, and India.

The above description and figure are from a specimen from Caracas kindly forwarded to me from Kew.

Natal.—Collected by Sanderson, but not found since.

Transvaal.—Dr J. M. Wood has had specimens from Swaziland.

These specimens have not been seen by us, and it is possible that both belong to *A. anthriscifolia*, which was formerly considered to be a variety of *A. tomentosa*.

189. ANEIMIA ANTHRISCIFOLIA Schrad. *Gött. gel. Anz.*

1824, 865.

Plate 164. Nat. size.

Stipe six inches long, bearing when fertile one barren and two fertile divisions. On fertile fronds the barren segment is firmly herbaceous, deltoid, five to six inches long, four to five inches wide, three-pinnate or three-pinnatifid, somewhat fibrillose from long white hairs; ultimate segments toothed;

fertile divisions erect, rigid, half inch wide, six inches long on three-inch stalks, somewhat tomentose, three to four-pinnate, the segments narrow, incurved over the sori. Barren fronds rather larger than the barren section of fertile fronds. This is included by Baker as a form of *A. tomentosa*, and considering the latter as a widely distributed and variable species it may be so, but so far as local specimens go this is sufficiently distinct to rank as a species here. In C. Christensen's *Index*, p. 51, *A. anthriscifolia* is credited to Mexico-Paraguay only.

Transvaal.—Barberton (J. M. Wood, 7599; J. Thornecroft, 959, 1911).
Rhodesia.—Near Umtali (Holland, Mrs Bennett).

SUB-ORDER VII. OSMUNDACEAE.

Genus 51. *TODEA* Willd.

Sori on the under surface of ordinary pinnae. A small genus, confined to South Africa, New Zealand, Australia, and South Sea Islands.

190. *TODEA BARBARA* (Linn.) Moore.

Plate 169. Nat. size.

Crowns sub-erect, in huge clumps, often three feet in height and diameter. Frond two-pinnate or two-pinnatifid, coriaceous, rather rigid, glabrous, ovate-lanceolate or sub-deltoid, two to four feet long, one to two feet broad at the middle, rather less below, and with a stout, naked stipe, one to two feet long. Pinnae sessile, lanceolate, six to twelve inches long, one to two inches broad, tapering to the point, and cut to the mid-rib in the lower part into oblong, obtuse, serrated pinnules, one inch long, quarter inch broad, with a wide adnate base; the upper part of the pinnae not cut quite to the mid-rib. Sori mostly on the lower pinnules; at first more or less distinct, round or oval, afterwards confluent, and filling the whole under surface. Veinlets free, once forked. Our plant is the only species now retained in *Todea*, which formerly included, besides this, three pellucid Australasian filmy ferns now removed to *Leptopteris*.

Todea barbara (Linn.). Moore's *Index*, 119; Hk. and Bkr, *Syn. Fil.* 427; Kuhn, *Fil. Afr.* 172; Sim, *Ferns of S. Afr.*, 1st ed., 228; C. Chr. *Ind.* 633.

Acrostichum barbarum. Linn. *Sp.* 7792.

Osmunda barbara. Thunb. *Prod.* 171; Thunb. *Fl. Cap.* 732.

Todea Africana Willd. Schl. *Adum.* 12; Kze, *Linnaea*, 10, 491;

Pappe and Rawson, 47.

Todea rivularis. Sieber.

Sub-tropical Australia, New Zealand, and South Africa; growing in wet open places. Pappe and Rawson and Lady Barkly say common all over the colony, but it is altogether absent from Kaffraria. In Natal it is abundant in wet woods in the lower districts, and Swynnerton speaks of it as "a large fern growing in dense clumps along the ledges of the cliffs in the Rhodesia-Portuguese boundary mountains."

West.—Table Mountain and district, frequent; Capetown (Rev. F. A. Rogers, 3037); Wellington (M. Knobel, 965); Sneeuwkop, above Bowesdorp, 1910 (Prof. Pearson, 5837).

East.—Tzitzikamma (Dr Atherstone); near Grahamstown (MacOwan): Van Staaden's River (Browning); Krakakamma (Zeyher).

Natal.—Common from Palmiet to Inanda, Noodsberg, and Umpu-mulo, 2500 feet (Buchanan, Wood, McKen); Drakensberg (Kunze); Success (T. R. Sim); Eshowe (Kelly).

Transvaal.—Kloof of Mamotsinri (Burt-Davy, 203).

Rhodesia.—Chimanimani Mts, 7000 ft (Swyn. 830).

Genus 52. *OSMUNDA* Linn.

Fertile pinnae with almost no lamina, and in our species confined to the upper part of the frond, while the lower part is foliaceous and barren. A small genus of nine species, mostly belonging to the temperate zones.

191. *OSMUNDA REGALIS* Linn.

Plate 170. Small frond, nat. size. b Occasional fertile condition.

Crown tufted, sub-erect, often large, the young fronds clothed with yellowish woolly tomentum. Fronds two to four feet long, one to one and a half feet broad, two-pinnate, and barren for the most part, but with a changed, two to three-pinnate, fertile apex. Barren pinnae three to six pairs, ovate-lanceolate, obtuse, glabrous, light green, herbaceous, or sub-coriaceous, eight to twelve inches long, three to four inches broad, and having six to ten pairs of rather irregular,

oblong, sessile pinnae, one to one and a half inches long, half inch broad, obtuse at the apex, entire or minutely serrate at the edges, and rounded or somewhat lobed at the base. Fertile pinnae shorter, and altogether different, very various; sometimes with entire, somewhat foliaceous pinnules two lines broad, and fertile only along the edges (fig. b); but more frequently the pinnules are entirely covered with capsules on the under surface, shortly stalked, and having several round or oblong lobes connected only by the mid-rib. The fertile part soon dies down, and the fronds mostly die down in winter. They are generally two-thirds barren, but sometimes altogether barren, and occasionally two-thirds fertile; while Baker mentions having received specimens from Natal, in which the lateral pinnae were fertile, while the terminal were barren. This is a freak only.

Willdenow makes the South African plant a separate species (*O. spectabilis* Willd.), differing from the European form in being more coriaceous, and having longer and frequently lobed pinnules. Pappe and Rawson give the two forms from South Africa, but I have seen only one form, and that not sufficiently distinct to be even a variety.

Osmunda regalis Linn. Kunze, *Linnaea*, 10, 491; Pappe and Rawson, 46; Hk. and Bkr, *Syn. Fil.* 427; Kuhn, *Fil. Afr.* 173; Sim, *Ferns of S. Afr.*, 1st ed., 227; C. Chr. *Ind.* 475.

O. spectabilis. Willd. *Sp. Pl.* 5, 98.

O. regalis L., var. *spectabilis* Kze. Pappe and Rawson, 47.

O. capensis. Presl (not *O. capensis* Linn., which is *Blechnum capense* (Linn.) Schlecht.).

Widely distributed in sub-tropical and temperate countries; growing in damp spots, usually in full sunshine.

West.—Dutoitskloof (Drège); Hottentot's Holland, Swellendam, Tulbagh (E. and Z.); Table Mountain (now eradicated), French Hoek, Groot Drakenstein, George, Knysna (Lady Barkly); Ceres, 1908 (Dr H. H. W. Pearson, 3517); Pools near Olifants River, Kradow Pass, 1910 (N. S. Pillans, 5327; 5293).

East.—Zuurberg, Uitenhage (E. and Z.); Grahamstown (Holland); Brookhaagen's and Howison's Poorts (Dr Atherstone).

Kaff.—Rare; Omsamcaba (Drège); N'cora Mountains, Cala (Mrs Young); Bazija (Rev. R. Baur); Engcoba (Flanagan, 2477).

Natal.—Common on the coast, and frequent thence to the Drakensberg (Buchanan); Krantzklouf, 1500 ft, 1893 (R. Schl. 3194); Buccleuch (W. Leighton); Shafton (Mrs H. Hutton, 81); Windy-hills, Clan, Zwaartkop, Hilton Road, Edendale, etc. (T. R. Sim).

Transvaal.—Pilgrim's Rest (W. Roe; Bolus, 1732); Shilouvane (Junod, 516); not common, kloofs of Mountains (Burt-Davy, 206); Rustenburg (R. Leendertz, 3516); Belfast and Heidelberg (R. Leendertz, 2778 and 2555); Groenfontein, Waterberg (H. A. Baily, 356); Tzaneen, 2600 ft (Pole-Evans, 643); Woodbush (W. Nelson, 467); Rosehaugh (J. M. Sim); Haenertsberg (Mrs Pott, 4623).

Rhodesia.—Mazoe (H. M. Hole); Umtali (J. F. Darling; Mrs Bennett); Mr Edmond's farm near Salisbury (Holland); Matopo Hills (Eyles; Miss Gibbs; Marloth; Rev. F. A. Rogers); Chirinda, 3700 ft (Swyn. 828); Chipetzana source, 4000 ft (Swyn.).

ORDER II. SALVINIACEAE.

(Included in *Rhizocarpeae* in our first edition.)

Genus 53. *AZOLLA* Lam.

A curious genus of minute plants, floating on water, and having short pinnately branched stems, from the under side of which the roots depend into the water. The branches are set with short clasping leaves, somewhat distant below, abundant and closely overlapping toward the points of the branches. In the axils of the leaves are produced the two kinds of sporangia, both sessile; the larger kind roundish, and containing several or many globular stalked capsules, each containing a few microspores, the smaller roundish, with a conical point, and containing a single reproductive macrospore. There are five species widely distributed, two of which are recorded from Africa.

192. *AZOLLA PINNATA* R. Br.

Plate 172. Fig. 1. a Plant, nat. size. b Point of branch, enlarged. c Sporangium of macrospore, enlarged. d Sporangium of microspores, enlarged.

Plant brownish, one-half to one inch long and broad, formed of one or few fronds, each about a half inch long and a half inch broad at the base, and having three to five pairs of alternate branches, of which the lower are longest

and again slightly branched at the tip, and the others are simple, and each one upward is shorter. Roots clustered, and with abundant rootlets.

A. pinnata R. Br. Kunze, *Linnaea*, 10, 556; Baker, *Fern Allies*, 138; Kuhn, *Fil. Afr.* 202; C. Chr. *Ind.* 148.

Australia, Africa, and Asia.

West.—Incanhini, 10 ft, 1898 (R. Schlechter, 12,033); Cunene River marshes at Houmbe to Fort Rosadas, Angola (Dr H. H. W. Pearson).

Natal.—In a valley near Umgeni, 100 feet alt. (Drège, Hb. Kunze).

Portuguese East Africa.—Lake Ingwenya near the Portuguese Maputa (Prof. Wager, in *Agr. Dept. Herb.* No. 332, 1914).

Kuhn gives "Cape (Drège), Natal (Gueinzus)."

Till Prof. Wager's specimens arrived I had seen no Natal specimen, so the above description and figure are from specimens from the Niger kindly forwarded to me from Kew, but I have since seen the two west coast specimens above referred to, and the Maputa specimens, which all agree with the above.

ORDER III. MARSILIACEAE.

(Included in *Rhizocarpeae* in our first edition.)

Genus 54. *MARSILIA* Linn.

Plants growing in water in constant pools, or where water is generally standing, but seldom in streams. Rhizomes slender, widely creeping, rooting freely, and frequently branching, producing from alternate sides petioles which, when in water, lengthen to the surface, and bear four-foliate leaves with cuneate leaflets. The stalked capsules also arise from the rhizome near the bases of the leaves, but are often only to be found on short branches from which the leaves are decayed. The capsules are oblong, two-valved, opening down the front, and contain a mucilaginous cord, on which at occasional intervals are produced groups of sporangia of both kinds; those for the large spores containing only one spore, and those for the small spores many.

In habit and appearance these plants nearly resemble clover, and they are readily eaten by cattle.

Dr Asa Gray points out that as the genus is named after Marsili, an Italian naturalist, it should be written Marsilia, not Marsilea. Christensen retains Marsilea.

About fifty species are described, of which nearly half are African. The size and appearance change exceedingly in accordance with water supply, as also does the amount of silky pubescence, and we had great doubts about introducing four species into our first edition and have now reduced them to varieties or conditional forms of one species, satisfied that the variations are not fixed.

193. MARSILIA MACROCARPA Presl.

Plate 171. Normal form, nat. size.

Rhizome wide creeping, somewhat succulent, with distant leaves on petioles four to six inches long when growing out of water, and often eighteen inches long in water. Leaflets glabrous, on average plants three-quarter inch long, three-quarter inch broad, with a broadly cuneate base, and rounded, crenate, or occasionally emarginate outer edge. Capsules produced mostly on shorter branches, often after the leaves are decayed, two to three lines long, one to one and a half lines broad, oval oblong, shortly pointed at the lower corner, adnate by nearly the whole base to the half-inch stipe.

M. macrocarpa. Presl, *Abh. böhm. Ges.* 5, 3, 580 (1845); Baker, *Fern Allies*, 144; Kuhn, *Fil. Afr.* 199; Sim, *Ferns of S. Afr.*, 1st ed., 259; C. Chr. *Ind.* 418.

M. Drègeana. A. Br. 1864.

The above is the typical and usual form, but it varies into the forms described below.

West.—“Cape (Drège, E. and Z., Burchell),” Kuhn.

East.—Uitenhage and Grahamstown (Dr Schönland).

Kaff.—East London, King William’s Town, Breakfast Vley, Frankfort, etc. (T. R. Sim); Lovedale (W. G. B. 733); Xalanga (Dr Kolbe, Miss Pegler).

Natal.—Abundant in ponds and slow streams (T. R. Sim).

Transvaal.—Pretoria (Dr Rehmann); Mooi River ditches at Potchefstroom (Burt-Davy, 1027); Rapetoe, 4000 ft (R. Schl. 4675); Springbok Flats (Burt-Davy, 1746).

Var. BURCHELLII (A. Br.) Sim.

Plate 172. Fig. 2. Nat. size.

Rhizome short, freely branched, with a compact habit, hairy buds, and numerous leaves upon petioles about an inch long. Leaflets narrowly cuneate, one to two lines long, half line broad, slightly emarginate at the point, villose. Capsules one line long and broad, on a stipe one line long; attached to the stalk along the whole base, nearly square, but with a distinct point at the upper corner, and rounded from that to the stipe.

M. Burchellii A. Br. Baker, *Fern Allies*, 144; Kuhn, *Fil. Afr.* 198; Sim, *Ferns of S. Afr.*, 1st ed., 258; C. Chr. *Ind.* 417.

M. quadrifolia, γ. *Burchellii*. Kze, *Linnaea*, 10, 556.

M. minuta. Burchell.

M. pusilla. A. Br.

M. pumila. Meyer.

M. filiformis. Burch. (grown in water, so rather larger).

"Cape (Drège; Burchell, 1625, 2123); Orange River (Backhouse)," *fide* Kuhn.

"Cape Colony as far North as the Transvaal" (Baker, *Fern Allies*, 144); Papelfontein, Onder-Bokkeveld, 2200 ft (R. Schl. 10,909).

Var. BILOBA (Willd.) Sim.

Plate 172. Fig. 3. Nat. size.

Rhizome wide creeping, with short branches on which the numerous leaves and capsules are thickly crowded. Leaflets two to six lines long, cuneate, and divided about halfway into two linear lobes; petioles one to three inches long, slender; capsule attached to the two to three line petiole by its whole base, somewhat ascending, nearly square, but with a point at the lower corner, and rounded at the upper corner; one and a half lines long, one line broad, and set with red silky hairs.

M. biloba Willd. Baker, *Fern Allies*, 144; Kuhn, *Fil. Afr.* 198; Sim, *Ferns of S. Afr.*, 1st ed., 258; C. Chr. *Ind.* 417.

M. glomerata. Presl.

"Cape, near Mossel Bay (Meuron), (Drège; Burchell, 4444)," *fide* Kuhn; Lovedale (W. G. B. 729); Boterkloof (*West*), 2300 ft (R. Schl. 10,889); Gwelo (*Rhodesia*), (Gardner, 28); Transvaal (Burtt-Davy).

Var. CAPENSIS (A. Br.) Sim.

Plate 172. Fig. 4. Nat. size.

Rhizome short jointed, with branches producing numerous leaves and capsules; the leaves on petioles four to six inches long. Leaflets cuneate, rounded at the point or slightly emarginate, almost glabrous, half inch long, two lines broad. Capsules oblong-oval, one to one and a half lines long, one line broad, horizontal, slightly pointed at the lower corner, and only shortly adnate to the stipe, which is two lines long.

M. capensis A. Br. Baker, *Fern Allies*, 144; Kuhn, *Fil. Afr.* 198; Sim, *Ferns of S. Afr.*, 1st ed., 259.

M. quadrifolia, var. β . Kunze, *Linn.* 10, 555.

M. villosa. Burchell (leaves densely silky).

Common in Kaffraria in pools where the water is not constant.

"Uitenhage (E. and Z.; Alexander, 50); Olifants River (Mund and Maire); Kurrée (Mund and Maire, Drège, Zeyher); Natal (Robertson, 472)," *vide* Kuhn; Lovedale (W. G. B. 727).

Natal.—Near Fox Hill, Maritzburg, Little Noodsberg, Durban Flat, Caedmore (Buchanan).

Rhodesia.—Matopo Hills, Malmani River (Miss Gibbs, 289); Cunene River marshes at Houmbe to Fort Rosadas, Angola (Dr H. H. W. Pearson).

Var. DISSECTA Sim.

Plate 172. Fig. 5.

Leaves on petioles four to six inches long; leaflets one-half inch long and wide, deeply four-lobed, the lobes linear and rounded at the apex.

Uitenhage (R. Schlechter, 2536; distributed as *M. biloba*).

Var. LOBATA Sim.

Plate 172. Fig. 6.

A vigorous plant six inches high; leaves three-quarter to one and a half inches across; nearly glabrous; the lobes cuneate, four-lobed, one to two lines long; petioles pubescent, slender; crown stout, set with brown scales. Capsules very large, pubescent.

Bulawayo, 4500 ft, June (Eyles, 26).

DIVISION II. MARATTIALES.

ORDER IV. MARATTIACEAE.

Genus 54. *MARATTIA* Swartz.

Capsules united in a double line into a concrete sorus. Sori on the back of ordinary pinnae. Vernation circinate. A small tropical genus of about 20 species; rare in South Africa.

194. *MARATTIA FRAXINEA* Sm.

Plate 173. Pinna, nat. size.

Crown erect, large, irregular. Frond two-pinnate, coriaceous, glabrous, four to six feet long, two to three feet broad, with a very stout paleaceous stipe, one to two feet long, swollen at the base, and articulated to the crown. Pinnae one to two feet long, one foot broad, with a terminal pinnule, and numerous similar opposite sessile pinnules, only slightly reduced upward, and with a margined or winged rachis. Pinnules four to six inches long, one-half to one inch broad, lanceolate, rounded below, sharply toothed along the edges, and tapering to a rather long, toothed point. Mid-rib distinct, other veins parallel, simple or forked, with clavate apices. Sori (synangia) oblong or linear, parallel, in a straight line near the margin. Some of Baur's specimens, and also Flanagan's 2476, have the pinnules pinnatifid, or rather bearing beyond their usual breadth occasional lobes half inch long, quarter inch broad, with several sori in each. Kuhn calls our plant *M. salicifolia* Schr., and separates it by its narrow pinnules from *M. fraxinea* Sm., which he allows as far south as Angola and Madagascar. Baker unites these, and Christensen separates them. Most specimens have narrow pinnules, but some have them one inch broad, and the young plants I have seen in growth were so. Kuhn also places here (as sterile fronds) *Pteris cuspidata* Thunb. (*Prod.* 171; Pappe and Rawson, 51; Schl. *Adum.* 46).

M. fraxinea. Smith, *Pl. Icon.* ined., 2, tab. 48; Beddome, tab. 79; Gmel. *Syst. Nat.* 2^d 1294 (1791); Hk. and Bkr, *Syn. Fil.* 440; Sim, *Ferns of S. Afr.*, 1st ed., 235; C. Chr. *Ind.* 414.

M. salicifolia Schrad. Kze, *Linn.* 10, 488; Schl. *Adum.* 11; Pappe and Rawson, 47; Kuhn, *Fil. Afr.* 175; C. Chr. *Ind.* 415.

M. Drègeana. Presl.

M. natalensis. Presl.

M. fraxinea Sm., var. *salicifolia.* McKen.

Tropics and sub-tropics; growing in ravines in shade.

West.—Lakes at George (Lady Barkly, Holland); Knysna (T. H. Rex, 833).

East.—Tzitzikamma (Drège, Atherstone); Storm's River (Roth).

Kaff.—Between Omsamcaba and Omsamwobo (Drège); Bazija (Baur).

Natal.—Maritzburg (Krauss); coast to Maritzburg (Wood); Great Noodsberg, Inanda, Zwaartkop, Field's Hill (McKen); Umbilo Falls, Umpumulo (Buchanan); Buccleuch (W. Leighton).

Transvaal.—Drakensberg (McLea, 53); Marovuni (Burt-Davy, 233); Haenertsberg (Eastwood; Mrs Pott, 4622, 4682 and 4683, lobed); Houtboschberg (W. Nelson, 494); Barberton (Miss Williams, 785).

Rhodesia.—Umtali (J. F. Darling; Mrs Bennett); Penahalanga (Holland); Chirinda Forest, 3700—4000 ft (Swyn. 826); Mt Pene, 6500—7000 ft (Swyn. 826 a, 6025).

DIVISION III. OPHIOGLOSSALES.

ORDER V. OPHIOGLOSSACEAE.

Genus 56. *OPHIOGLOSSUM* Linn.

Capsules without a ring, permanent, and united into a line on each side the spike, which is separate from the barren pinna. Vernation erect. Fertile segment of the frond simple. A small but almost cosmopolitan genus of plants having little resemblance to ferns in general outline, and doubtless often overlooked. They are known as Adder's tongue ferns, and different authors have very different opinions as to how many species they should be divided into. Christensen retains 43 species.

Key to the species:

§ Fertile and barren fronds distinct to the crown. (*Rhizoglossum* Presl.)

195. *O. Bergianum.*

§§ Fertile spike single, arising from the base of the barren segment or from its stipe. (*Eu-ophioglossum.*)

- 196. *O. lusitanicum*. Barren frond linear-lanceolate; plant one to three inches high.
- 197. *O. nudicaule*. Barren frond ovate-lanceolate; plant one to three inches high. Barren segment united low.
- 198. *O. capense*. Frond ovate, tapering to the base, with a more or less distinct mid-rib. Barren segment united high; plant four to eight inches high.
- 199. *O. reticulatum*. Frond cordate at the base, veins reticulated, without distinct mid-rib. Larger than the other species.

195. OPHIOGLOSSUM BERGIANUM Schl.

Plate 167. Fig. 1. Nat. size.

Crown erect, not bulbous, bearing four to eight fronds; the barren and fertile fronds separate to the base; barren fronds one to three inches long, one-half to one line broad, fleshy, tapering below to a narrow yellow stipe; fertile frond one to one and a half inches long, quite linear, with quarter-inch fertile, placed quarter inch or so below the point, which is sometimes linear and sometimes a flattened lamina. The fertile part has four to eight pairs of capsules, placed together. A very distinct little plant, collected many years ago as below, but not found since, till 1892, when it was again found near Cape Town by Mr R. Schlechter.

He collected somewhat similar plants in several localities near Cape Town and distributed specimens, considering that his 989 was typical *O. Bergianum* Schl., and that his 1017 and 1058 were a variety of the same, which he named var. *Harveyanum*. The latter however are Schlechtendal's *O. Bergianum*, as figured in Hooker's *Icones Plantarum*, plate 263, and correspond with Harvey and Pappe's specimens. The name var. *Harveyanum* must therefore sink. These specimens are (1017) from Table Mountain, above Orange Kloof, 700 to 1000 ft alt., and (1058) from moist sandy ground near Wynberg, 80 ft alt., and Schlechter's 10,843 collected at Lammkraal, Clanwilliam, in 1897 also belongs to this. There is an evident misprint in Hk. and Bkr, *Syn. Fil.* 447, where the barren frond is described as one-half to one line long.

Ophioglossum Bergianum. Schl. *Adum.* 10; Kunze, *Linnaea*, 10, 487; Hk. *Icon. Pl.* plate 263; Pappe and Rawson, 48; Kuhn, *Fil. Afr.* 176; Hk. and Bkr, *Syn. Fil.* 447; Sim, *Ferns of S. Afr.*, 1st ed., 236; C. Chr. *Index*, 469.

Ophioglossum pygmaeum. Bergius.

Cape Colony only, and very rare; probably often overlooked.

West.—Seaside of Lion's Mountain beyond Sea Point (Bergius, Harvey, W. C. Faure); in turf near Kuil's River (Pappe); Table Mountain (R. Schl. 1017); Wynberg (R. Schl. 1058); Lammkraal, Clanwilliam (R. Schl. 10,843).

196. OPHIOGLOSSUM LUSITANICUM Linn.

Plate 168 A.

Fertile frond three-quarter to one and a half inches high, including the spike, which is one-third inch long, with about six pairs of capsules, and surmounted by a flattened leafy point. Barren frond rising from the fertile above the base, shortly petioled, one-half to three-quarter inch long, two lines wide, linear-lanceolate. Roots few, fleshy; rootstock not descending. This is Schlechter's 989 referred to under *O. Bergianum*, and the one which he distributed under that name.

O. lusitanicum. Linn. *Sp.* 2, 1063 (1753); Hk. and Bkr, *Syn. Fil.*, in part; C. Chr. *Ind.* 471.

Western Europe, Canaries, Mediterranean, and South Africa; probably often overlooked.

West.—Constantiaberg, near Houtsbay, 250 ft alt. (R. Schl. 989).

197. OPHIOGLOSSUM NUDICAULE Linn. fil.

Plate 168 B.

Rootstock descending, fleshy; roots numerous. Fronds several, the barren segment ovate, three-quarter to one inch long, one-half inch wide, shortly stalked, rising from the lower portion of the fertile peduncle which is one to one and a half inches long, slender, and bearing a one-third inch spike of six to seven pairs of capsules, surmounted by a single acute point. Differs from *O. capense* in its small size, in having the fertile and sterile segments united near the base instead of higher up, and in the barren segment being more distinctly stalked.

Christensen doubtfully places this in *O. Gomezianum* Welw., which he locates in tropical and South Africa.

West.—Lammkraal, Clanwilliam, 1000 ft, Aug. 1897 (R. Schl. 10,842).

East.—Hankey (Mrs T. V. Patterson, 21).

198. OPHIOGLOSSUM CAPENSE Sw.

Plate 166. Fig. 2. Nat. size. Fig. 3. Part of fertile spike, magnified, composed of attached capsules, one above another.

Plate 167. Fig. 3. Small form, nat. size.

Crown erect, with a few large sheathing bracts, but not tuberous. Fronds one or two from a root, four to eight inches high; the fertile part one and a half inches long, surmounted by a short point, and having a petiole one to three inches long from where it joins the barren pinnule, which is glabrous, one to three inches long, three-quarters to one and a half inches broad, ovate, pointed, or obtuse and mucronate, and tapering to the base, with a more or less distinct mid-rib, thick texture, and plain surface, or slightly reflexed edges. Frequently the petiole of the fertile segment is connected for a quarter inch or more with the mid-rib of the barren, but sometimes they are free as far down, making the barren segment shortly stalked.

This plant varies much with situation in size, texture, form, etc., and I have great difficulty in believing that this and the next are distinct species, and not merely conditional extremes of the almost cosmopolitan *O. vulgatum* Linn.; but both are maintained by all authorities. The South African plant has been separated from *O. vulgatum* under the name of *O. capense*, on account of its sometimes more distinct mid-rib, and this name is used by Kunze, Buchanan, Wood, and Kuhn; while Kunze, and Pappe and Rawson, introduce in addition *O. costatum* R. Br., on account of this same character.

Schlechtendal separates as *O. capense* Schl., var. *β. nudicaule*, a plant with the barren frond placed near the base of the stalk, and makes it synonymous with *O. nudicaule* L. This is maintained by Kuhn (*Fil. Afr.* 178), as also is *O. fibrosum* Schum. (from near Magalisberg?), a similar plant, with thin reticulated barren fronds. Christensen also makes

two species out of *O. capense* Schlechtendal, viz. *O. regulare* Schl. and *O. capense* Sw. I do not find anything to justify the two, further than that a small form, differing in size only, has come in from Griquatown (Plate 167, fig. 3).

O. capense. Sw. *Schrader's Jour.* 1803; Schl. *Adum.* 9, pl. 1; Kunze, *Linn.* 10, 487; Kuhn, *Fil. Afr.* 176; Buchanan's List, No. 131; Wood's *Natal Ferns*, 40.

O. vulgatum. Linn. *Sp.* 7740; Hk. and Bkr, *Syn. Fil.* 445; Sim, *Ferns of S. Afr.*, 1st ed., 237.

O. nudicaule. Pappe and Rawson, 54 (not *O. nudicaule* Linn.).

O. lusitanicum. Thunb. *Fl. Cap.* 731; *Prod.* 171 (not *O. lusitanicum* Linn.).

O. costatum. (R. Br.) Kunze, *Linnaea* (1836); Pappe and Rawson, 48.

O. nudicaule, var. *capensis*. Mett.

Widely distributed in South Africa; growing among grass on dry banks.

West.—Table Mountain and Lion's Mountain (Thunb.); Oliphant's River (Mund and Maire); near Cape Town (Bergius); Gamka River (E. and Z.); Griquatown (A. W. Rogers, 1906, small form); Dabeep, Bushmanland (Dr Pearson, 6224); common at Kuibi's Station, German S.-W. Africa (Dr Pearson); Osona, Damaraland, 4000 ft (Dinter, 364).

East.—Uitenhage (Zeyher); Koegaberg, and Bushman's River (E. and Z.); Bedford (Dr Atherstone); top of Cave Mountain, near Graaffreinet, 4500 feet; Nel's Poort, Somerset East (MacOwan; R. Schl. 2695); Port Alfred (Miss L. Britten).

Kaff.—Bazija (Baur); Cathcart (Roth); near King William's Town, frequent (T. R. Sim).

Natal.—Sandy banks near Durban (Wood); Nottingham (McKen); Phcenix (R. Schl. 2935); Maritzburg, Port Shepstone, Vryheid, etc. (T. R. Sim).

Transvaal.—Magalisberg (? see above).

Rhodesia.—Khami (Marloth, 3354).

Portuguese East Africa.—Abundant near Inhambane (T. R. Sim).

199. OPHIOGLOSSUM RETICULATUM Linn.

Plate 167. Fig. 2. Nat. size.

Crown erect, with several sheathing bracts, but not tuberous. Fronds one or two from a root, six to nine inches high, the fertile part one to one and a half inches long, surmounted by a short point, and having a petiole three to four

inches long from where it joins the barren pinnule, which is glabrous, thin, cordate, pointed, somewhat involute, three to four inches long, one and a half to two inches broad, with a distinctly cordate base, and very short petiole or none. Veins distinct, reticulated, without a mid-rib. Fertile spike longer than the barren frond. Larger and thinner than *O. vulgatum*, to which it is closely allied.

O. reticulatum. Linn. *Sp.* 1518; Kunze, *Linnaea*, 9, 12; Pappe and Rawson, 48; Kuhn, *Fil. Afr.* 179; Hk. and Bkr, *Syn. Fil.* 447; Sim, *Ferns of S. Afr.*, 1st ed., 238; C. Chr. *Ind.* 472.

O. vulgatum, var. *reticulatum*. Mett.

Widely distributed; growing among grass, or under bushes. All the specimens in the Cape Herbarium are from Natal, and Kuhn's furthest south locality is Natal, though Lady Barkly says "throughout South Africa," and Baker gives "Cape Colony."

Natal.—All over the colony (Wood); about the upper margins of bush over most of the colony (Buchanan); Cato's Creek, Durban; in Natal Botanic Garden; Umbilo; near Tongaat (McKen); Umlaas River (Krauss).

Transvaal.—(Burt-Davy).

Rhodesia.—Ironmask Hill, Mazoe, 5000 ft (E. Eyles, whose specimen was fifteen inches long; barren frond three inches long, two inches wide, cordate, shortly stalked, placed half up, fertile part one and a half inches long).

Portuguese East Africa.—Zambesiland (Kirk).

COHORT II. LYCOPODIALES.

ORDER VI. LYCOPODIACEAE.

Genus 57. *LYCOPODIUM* Linn.

Capsules uniform, reniform, one-celled, opening lengthways along the top. Spores uniform. Capsules placed singly in the axils of ordinary leaves, or of bracts arranged in terminal spikes. A large genus; often very similar in appearance and habit to species of *Selaginella*.

Stems dichotomously branched, procumbent or sub-erect, clothed all round, or in some species on the upper side only, with adpressed or spreading leaves. In some the capsules

(sporangia) are produced in the axils of ordinary leaves all along the stem; in others they are confined to the upper part of the stem, or to separate spikes, terminal on the branches, and in these cases the capsule-bearing leaves are reduced to ovate bracts. The spores develop prothallia, in which the sexual organs occur.

Synopsis of the species :

§ Capsules in the axils of ordinary leaves all along the stem.

200. *L. saururus*. Stem erect, leaves strap-shaped, one line broad, shortly pointed.

201. *L. verticillatum*. Stem pendulous; leaves subulate, very narrow.

§§ Capsules confined to upper parts of the branches, and having bracts rather different from the leaves, but passing gradually into them.

202. *L. gnidioides*. Fertile portion dichotomously branched.

203. *L. dacrydioides*. Fertile portion not branched.

§§§ Capsules in short distinct spikes with bracts different from the leaves, but with ordinary leaves up to the base of the spike. Stem sub-erect.

204. *L. cernuum*.

§§§§ Capsules in distinct cylindrical or forked spikes, with changed bracts, and having a nearly leafless stalk of several inches. Leaves on all sides of the procumbent stem.

205. *L. clavatum*.

§§§§§ Capsules in a cylindrical spike on a nearly leafless stalk. Lower side of the procumbent stem leafless, and the leaves of two kinds all along the stem.

206. *L. carolinianum*.

200. LYCOPODIUM SAURURUS Lam.

Plate 175. Nat. size. B Leaf and sporangium.

Stems upright, once or twice dichotomously forked, six to eighteen inches long, half inch diameter including leaves, and producing capsules in the axils of unchanged leaves along the stem. Leaves ligulate, half inch long, one line broad, thickly coriaceous, entire, shortly pointed, and loosely ad-

pressed. This is not unlike a small state of *L. gnidioides*, but the capsules are not confined to the points of the branches, nor are the leaves reduced to bracts where fertile.

L. saururus Lam. Baker, *Fern Allies*, 10; Kuhn, *Fil. Afr.* 186; Buchanan's List, 27; Sim, *Ferns of S. Afr.*, 1st ed., 243.

South America, Africa, and its islands; growing on stones.

Cape.—(Ecklon and Zeyher, *vide* Kuhn.)

Natal.—Nottingham Bush, and Lynedoch (Buchanan); Shafton (Mrs H. Hutton, 166); Zwaartkop (T. R. Sim).

201. LYCOPODIUM VERTICILLATUM Linn.

Plate 178. Nat. size.

Stems at first upright, pendulous after they get a foot long, or less if horizontal; slender, weak, one to three feet long, two to three lines diameter, including leaves, repeatedly dichotomously forked; the terminal branches often a foot long, and unforked. Leaves set all round the stem in a spiral or sub-whorled arrangement, deep green, entire, very numerous, subulate, quarter inch long, quarter line broad, somewhat spreading, but with the point inflexed. Sporangia small, in the axils of ordinary leaves, abundant on the upper branches, and often produced over most of the plant, but with no distinct spike, or separate bracts.

Young plants have stems half inch diameter, including leaves, and the leaves on them are a half inch long, but narrow and subulate.

L. verticillatum. Linn. *Suppl.* 448; Pappe and Rawson, 50; Baker, *Fern Allies*, 14; Kuhn, *Fil. Afr.* 187; Buchanan's List, 27; Sim, *Ferns of S. Afr.*, 1st ed., 243.

L. setaceum. Pappe and Rawson, 159.

On ledges of rock, or epiphytal on trees, through most of the southern hemisphere.

Kaff.—Komgha (Flanagan); not uncommon in the Perie, Chumie, and Stutterheim Forests.

Natal.—Maritzburg and Umpumulo Bush (Buchanan); collected also by Gueinzus, and Plant; frequent in all dense bushes in Natal and Zululand (T. R. Sim).

Transvaal.—Macamac (McLea, 31); Houtbosch, 6800 ft (R. Schl. 4757, 6800; W. Nelson, 458; J. Burt-Davy, 5155); Woodbush (Miss Doidge).

Rhodesia.—Umtali (Holland); Mt Pene, 7000 ft (Swyn. 6010).

202. *LYCOPodium GNIDIoides* Linn.

Plate 177. 1. Fertile part, nat. size. 2. Young shoot, barren, nat. size. B Bract. C Leaves.

Stem one to two feet long, two to four times dichotomously forked, stout and erect below, half inch or more in diameter, including leaves, becoming more slender and pendulous upward; often fertile for half its length, but with the fertile part distinct, dichotomously forked, one to two lines diameter, and with differently shaped leaves or bracts, though these pass gradually into the ordinary form where they meet. Fertile portion of stem often continuing to elongate year after year, the present year's growth often succulent and wider, and containing large yellow unopened sporangia while the older portion is more slender and less succulent, but with empty sporangia in the axils of the bracts. Leaves set all round the stem, but in about eight regular straight lines. Leaves thick, coriaceous, green or yellowish green, half inch long, one line broad, blunt or shortly pointed, loosely adpressed, entire, those in the fertile portion shorter, rounder, more pointed, and scarcely larger than the very large yellow spore cases.

L. gnidioides. Linn. *Fil. Suppl.* 448; Schl. *Adum.* 7, tab. 2; Kze, *Linnaea*, 10, 486; Pappe and Rawson, 49; Kuhn, *Fil. Afr.* 184; Baker, *Fern Allies*, 17; Sim, *Ferns of S. Afr.*, 1st ed., 243.

L. pinifolium Kaulf. Pappe and Rawson, 49.

South Africa and Mascarenes; growing on trees or in clefts of rock in forest.

West.—George, Table Mountain (E. and Z.); Knysna (Bulus); Koratra (Drège).

East.—Grahamstown (Dr Atherstone); Howison's Poort (MacOwan).

Kaff.—Frequent in the Perie and other forests, over 2000 feet alt.

Natal.—Inanda, Umpumulo, Maritzburg, Richmond, Karkloof, nowhere common (Buchanan); Zwaartkop, Quideni, Nkandhla, Ngomi, Ngoya, etc. (T. R. Sim).

Transvaal.—Macamac (McLea); Houtbosch, 6800 ft (R. Schlechter, 4758); Haenertsberg (Pole-Evans, 325).

Portuguese East Africa.—Highlands inland from Beira (T. R. Sim).

203. *LYCOPodium DACRYDIOIDES* Baker.

Plate 176. Nat. size. B Leaf, nat. size. C Bracts $\times 4$.

Stems up to two feet long, sparingly branched. Branches about one inch diameter, including leaves. Leaves about nine-ranked, three-quarter inch long, rather shorter upward, all narrowed gradually to an acute point from a base one line wide, dark green, glossy. Branching dichotomous. Fertile portion distinct, one to several inches long, thickened, with nine to ten ranks of quarter inch subulate bracts, acute from a wide base. Closely allied to *L. gnidioides*, but with simple instead of forked spikes, narrower and longer leaves, up to three-quarter inch long, and rather longer bracts than that species.

“Mountains of Transvaal, Natal, Zambesiland, Cameroons, Fernando Po and St Thomas” (Baker, *Fern Allies*, 18).

Natal.—Zwaartkop (Marriott); Ngomi, Nkandhla, Ngoya (T. R. Sim).

Transvaal.—(Burt-Davy).

Portuguese East Africa.—Plants from near Macequece seen in Beira in cultivation (T. R. Sim).

204. *LYCOPodium CERNUUM* Linn.

Plate 179. Fig. 1. Nat. size.

Stem three to four feet long, two to three lines diameter, including leaves, very much branched upwards, rigid, erect, and tree-like, or sub-erect and elongating like *L. clavatum*, but not rooting. Branches short, produced all round the stem at short intervals, mostly in opposite pairs; pinnately branched, with alternate, simple, dichotomous, or repeatedly dichotomous branchlets, which almost all terminate in fertile spikes. Leaves imbricated on the branches, lax and spreading on the stem, subulate, one to two lines long, with a distinct mid-rib. Fertile spikes terminal on the branchlets, a quarter to a half inch long, one line diameter, conical, sessile, often drooping; bracts ovate, pointed, adpressed, ciliated.

L. cernuum Linn. Schl. *Adum.* 5; Kze, *Linnaea* (1836); Pappe and Rawson, 49; Kuhn, *Fil. Afr.* 183; Baker, *Fern Allies*, 23; Sim, *Ferns of S. Afr.*, 1st ed., 244.

Widely distributed in the tropics; growing on damp banks or among stones in sunshine.

West.—Hot springs of the Goudine (Mund); Klip River, Swellendam (Holland); Tulbagh, and Mitchell's Pass (MacOwan); Bain's Kloof, 2000 ft (R. Schl. 10,257); Knysna (T. H. Rex, 845).

East.—Bosch Kloof (Drège); Van Staaden's River (Browning).

Kaff.—Omsamwobo (Dr Atherstone); Magua, E. Pondoland (T. R. Sim).

Natal.—Umgeni (Dr Rehmann, 8662); common on the coast, Durban Flat to Field's Hill, Inanda, and Umpumulo (Buchanan); Hilton Road (T. R. Sim); Zululand sour coast flats, Umlalazi (T. R. Sim).

Transvaal.—Elandshoek (F. A. Rogers, 88); Rustenburg (M. Collins, 776); Barberton (L. C. de Beer, 128); Rosehaugh (J. M. Sim).

Rhodesia.—Chirinda, 3800 ft (Swyn. 458).

205. LYCOPODIUM CLAVATUM Linn.

Plate 180. Fig. 1. Nat. size. B Leaf. C Top of spike, slightly enlarged. D Bract $\times 4$.

Stem procumbent, several yards long, pinnately branched, rooting at short intervals, generally with a long tail-like point, behind which the branches are short and simple, then dichotomous, then repeatedly dichotomous, or pinnate. Branches all more or less ascending, sometimes rooting, the lower ones very much branched, six to twelve inches long or elongating into fresh stems. Leaves finely toothed, firm, green, linear or subulate, channelled, one and a half to four lines long, loosely spreading, with the white hair point directed forward. Fertile part distinct, terminal on ordinary side branches, separated from the leafy part by a nearly naked stalk, two to six inches high, and divided into two, or sometimes into three or four, yellow shortly stalked spikes, two to three inches long, three lines diameter, with spreading, ovate, ciliated, pointed bracts. Roots firm, single, wiry. Common name is "Tod's Tail," or "Club moss."

L. clavatum. Linn. *Sp.*; Pappe and Rawson, 49; Baker, *Fern Allies*, 26; Sim, *Ferns of S. Afr.*, 1st ed., 245.

L. clavatum L., var. *inflexum* Spring. Kuhn, *Fil. Afr.* 184; Buchanan's List, 27.

L. inflexum. Swartz.

Widely distributed in cold countries. In South Africa and other sub-tropical countries seldom below 4000 feet alt.; growing in open grassy slopes. Our form is var. *inflexum* Spring.

West.—Mountains of Hottentot's Holland (Zeyher); Langebergen, near Zuurbraak, 3000 ft (R. Schl. 2147).

East.—Boschberg (MacOwan); Stone's Hill, Grahamstown.

Kaff.—Bethel (Zeyher); Katberg (Holland); Perie, and Mount Kemp, rare (T. R. Sim).

Natal.—Inanda, Umpumulo, Maritzburg (Buchanan; Plant, 329); Zwaartkop and Sweetwaters (T. R. Sim).

Transvaal.—Macamac (McLea, 19); Sabie Falls to Pilgrim's Rest (Burt-Davy, 432); Barberton (Burt-Davy, 558; L. Reck, 372); Rosehaugh (J. M. Sim).

Rhodesia.—Mt Pene, 6500—7000 ft (Swyn. 805).

206. LYCOPODIUM CAROLINIANUM Linn.

Plate 181. Fig. 1. Nat. size. b Capsule and bract, enlarged.

Stem quite prostrate, rooting at every branch, pinnately branched, three to nine inches long, and terminated by the fertile spike, or more frequently extending beyond it; leafless on the under surface, but with a row on each side of spreading, nearly horizontal, obliquely lanceolate or falcate, pointed, firmly herbaceous leaves, a quarter to half inch long, and one line broad; and also with the upper surface thinly covered with smaller, lanceolate pointed, somewhat imbricated leaves in about three rows, which keep the direction of the stem, but are not closely adpressed, and are hardly half the size of the others. Fertile spike single, one to two inches long, two lines diameter, on a nearly naked erect stalk, two to four inches long. Bracts in regular lines, roundly ovate or sub-cordate, with a deflexed or spreading point. The growth of the stem is nearly annual, the older stem dying off during dry weather, leaving only the branches, or two to three inches of the point to start again. I have not seen more than two spikes on one plant, though Schlechtendal figures

five on a plant without branches, and names it *L. repens* Sw. There are several forms of this species, and ours is *L. sarcocaulon* Welw., distinguished by its very large side leaves.

L. carolinianum. Linn. *Sp.*; Kunze, *Linnaea*, 10, 485; Pappe and Rawson, 48; Baker, *Fern Allies*, 28; Kuhn, *Fil. Afr.* 183; Sim, *Ferns of S. Afr.*, 1st ed., 246.

L. repens Sw. Schl. *Adum.* 5, tab. 4.

L. sarcocaulon A. Br. Welw. MS.; Kuhn, *Fil. Afr.* 210 (described).

L. ambiguum Schrad. Schl. *Adum.* 8; Pappe and Rawson, 53; Kuhn, *Fil. Afr.* 183.

L. ericetorum. Schrad. *Gött. Gel. Anz.* 1818, 920.

Widely distributed; growing in open swampy sloping ground where water is constantly running.

West.—Lion's Mountain (Rev. Hesse); Attaquaskloof and Swellendam (Mund); Hottentot's Holland, and Montagu's Pass (E. and Z.); Lowry's Pass, Caledon (MacOwan); near Tulbagh (Dr Marloth); Cedarberg, Kloofsberg (Drège); and Burchell's No. 8091; Langebergen, near Zuurbraak (R. Schl. 2152); Wellington, Bain's Kloof (Miss Doidge).

East.—Howison's Poort, Grahamstown (MacOwan).

Kaff.—Between Omsamcaba and Omsamwobo (Drège); Evelyn Valley, 4000 feet alt. (T. R. Sim).

Natal.—Head of Bay of Natal, Inanda heights, Umpumulo (Buchanan); Windy Hills, Noodsberg (T. R. Sim).

Transvaal.—Magalisberg (Burke, Kuhn); Rosehaugh (J. M. Sim).

Rhodesia.—Matopo Hills, 5000 ft (F. Eyles, 51; Miss Gibbs, 231).

ORDER VII. SELAGINELLACEAE.

Genus 58. *SELAGINELLA* Spring.

Plants very similar in habit to some species of *Lycopodium*, in which genus this was formerly included, and from which it is distinguished by having dimorphous spores and sporangia. Many species have procumbent rooting stems; some have erect stems from spreading rhizomes, others have the stems proceeding from a crown, while a few are annual, and erect or procumbent. In almost all the species the leaves are distichous and dimorphous, though in a few the leaves are all alike and produced all round the stem. Sporangia one-celled,

two-valved, arranged in the axils of bracts in spikes terminal on the branches. The smaller kind of sporangia, which contain numerous small spores, occupy the upper part of the spike, and the larger kind occupy the lower part, and contain several large spores, which on development produce a minute prothallium, on which fertilisation takes place. There are very many species, and the genus is represented in all warmer countries. The habit of growth in *Isoetes* is altogether different.

Synopsis of the species :

§ Leaves set all round the stem, and all of one kind.

207. *S. pumila*. Annual, sub-erect, leaves not awned.

208. *S. rupestris*. Perennial, procumbent, leaves awned.

§§ Leaves of two kinds, one line of larger spreading leaves along both sides of the decumbent stem, and two lines of smaller ascending leaves on the upper surface. Bracts uniform with the leaves, but smaller. Perennials of firm texture.

209. *S. depressa*. Stem not jointed, two to three inches long, slightly branched, procumbent.

210. *S. Kraussiana*. Stem jointed, six to twelve inches long, much branched, prostrate.

211. *S. imbricata*. Stems erect, tufted.

§§§ Leaves as in the previous section. Annuals of thin texture.

212. *S. integerrima*. Leaves not ciliated at all.

213. *S. tectissima*. Leaves half line long, strongly ciliated on the upper side at the base. Smaller leaves cuspidate. Spike half line diameter.

214. *S. Mackenii*. Leaves one line long, shortly ciliated on the upper side at the base; smaller leaves not cuspidate. Spike one line diameter.

215. *S. Cooperi*. Leaves one line long, strongly ciliated on the upper side at the base; smaller leaves cuspidate. Spikes quarter inch long, one line diameter.

§§§§ Leaves as in section 2; spikes resupinate (*i.e.* the smaller bracts in the same plane as the larger leaves, and *vice versa*).

216. *S. molliceps*. Stems erect, tufted.

The third section is altogether unknown to me, and the descriptions given are from Baker's *Fern Allies*.

207. SELAGINELLA PUMILA Spring.

Plate 182. Figs. 2, 3. Forms, nat. size. b Leaf $\times 5$. c Bract $\times 5$.

Plant annual; stems erect or sub-erect, in dense tufts; one to four inches long, very slender, simple or slightly branched; the branches alternate, a quarter to half inch long, and each as well as the terminal one terminated by one or two fertile spikes, a quarter to half inch long, and one line diameter. Leaves few, scattered, all of one kind, and produced on all sides of the stem, at first green, cordate, ovate, pointed, spreading, entire, and about one line long and half a line broad; afterwards reflexed, yellow, and very much smaller. Bracts in regular lines; nearly circular, with a long spreading point. Roots at the base only. Schlechtendal figures, without any difference except size, vars. *pygmaeum* and *bryoides*, the latter being the larger and more procumbent plant.

Selaginella pumila. Spring, *Mon.* 2, 60; Baker, *Fern Allies*, 35; Kuhn, *Fil. Afr.* 192; Herb. Norm. Austr. Afr. No. 967; Sim, *Ferns of S. Afr.*, 1st ed., 249.

Lycopodium pumilum. Schl. *Adum.* 6, tab. 3.

Lycopodium pygmaeum Kaulf. Kze, *Linn.* 10, 6; Pappe and Rawson, 49.

Lycopodium bryoides. Kaulf.

South Africa only, filling small damp mud-holes; rare and local.

West.—Sandy soil, west base of Devil's Mountain (Bergius); Hottentot's Holland (P. and R.); Paarlberg, Stellenbosch (Drège); Claremont (Marloth); Knysna Lake (Mund and Maire); Riversdale (R. Schl. 1724); Vogelgat, 400 ft (R. Schl. 9537); Wynberg, 100 ft (R. Schl. 1572); Grootvadersbosch, Swellendam (P. and R.).

East.—Port Elizabeth (Mrs T. V. Patterson, 2341).

Natal.—(Drège, Kuhn); not known to Buchanan, nor to us.

208. SELAGINELLA RUPESTRIS Sprengel.

Plate 179. Fig. 2. Nat. size.

Stems two to six inches long, one-half to one line diameter, including leaves, mostly procumbent, rather rigid and coriaceous, repeatedly pinnately branched, rooting freely, and growing in dense masses under stones on the top of flat rock. Leaves imbricated all round the stem, and all alike,

one line long, lanceolate, ciliated, keeled, and hair-pointed ; spreading when wet, adpressed when dry. Fertile spikes on the lower branches, not terminal, often in pairs ; half inch long, half line diameter, four-angled, the bracts in four regular keeled rows, ovate-pointed, ciliated, hair-pointed, adpressed.

S. rupestris Spreng. Baker, *Fern Allies*, 35 ; Kuhn, *Fil. Afr.* 192 and 212 ; Buchanan's List, p. 27 ; Sim, *Ferns of S. Afr.*, 1st ed., 250.

S. rupestris, var. *caffrorum*. Milde, *Fil. Eur.* 262.

Lycopodium rupestre. Linn. *Sp.* 1564 ; Pappe and Rawson, 50.

Lycopodium Drègei. Presl.

Braun (in Kuhn, *Fil. Afr.* 212) divides the African forms of this species into several sub-species receding from the American and Asiatic type ; but the distinctions are too finely cut, and one patch partly in shade and partly exposed gives at least two of his forms.

He gives as South African forms :

β. *incurva*. A. Br. MS. Green ; stems adpressed to the ground ; point of the leaves incurved, with the hair-point round upward, and denticulate at the apex. Cilia twelve to twenty ; the lower long, the upper short and toothlike.

A. *capensis*. Cilia twelve to fifteen, hair-point quarter the length of the lamina or less ; white.

B. *angolensis*. Cilia fifteen to twenty, hair-point more than quarter the length of the lamina ; yellowish.

γ. *recurva*. A. Br. MS. Glauous, prostrate but not adpressed ; point of the leaves recurved. Cilia ten to fifteen, spreading. Arista flattened, ciliate or toothed.

A. *Drègeana*. A. Br. MS. = var. *Drègei* Milde. Leaves narrow, bristle-ciliated below.

B. *Welwitschiana*. A. Br. MS. Leaves wider, much recurved, bristle-toothed below.

Widely distributed in temperate regions, or on mountains in the tropics, usually on bare rocks. In South Africa from 2000 to 7000 feet alt. or more. Not recorded from West, but doubtless present on some of the rocky mountains of that region. Burt-Davy includes in his Check-list *S. Drègei* Hiern., var. *pretoriensis* Hiern., which belongs here.

East.—Algoa Bay (Lehmann).

Kaff.—Windvogelsberg (Baur) ; Katberg, 4000 to 5000 feet ; and Witbergen, 5000 to 6000 feet (Drège) ; between Omsamcaba

and Omsamwobo, 2000 feet (Drège); top of Dohne Hill; Bolassi, S.W. of King William's Town (T. R. Sim); Tina River, Transkei (R. Schl. 6397); Main (Mrs Young).

Natal.—(Plant); Umzinyati Falls, Inanda (Buch.); Krantzkloof (R. Schl. 3215); abundant on bare rocks from the coast to the highest mountains, Murchison Flats, Zwaartkop, Giant's Castle, etc. (T. R. Sim).

Transvaal.—Houtbosch (Dr Rehmann, 5576); Marovuni, Crocodile and Magalies Rivers, and Forbes Reef, Swaziland (Burtt-Davy, 14, 199, 2794); Johannesburg, Dreede Poort, Heidelberg (R. Leendertz, 1751, 935, 2568); Breyton (T. R. Sim); Rhenosterpoort (W. Nelson, 492); P. P. Rust and Potgietersrust (F. A. Rogers, 891, 59); Rosehaugh (J. M. Sim).

Rhodesia.—On the walls of Great Zimbabwe (B. H. Holland, *with long white hair tips*); Matopo Hills, general (Miss Gibbs, 4; Burtt-Davy, and Engler); Chimanimani Mountains, 7000 feet (Swyn. 617 a).

209. SELAGINELLA DEPRESSA A. Braun.

Plate 168. Fig. C. Nat. size. D Leaves $\times 10$. E Bract $\times 5$.

Stems in large masses, prostrate, continuing to extend while the back dies off, two to six inches long, pinnately branched, with few, mostly simple, branches. Leaves of the lower plane spaced, spreading, oblong-lanceolate, subacute, flat, moderately firm in texture, one-twelfth inch long, more produced on the upper side of the distinct mid-rib, very cordate, strongly ciliated and much imbricated over the stem on the upper side at the base; leaves of the upper plane a third as long, ovate, little imbricated. Spikes a quarter to a half inch long, one line diameter, not regularly square; bracts lanceolate-deltoid, a line long. Usually prostrate on moist rocks or damp ground under rocks, procumbent when fresh, curled up and yellow when dry, but retaining vitality.

Selaginella depressa. A. Braun; Baker, *Fern Allies*, 50; Sim, *Ferns of S. Afr.*, 1st ed., 251.

S. denticulata. Spring (*ex parte*).

Lycopodium depressum. Sw.

Cape.—(Thunberg, Menzies).

Orange Free State (Cooper).

Kaffraria.—Mount Fletcher (T. R. Sim).

Natal.—Zwaartkop (Stayner); Howick (R. Schl. 6778); Sweetwaters, Bulwer, Nottingham Road, Rosetta, Giant's Castle, Inanda, etc., frequent (T. R. Sim).

Transvaal.—Rosehaugh (J. M. Sim).

Rhodesia.—Matopo Hills, 4500 ft (Eyles, 1043).

Baker remarks: "This is quite distinct from the European *S. denticulata*, with which Spring combines it."

This is evidently rare westward, as Schlechtendal (*Adum.* 8), Kunze (*Linn.* 10, 487), and Pappe and Rawson (53), all place it among little known or doubtful species, and Kuhn only records "Cape (Thunberg), Natal (Gueinzus)"; while we had seen no specimens alive nor in the herbaria, when our first edition was published.

Buchanan gives "*S. denticulata* Link, in damp parts of bush in most parts of Natal," which seems to belong to this species, as *S. Kraussiana* Br., which is also cultivated as *L. denticulatum*, is separately mentioned by him.

210. SELAGINELLA KRAUSSIANA A. Braun.

Plate 182. Fig. 1. Nat. size.

Stem procumbent or sub-erect, herbaceous, half line diameter, not including leaves, one to three feet long, pinnately branched, jointed at each branch, and with one root at the base of each branch. Branches ascending or procumbent, branching repeatedly in a pinnate manner, the ultimate branches often dichotomous. Leaves of two kinds, rather distant, except at the points of the branches; the lower ones spreading, horizontal, broadly lanceolate, pointed, one to two lines long, one-half to one line broad, slightly oblique, minutely toothed all along the edges. The smaller leaves lie along the upper surface of the stem in two rows, flat, with the point upturned, lanceolate-acuminate; one line long, one-third line broad, very oblique at the base. Spikes on the lower branches, one-half to three-quarter inch long, half line broad, four-angled from the ovate-acuminate keeled bracts, being arranged in four regular rows.

S. Kraussiana A. Braun. Baker, *Fern Allies*, 65; Kuhn, *Fil. Afr.* 190; Sim, *Ferns of S. Afr.*, 1st ed., 252.

Lycopodium Kraussianum. Kze, *Linnaea*, 18, 114; P. and R. 50.

Lycopodium denticulatum. Hort. (not Link).

Throughout Africa and African Islands, growing as a carpet on moist ground under trees.

East.—Tzitzikamma (Dr Krauss).

Kaff.—Katberg (Holland); Griqualand East, and Matatiele (Tyson); Bazija (Baur); very common in Perie, Chumie, and Stutterheim Forests, 2000 to 5000 feet (T. R. Sim).

Natal.—Near Chaka's Kraal (Gueinzius); in most parts of the colony in bush (Buchanan); Buccleuch (W. Leighton); frequent (T. R. Sim).

Transvaal.—Pilgrim's Rest (McLea); Barberton (L. C. de Beer, 126); Houtboschberg (Schl. 4425); Hlalikulu, Swaziland (J. Burt-Davy, 5101); Rosehaugh (J. M. Sim).

Rhodesia.—Umtali, 1892 (J. F. Darling); Chimanimani Mts, 7000 ft (Swyn. 803); Mt Pene, 7000 ft (Swyn. 6013).

211. SELAGINELLA IMBRICATA Spring.

Plate 184. Fig. 3. B Upper surface $\times 4$. C Under surface $\times 4$.

Stems erect, six to nine inches long, wiry and bare below, rising several together but hardly rosulate; frond deltoid, usually but not always widest below, tapering to a point which is either normal or long extended. Leaves sparse and irregular on the wiry part of the stem, flat and imbricated above that, ovate-oblique, subacute, half to one line long, firm; leaves of upper plane smaller and more acute. Spikes half inch long, half line wide, four-ranked, square. Bracts ovate, keeled, pointed.

This has long leafless stolons, and Miss Gibbs referring to its growth at Victoria Falls says: "On the top of, and lower down the cliff of the lower gorge of the Zambesi River, forming dense carpeting masses on the edge of the plateau. In drought condition the whole frond is tightly curled up, exposing the light under surface of the pinnae," and a photograph, unfortunately rather indistinct, is given (*Linn. Soc. Jour. Bot.* 37, 262, 1906, pl. 17) of this plant under a tree.

Occurs in the Cameroons, Abyssinia, Zambesia and Arabia.

Rhodesia.—Victoria Falls, 3000 feet (E. E. Galpin, 7054; Eyles, 546; Allen, 90; Jas. Sim; Miss Gibbs, 179, etc.).

212. SELAGINELLA INTEGERRIMA Spring.

(Description from Baker's *Fern Allies*, page 66.)

"Stem trailing, very slender, reaching a length of one-half to one foot, flat on the back, bisulcate on the face, irregularly forked low down, the pinnately arranged branches distant, short, and but little compound. Leaves of the lower plane crowded and ascending on the branchlets, spaced and spreading or deflexed on the main stem, oblique oblong, subacute, one-twelfth inch long, bright or pale green, membranous, more produced on the upper side of the mid-rib, not ciliated at all, rounded on both sides at the base, but only imbricated over the stem on the branchlets; leaves of the upper plane one-third to one-half as long, oblique-ovate. Spikes square, one-quarter to one-half inch long, one to one and a half lines diameter; bracts ovate-lanceolate, strongly keeled.

S. integerrima. Spring, *Mon.* 2, 79.

Lycopodium integerrimum. Hk. and Gr.

Lycopodium ornithopodioides. Hk. and Gr.

Ceylon. Closely allied plants have been sent from Magaliberg, Transvaal, by Sanderson; and from Japan, Bourbon, and Chusan, but none of the specimens are in fruit, and they may be platystachyoid."

We have seen no specimen or further record to support this.

213. SELAGINELLA TECTISSIMA Baker.

(Description from Baker's *Fern Allies*, page 67.)

"Stems filiform, trailing, intermatted, flat on the face, one and a half to two inches long, the few short branches simple or little compound. Leaves of the lower plane spreading, contiguous or slightly spaced, ovate-deltoid, acute, bright green, membranous, not more than half line long, very unequal sided, very cordate, and strongly ciliated on the upper side at the base and much imbricated over the stem, the leaves of the opposite side considerably overlapping each other; leaves of the upper plane half as long, ovate, with a

distinct cusp. Spikes short, half-line diameter, square; bracts ovate, acute, membranous, strongly ciliated, sharply keeled.

S. tectissima. Baker in *Journ. Bot.* 1884, 89.

Magalisberg Mountains, Transvaal, along with the plant mentioned under *S. integerrima* (Sanderson)."

No further specimen or record has been seen by us.

214. SELAGINELLA MACKENII Baker.

(Description from Baker's *Fern Allies*, page 67.)

"Stems filiform, trailing, intermatted, three to four inches long, sulcate both on back and face, forked low down, the few pinnate ascending branches simple or little compound. Leaves of the lower plane spreading, contiguous on the branchlets, spaced on the main stem, oblong, subacute, one-twelfth inch long, pale green, membranous, more produced on the upper side of the mid-rib, cordate and shortly ciliated, and a little imbricated over the stem on the upper side at the base; leaves of the upper plane half as long, oblique-ovate, acute, not cuspidate. Spikes very short, square, one line diameter; bracts ovate-lanceolate, membranous, strongly keeled.

S. Mackenii. Baker in *Journ. Bot.* 1884, 89.

Banks of Tugela River, Natal (Gerrard and McKen, 237). A near ally of *S. integerrima*."

No further specimen or record has been seen by us.

215. SELAGINELLA COOPERI Baker.

(Description from Baker's *Fern Allies*, page 68.)

"Stems intermatted, trailing, filiform, two to three inches long, flat on the back, bisulcate on the face, the few erectopatent branches sparingly compound. Leaves of the lower plane contiguous and ascending on the branches, rather spaced and spreading on the main stem, oblong, acute, one-twelfth inch long, membranous, rather unequal sided, cordate, and strongly ciliated and imbricated over the stem on the upper side at the base; leaves of the upper side half as long, ovate,

with a short cusp. Spikes quarter inch long, square, one line diameter; bracts ovate-lanceolate, membranous, strongly keeled in the upper half.

S. Cooperi. Baker in *Journ. Bot.* 1884, 89.

Orange Free State (Cooper, 1056). Between *albo-nitens* and *integerrima*."

No further specimen or record has been seen by us.

216. SELAGINELLA MOLLICEPS. Spring (*Mon.* 2, 257; Baker, *Fern Allies*, 120).

Plate 183. Nat. size. A Upper surface, magnified. B Under surface, magnified. C Main stem, upper surface, magnified.

Stems six to eight inches long, erect or sub-erect, or procumbent and rooting at the base, and continuous and ascending toward the point. Green portion pinnately and repeatedly much branched. Leaves of two kinds, the smaller above on the stems and under on the spikes. Larger leaves one line long, rather distant on the main stem, close on the branches, acute, oblique, serrulate on the upper edge, overlapping; small leaves shorter, pointed. Spikes one-third inch long, terminal on the branchlets, with the smaller bracts on the same plane as the larger leaves, *i.e.* below. This was referred to but not identified in our first edition, page 262.

Rhodesia.—Umtali, 1892 (J. F. Darling; Mrs Bennett); Matopo Hills (F. Eyles); Victoria Falls (F. Eyles).

Genus 59. *ISOETES* Linn.

Small rush-like plants, having a small bulbous crown from which rise numerous narrow linear-pointed leaves, one to four inches long, containing four air tubes, and with frequent transverse partitions. The leaves widen and thicken at the base, and in their axils somewhat sunk into the base of the leaf, and often partly covered by its epidermis, is to be found the single sporangium. Sporangia one-celled, those in the axils of the outer leaves containing a few large reproductive spores, those in the axils of the inner leaves the numerous minute microspores.

The genus has no outward resemblance to *Selaginella*,

nor to any other related genus. The numerous species grow on damp ground, or in water, and are distributed over America, Europe, Africa, Australia, and New Zealand.

A good many species occur in North Africa, and south to Angola, and they vary immensely in accordance with the supply or absence of water.

217. *ISOETES NATALENSIS* Baker.

Plate 184. Fig. 2. B Sporangium, enlarged.

Plant three to four inches high. Rootstock three-lobed. Leaves ten to twenty, ascending or erect, very slender (quarter line diameter), rush-like, pale green, opaque, firm in texture, two to four inches long, rounded on the back, channelled down the face, furnished with stomata and accessory bast-bundles. Sporangium small, globose, brownish; veil none. Macrospores white, with small tubercles between the ribs, and large ones over the remainder of the surface. Microspores granulated. A small rush-like plant, growing in constantly wet ground not often flooded.

Natal.—Griffin's Hill, Eastcourt (Rehmann, 7296); Upper Mooi River, near the Berg (T. R. Sim).

218. *ISOETES WORMALDII* Sim. (New species.)¹

Plate 185. Nat. size. B Sporangium, nat. size. C Macrospore, much magnified.

Rootstock three-lobed; leaves fifty to seventy, ligulate-

¹ 218. *ISOETES WORMALDII* Sim. (Species nova.)

Tab. 185. Mag. nat. B Sporangium, mag. nat. C Macrospora, multum amplific.

Rhizoma trilobatum; folia 50—70, ligulato-teretia seu planiuscula, 9—18" longa, $\frac{1}{12}$ " diametro, ad apicem rotundatum vix attenuata, flaccida, ad summam aquam surgentia, deinde natantia magisque extensa; partibus submersis desunt stomata; partes natantes atrovirides ac gramineae; nervi unus medianus, unus marginalis utrinque undique; vagina folii membranacea, dilatata, margines complectentes et ad dimidium obtegentes sporangia in superficie superiore; sporangia plerumque prolata in basi singulorum foliorum, $\frac{1}{3}$ " longa, $\frac{1}{6}$ " lata, membranacea, exteriora macrosporas paucas, interiora microsporas numerosas continentia; macrospora albescentes, durae, trisulcatae, tuberculatae; microspora minutissimae.

In stagnis prope East London: ibidem, in Victoria Park. Primum inventa a W. H. Wormald, Dec. 1893.

Abundans in stagnis supra dictis, 1902 (T. R. Sim, 1567).

terete or somewhat flattened, nine to eighteen inches long, one line diameter, hardly narrowed to the rounded point, flaccid, rising to the surface of the water, then floating and more flattened. No stomata on the submerged parts; floating parts dark green and grass-like. Veins one central and one marginal on each side throughout. Membranous leaf-base dilated, and its margins enclosing and half covering the sporangium on its upper surface. Sporangia usually produced in the base of every leaf, one-third inch long, one-sixth inch wide, membranous, the outer containing a few macrospores, the inner containing numerous microspores. Macrospores white, hard, three-ridged, tubercular; microspores very minute.

Floating in ponds around East London, and in the Victoria Park, East London. First found by Mr W. H. Wormald, Dec. 1893.

Abundant in these ponds, 1902 (T. R. Sim, 1567).

Described and illustrated by us in *Trans. S. A. Phil. Soc.*, Vol. 16, Pt 3 (Aug. 1906), which illustration is reproduced here.

COHORT III. SPHENOPHYLLALES.

ORDER VIII. PSILOTACEAE.

Genus 60. *PSILOTUM* Swartz.

Epiphytal, rigid, almost leafless plants, with much-twisted stems, repeatedly branched dichotomously, and bearing the sporangiophores in the axils of the few small scattered leaves. Sporangiophore three-lobed, consisting of three sporangia united together, without indusium. Included in Lycopodiaceae in our first edition on account of the uniform sporangia and spores, but now separated as having a sporangiophore of three united sporangia, each cell splitting down its central face to discharge the oblong spores from which the prothallia are produced. Roots like those of *Lycopodium*, and from near the base only.

The genus consists of one or two species of tropical and sub-tropical plants.

219. *PSILOTUM TRIQUETRUM* Swartz.

Plate 181. Fig. 2. Nat. size.

Rhizome wiry, creeping. Stems three-angled, six to eighteen inches long, almost leafless, very much twisted throughout, dichotomously forked repeatedly, the ultimate branches one to four inches long. The leaves are few and rigid, ovate, pointed, set on the angles of the stem, and bearing the sporangiophores in their axils.

P. triquetrum Swartz. Pappe and Rawson, 50; Baker, *Fern Allies*, 30; Sim, *Ferns of S. Afr.*, 1st ed., 247.

Lycopodium nudum. Linn. *Sp.* 1564.

Bernhardia capensis. C. Müller.

Tropics generally, and a little beyond them; epiphytal on trees.

Natal.—(Gueinzus); on the coast, rare; bush swamp at head of Bay of Natal (Buchanan); Murchison Flats (Wood, 2429); Edendale (T. R. Sim).

Rhodesia.—In rain forest at Victoria Falls (Eyles, 115; Engler).

COHORT IV. EQUISETALES.

ORDER IX. EQUISETACEAE.

Genus 61. *EQUISETUM* Linn.

The only genus in the order. Plants of very distinct habit, having no leaves, but with hollow-ribbed stems, coated with silica, rising from long solid underground rhizomes. The stems are jointed at regular distances, and at each joint the lower node is surmounted by a whorl of membranaceous teeth, surrounding the base of the next node (fig. e). These teeth are mostly connate, except at the tips, and are equal in number to the ribs on the stem. Each rib is hollow in addition to the large central tube of the stem. In some species the stem is simple, in others similar, but smaller branches proceed in regular whorls, or, as in our species irregularly, from inside the sheath at the joints. The fertile cone is terminal on the stem or branches, and composed of numerous, peltate, many-sided, roundish receptacles (figs. b, c), bearing on the under

surface several sessile, one-celled, pouch-like capsules (sporangia), one corresponding with each side of the receptacle, and each opening towards the centre. Spores uniform, each supplied with four hygrometric filaments known as *elaters* (fig. d). On development the spores produce prothallia, on the under surface of which the sexual organs are to be found.

220. *EQUISETUM RAMOSISSIMUM* Desf.

Plate 174. Nat. size. b, c Receptacles, magnified. d Spore and elaters, magnified. e Sheath, magnified.

Rhizome creeping, slender. Stem one to six feet long, hollow, often simple and only one line diameter when small; when large varying from three to four lines diameter, irregularly branched, or sometimes irregularly whorled, with branches again sometimes branched, the terminal branch generally fertile, and often many other branches fertile, especially if the terminal one has been destroyed. Spikes one-half to one inch long, one and a half to three lines thick, oblong, pointed. Barren stems not different from the others. Sheaths two to four lines long, including the black pointed teeth, which vary in size and in number, as also do the ribs from five to twenty, according to the size of the stem. Large and small specimens look very different, and Kuhn includes the following varieties and localities from South Africa, from Milde's monograph, which I have been unable to see.

Var. *capense* Milde = *E. capense*. Bory MS., Prom. Bon. Spei (Bory, Drège, Zeyher).

Var. *Burchellii* Milde = *E. Burchellii* Vaucher. Prom. Bon. Spei (Burchell Cat. 2464).

Var. *Drègeanum* Milde = *E. Thunbergii* Wickstr. = *E. giganteum*. Thbg, *Prod.* 171.
Prom. Bon. Spei (Thunberg, Drège).

Var. *arcuatum* Milde.
Prom. Bon. Spei, near Gekau (Drège).

Var. *flagelliferum* Milde = *E. incanum* Webb and Berth.
Tugela River, Natal (Gueinzus).

Var. *distortum* Milde.

Prom. Bon. Spei (Mund and Maire).

Var. *natalense* Milde = *E. natale*. Fée MS., Natal (Gueinzius).

These varieties are not separated by Baker, and the most diverse forms seem to grade into one another in accordance with surroundings.

E. ramosissimum. Desf. *Flor. Atlant.* 2, 398; Buchanan's List; Baker, *Fern Allies*, 4; Kuhn, *Fil. Afr.* 181; Sim, *Ferns of S. Afr.*, 1st ed., 240.

E. elongatum (W.). Schl. *Adum.* 3, tab. 1; Harvey, *Genera*, Ed. 1, 377.

Almost cosmopolitan; rare or local in South Africa; growing in or near water.

West.—Chamka and Olifant's Rivers (Mund and Maire); Bankberg, near Baaken, on the Gareip (Drège).

East.—Sunday's River, Graaffreinet, common (Bolus); Fish River, Somerset (J. Leonard); Zwaartkop River (Zeyher); Graaffreinet (Tyson, 18); Uitenhage, 250 ft (R. Schl. 2481).

Kaff.—Matatiele (Tyson); Buffalo River, near Izeli Hotel; stream below Fort Cunynghame (T. R. Sim); Chalumna (E. E. Galpin, 6292).

Natal.—Umpumulo, Uyr's Doorns Spruit Drift (Buchanan); Centocow, Maritzburg, Umlalazi and many other places (T. R. Sim).

Orange Free State.—Parijs, near Vaal River, 4500 ft (Potts, 542; Rev. F. A. Rogers, 671).

Transvaal.—Rustenburg, Fairy Glen, Potgietersrust, Pretoria (R. Leendertz, 3416, 1624, 4486, 1653); Barberton (T. Thorncroft, 89); many localities (J. Burt-Davy).

Rhodesia.—Matopo Hills, 4800 ft (Eyles, 151); Umguzi River, Bulawayo; Mazoe (Eyles); Umtali (Engler).

(*EQUISETUM ARVENSE* Linn., which has the fertile stem simple, herbaceous, and evanescent, and the barren stem annual and very much branched in regular whorls, is included by Kuhn (*Fil. Afr.* 181) from the Cape (Bergius). It is not known at the Cape, nor is it known at Kew as a Cape plant, and is probably a mistake.)

CHAPTER X

DISTRIBUTION

IN chapter IX. 220 species are enumerated as South African. Included among these are a few species which are admitted with hesitation, and which require further evidence of their presence, such as *Trichomanes erosum*, *Hymenophyllum ciliatum*, *Hymenophyllum lineare*, *Asplenium Gueinzianum*, *Adiantum reniforme*, *Adiantum Paradiseae*, *Monogramma graminea*, *Notholaena Rawsoni*, *Vittaria scolopendrina* and *Polypodium Billardieri*, while several others have not been collected for many years.

It has been found necessary to exclude several species which at one time were considered South African, including *Asplenium bulbiferum*, *A. flaccidum*, *Lomaria spicant*, *L. eriopus*, *Pellaea andromedifolia*, *Adiantum rotundatum*, *Pteris serrulata* and *P. tremula*.

Reference is also made to several, which for various reasons are not admitted, including : *Trichomanes digitatum*, *Dryopteris obtusiloba*, *Leptochilus auriculatus*, *Asplenium polypodioides* and *Cheilanthes refracta*.

But the distribution of the enumerated species, alike in South Africa and elsewhere, is worthy of closer analysis, and works out as under :

	Endemic to South Africa	Not recorded elsewhere in South Africa	Total Species
South Africa as defined in this work	58	69	220
Cape Province—Western Districts	12	15	96
Cape Province—Eastern Districts	1	1	90
Kaffraria, including Transkei	1	2	109
Natal	3	10	151
Orange Free State	1	1	31
Transvaal	2	6	113
Rhodesia	7	21	126
Portuguese East Africa	1	8	45
Uncertain (<i>Polypodium Billardieri</i>)	—	1	1
Western and Eastern Districts of Cape Province ...	15	18	115
Eastern Districts of Cape Province and Kaffraria ...	2	3	118
Kaffraria and Natal	6	16	154
Natal and Orange Free State	4	11	152
Natal and Transvaal	5	20	164
Transvaal and Rhodesia	9	31	161
Rhodesia and Portuguese East Africa	9	33	139
Natal and Portuguese East Africa	4	18	164
Western and Eastern Districts and Kaffraria ...	16	20	140
Eastern Districts, Kaffraria and Natal	7	17	157
Kaffraria, Natal and Transvaal	8	29	165
Natal, Transvaal and Rhodesia	9	58	190
Transvaal, Rhodesia and Portuguese East Africa ...	11	44	170
Natal, Rhodesia and Portuguese East Africa ...	12	52	191
Common to West, East, Kaffraria and Natal ...	—	6	66
„ East, Kaffraria, Natal and Transvaal ...	—	4	67
„ Kaffraria, Natal, Transvaal and Rhodesia ...	—	7	52
„ Natal, Transvaal, Rhodesia and Portuguese East Africa	—	3	19
„ each of the eight areas	—	—	7
„ seven of the eight areas	—	—	27
„ six of the eight areas	—	—	48

Perhaps the most striking feature is that although there is a reasonable representation of species in each distribution-area only seven species are known to occur in all the eight areas, viz.: *Adiantum capillus-veneris*, *Pteridium aquilinum*, *Polypodium lanceolatum*, *Dryopteris Bergiana*, *D. elongata*, *Pellaea viridis* and *Mohria caffrorum*. The first three of these are almost cosmopolitan in similar climates; the last four are confined to Africa and its islands. But most of the

Orange Free State is not fern country, while Portuguese East Africa cannot be said to have been fully explored, especially in regard to its mountain slopes, and further examination of these localities will probably increase the above list.

Species common to some seven of the eight areas include, besides the above, other 20 species, viz.: *Dryopteris gongylodes*, *D. thelypteris*, *D. inaequalis*, *Asplenium theciferum*, *Polypodium polypodioides* and *Ophioglossum capense*, which are not recorded from the Orange Free State, and *Polystichum aculeatum*, *P. pungens*, *Asplenium monanthes*, *A. lunulatum*, *A. adiantum-nigrum*, *Ceterach cordatum*, *Pellaea hastata*, *P. quadripinnata*, *Cheilanthes hirta*, *Pteris cretica*, *Elaphoglossum petiolatum*, *Gleichenia polypodioides* and *Equisetum ramosissimum*, which are not recorded from Portuguese East Africa.

Turning from those which are most widely dispersed to those which are most local in their distribution, at least in South Africa, the following list shows the species confined to one or two areas, together with their distribution in other parts of the world, those which are endemic to South Africa being marked x. The endemic species naturally include all new species, as well as some of doubtful status.

	Other parts of Africa and its Islands	Europe	Asia	Australia and Polynesia	America
Western Districts of Cape Province only					
x <i>Hymenophyllum uncinatum</i> (New species) ...	—	—	—	—	—
x <i>Asplenium Rawsoni</i> (Only once found) ...	—	—	—	—	—
x <i>Pellaea auriculata</i>	—	—	—	—	—
x <i>Pellaea pteroides</i>	—	—	—	—	—
x <i>Pellaea lancifolia</i> (Namaqualand only) ...	—	—	—	—	—
x <i>Pellaea namaquensis</i> „ „ ...	—	—	—	—	—
x <i>Doryopteris deltoidea</i> „ „ ...	—	—	—	—	—
x <i>Doryopteris robusta</i> „ „ ...	—	—	—	—	—
x <i>Notholaena Rawsoni</i> „ „ (Once found)	—	—	—	—	—
x <i>Cheilanthes depauperata</i> (Rare) ...	—	—	—	—	—
x <i>Cheilanthes induta</i> (Namaqualand) ...	—	—	—	—	—
<i>Adiantum Poiretii</i>	x	—	x	—	x
<i>Monogramma graminea</i> (Doubtfully present) ...	x	—	—	—	—
x <i>Ophioglossum Bergianum</i> (Very rare) ...	—	—	—	—	—
<i>Ophioglossum lusitanicum</i> (Only once collected)	x	x	—	—	—

	Other parts of Africa and its Islands	Europe	Asia	Australia and Polynesia	America
Western and Eastern Districts of Cape Province only					
× <i>Hymenophyllum Marlothii</i> (A recent species) ...	—	—	—	—	—
× <i>Ophioglossum nudicaule</i>	—	—	—	—	—
Eastern District of Cape Province only					
× <i>Adiantum Paradiseae</i> (A doubtful species) ...	—	—	—	—	—
Kaffraria only					
× <i>Isoetes Wormaldii</i> (New species)	—	—	—	—	—
<i>Blechnum auriculatum</i>	—	—	—	—	×
Kaffraria and Natal only					
<i>Davallia chaerophylloides</i>	×	—	—	—	—
<i>Athyrium Schimperii</i>	×	—	—	—	—
× <i>Blechnum inflexum</i>	—	—	—	—	—
× <i>Polypodium Pappei</i>	—	—	—	—	—
Natal only					
<i>Trichomanes erosum</i>	×	—	—	—	—
<i>Nephrolepis biserrata</i>	×	—	—	—	—
<i>Schizoloma ensifolium</i>	×	—	×	×	—
× <i>Asplenium Gueinzianum</i> (A doubtful species) ...	—	—	—	—	—
<i>Adiantum reniforme</i>	×	—	—	—	—
<i>Polypodium lycopodioides</i>	×	—	—	—	×
<i>Elaphoglossum spathulatum</i>	×	—	×	—	×
<i>Lygodium scandens</i>	×	—	×	×	—
× <i>Selaginella Mackenii</i> (Only once collected) ...	—	—	—	—	—
× <i>Isoetes natalensis</i> (Very rare)	—	—	—	—	—
Orange Free State only					
× <i>Selaginella Cooperi</i>	—	—	—	—	—
Natal and Transvaal only					
<i>Trichomanes rigidum</i>	×	—	×	×	×
<i>Trichomanes montanum</i>	—	—	—	—	×
<i>Ceropteris calomelanos</i>	×	—	—	—	×
<i>Aneimia tomentosa</i>	×	—	×	—	×
Transvaal only					
<i>Hymenophyllum lineare</i> (Doubtfully S. African) ...	—	—	—	—	×
<i>Dryopteris crenata</i>	×	—	×	—	—
<i>Pellaea Boivini</i>	×	—	×	—	—
× <i>Pellaea leucomelas</i>	—	—	—	—	—
<i>Selaginella integerrima</i> (Only once collected in S.A.)	×	—	×	—	—
× <i>Selaginella tectissima</i>	—	—	—	—	—
Transvaal and Rhodesia only					
<i>Asplenium abyssinicum</i>	×	—	—	—	—
<i>Adiantum caudatum</i>	×	—	×	×	—
<i>Lygodium Kerstenii</i>	×	—	—	—	—
<i>Aneimia anthriscifolia</i>	—	—	—	—	×
Rhodesia only					
<i>Hymenophyllum ciliatum</i>	×	—	×	×	×
<i>Dryopteris patens</i> (Doubtfully S. African) ...	×	—	×	×	×
× <i>Dryopteris zambesiaca</i> (Only once collected) ...	—	—	—	—	—
<i>Nephrolepis exaltata</i>	×	—	×	×	×
<i>Nephrolepis cordifolia</i>	×	—	×	×	×
× <i>Asplenium Eylesii</i> (New species)	—	—	—	—	—

	Other parts of Africa and its Islands	Europe	Asia	Australia and Polynesia	America
Rhodesia only					
Asplenium unilaterale	x	—	x	x	—
x Asplenium Hollandii (New species)	—	—	—	—	—
x Pellaea Swynnertoniana (New species)	—	—	—	—	—
x Notholaena bipinnata (New species)	—	—	—	—	—
Cheilanthes farinosa	x	—	x	—	x
Hypolepis Schimperii	x	—	—	—	—
Adiantum lunulatum	x	—	x	x	x
x Adiantum Oatesii	—	—	—	—	—
Adiantum hispidulum	x	—	x	x	x
Pteris brevisora	x	—	—	—	—
Pteris atrovirens	x	—	—	—	—
Elaphoglossum lineare	x	—	—	—	x
x Lygodium Brycei	—	—	—	—	—
Selaginella imbricata	x	—	x	—	—
Selaginella molliceps	x	—	—	—	—
Rhodesia and Portuguese East Africa only					
Asplenium Mannii	x	—	—	—	—
Pellaea Doniana	x	—	—	—	—
Platynerium bifurcatum	x	—	—	x	—
x Mohria lepigera	—	—	—	—	—
Portuguese East Africa only					
x Dryopteris Lastii	—	—	—	—	—
Leptochilus Heudelotii	x	—	—	—	—
Asplenium pumilum	x	—	—	—	x
Asplenium adiantoides	x	—	x	x	—
Vittaria scolopendrina	x	—	x	x	—
Polypodium parvulum	x	—	—	—	—
Platynerium angolense	x	—	—	—	—
Ceratopteris thalictroides	x	—	x	x	x

There are thus 82 species which are of limited distribution. Thirty-three of these as well as the following 25 more widely distributed species are endemic to South Africa, making the total of endemic species 58, viz.: *Adiantopsis capensis*, *Notholaena Buchanani*, *N. inaequalis*, *N. Eckloniana*, *Aneimia Drègeana*, *Woodsia Burgessiana*, *Dryopteris Bergiana*, *D. inaequalis*, *D. athamantica*, *Polystichum luctuosum*, *P. Macleaii*, *Asplenium Kraussii*, *A. solidum*, *A. auriculatum*, *Blechnum punctulatum*, *Cheilanthes parviloba*, *C. Bolussi*, *Hypolepis Bergiana*, *Polypodium ensiforme*, *Gleichenia umbraculifera*, *Schizaea tenella*, *Marsilia macrocarpa*, *Ophioglossum capense*, *Selaginella pumila*, *S. depressa*.

Of the endemic species 16 occur only in the Cape Province (West, East and Kaff.), 16 occur only in the rest of South Africa, and 26 are common to both these areas, so the Cape Province flora includes 42 species endemic to South Africa, and the other Provinces together contain an equal number.

No genus is confined to South Africa ; the nearest approach is *Mohria*, which however occurs in other parts of Africa and its islands. Of the 220 South African species the representation abroad, so far as known, is as follows :

	Ferns Cohort I	Fern Allies Cohorts II, III, IV	Total
In South Africa	199	21	220
In other parts of Africa or its islands including Madagascar and Mauritius	139	12	151
Europe	15	1	16
Asia	69	7	76
Australasia and Polynesia ...	53	7	60
America	69	8	77

As 58 species are endemic and 151 occur elsewhere in Africa only 11 species are common to South Africa and some other continent without being known elsewhere in Africa. These are: *Trichomanes montanum*, *Hymenophyllum lineare*, *Asplenium platyneuron*, *A. serra*, *Blechnum auriculatum*, *Adiantum sulphureum* and *Ancimia anthriscifolia* from America, *Asplenium varians* and *Selaginella integerrima* from Asia, *Polypodium Billardieri* from Australia, and *Selaginella pumila* from these three continents.

The species common to Europe and South Africa are: *Hymenophyllum tunbridgense*, *Cystopteris fragilis*, *Dryopteris thelypteris*, *Polystichum aculeatum*, *Athyrium filix-femina*, *Asplenium trichomanes*, *A. adiantum-nigrum*, *Anogramma leptophylla*, *Adiantum capillus-veneris*, *Pteris longifolia*, *P. cretica*, *Pteridium aquilinum*, *Polypodium vulgare*, *Osmunda regalis*, *Ophioglossum lusitanicum* and *Lycopodium clavatum*.

Of the 44 British species of Filices 13 species are also South African (included above), besides which these others are represented by very close relatives, viz.: *Dryopteris filix-*

mas (by *D. elongata*), *Ophioglossum vulgatum* (by *O. capense*) and *Ceterach officinarum* (by *C. cordatum*). *Lycopodium clavatum* is also British.

The most widely distributed species, known to occur in Europe, Asia, Africa, Australasia and America are : *Dryopteris thelypteris*, *Polystichum aculeatum*, *Asplenium trichomanes*, *Adiantum capillus-veneris*, *Pteris longifolia*, *Pteridium aquilinum* and *Lycopodium clavatum*.

It is interesting to note the rapid increase of knowledge concerning the distribution of species in South Africa made since our first edition was published 22 years ago, especially in regard to the newer provinces, as shown below :

	Total	West	East	Kaff.	Natal	Orange Free State	Transvaal	Rhodesia	P. E. A.
1892. First edition <i>Ferns of South Africa</i>	179	85	85	97	146	3	70	24	—
1905. Recent Information concerning <i>S. A. Ferns</i>	212	95	86	108	147	19	90	86	20
1914. Present edition <i>Ferns of South Africa</i>	220	96	90	109	151	31	113	126	45

The distribution of each species, and the species of each area, so far as now known, are shown in the following table :

Species confined in South Africa to the respective areas or groups of areas indicated, so far as now known.

West	East	Kaffraria	Natal	Orange Free State	Transvaal	Rhodesia	Portuguese East Africa	Uncertain	Numbers connected with the species in Chapter IX	Number of Species
×	—	—	—	—	—	—	—	—	11, 72, 98, 100, 103, 110, 112, 113, 115, 120, 124, 137, 151, 195, 196 ...	15
×	×	—	—	—	—	—	—	—	7, 197 ...	2
×	×	×	×	—	—	—	—	—	39, 74, 122, 157, 180, 181	6
×	×	×	×	×	—	—	—	—	10 ...	1
×	×	×	×	—	×	—	—	—	5, 13, 25, 104, 114, 146, 148, 155, 159 ...	9

Species confined in South Africa to the respective areas or groups of areas indicated, so far as now known, continued.

West	East	Kaffraria	Natal	Orange Free State	Transvaal	Rhodesia	Portuguese East Africa	Uncertain	Numbers connected with the species in Chapter IX	Number of Species
x	x	x	x	x	x	—	—	—	2, 90, 118	3
x	x	x	x	—	—	x	—	—	56, 87, 88	3
x	x	x	x	—	x	x	—	—	64, 71, 76, 80, 86, 127, 128, 143, 191, 193, 194, 204, 205, 206	14
x	x	x	x	x	x	x	—	—	36, 37, 58, 59, 73, 84, 101, 108, 121, 142, 168, 177, 220	13
x	x	x	x	—	x	—	x	—	202	1
x	x	x	x	—	x	x	x	—	21, 24, 28, 81, 123, 156, 198	7
x	x	x	x	x	x	x	x	—	17, 27, 105, 135, 150, 161, 185	7
x	x	x	x	—	—	x	x	—	89, 152	2
x	—	x	x	—	—	x	x	—	32	1
x	—	—	—	—	x	x	x	—	140	1
x	x	—	x	—	x	x	—	—	190	1
x	—	x	x	x	x	x	—	—	209	1
x	—	—	x	—	x	x	—	—	125	1
x	—	—	x	—	—	x	—	—	79, 167	2
x	—	—	—	—	—	x	—	—	93	1
x	x	—	x	—	—	—	—	—	149, 207	2
x	—	x	x	—	—	—	—	—	169	1
x	—	—	x	—	—	—	—	—	192, 200	2
—	x	—	—	—	—	—	—	—	136	1
—	x	x	x	—	—	—	—	—	57	1
—	x	x	x	—	x	—	—	—	38, 42, 54, 68	4
—	x	x	x	x	x	—	—	—	75	1
—	x	—	x	—	—	x	—	—	16	1
—	x	x	x	—	x	x	—	—	12, 60, 66, 111, 138, 208, 210	7
—	x	x	x	—	—	x	—	—	15	1
—	x	—	x	x	x	x	—	—	53	1
—	x	—	x	—	x	—	x	—	173	1
—	x	x	x	—	x	x	x	—	141	1
—	—	x	x	—	—	—	—	—	91, 218	2
—	—	x	x	x	—	—	—	—	48, 52, 85, 160	4
—	—	x	x	x	—	—	—	—	139	1
—	—	x	x	—	x	—	—	—	44, 187	2
—	—	x	x	x	x	—	—	—	14	1
—	—	x	x	—	x	—	—	—	41	1
—	—	x	x	—	x	x	—	—	19, 20, 29, 117, 163, 178, 201	7
—	—	x	x	—	—	x	—	—	78, 166	2
—	—	x	x	—	x	—	x	—	30, 40	2
—	—	x	x	—	—	—	x	—	92	1
—	—	x	x	—	—	x	x	—	165	1
—	—	x	x	—	x	x	x	—	144	1
—	—	—	x	—	—	—	—	—	4, 45, 50, 63, 130, 162, 172, 182, 214, 217	10
—	—	—	x	—	x	—	—	—	1, 3, 96, 188	4
—	—	—	x	—	—	x	—	—	6, 34, 51, 65, 69, 219	6
—	—	—	x	—	—	x	x	—	158, 170, 203	3

Species confined in South Africa to the respective areas or groups of areas indicated, so far as now known, continued

West	East	Kaffraria	Natal	Orange Free State	Transvaal	Rhodesia	Portuguese East Africa	Uncertain	Numbers connected with the species in Chapter IX	Number of Species
—	—	—	x	—	x	x	—	—	23, 49, 94, 97, 99, 116, 179	7
—	—	—	x	x	x	x	—	—	95	1
—	—	—	x	—	x	x	x	—	22, 55, 199	3
—	—	—	—	x	—	—	—	—	215	1
—	—	—	—	—	x	—	—	—	9, 33, 102, 106, 212, 213 ...	6
—	—	—	—	—	x	x	—	—	77, 131, 183, 189	4
—	—	—	—	—	x	x	x	—	35	1
—	—	—	—	—	—	x	—	—	8, 18, 26, 46, 47, 61, 67, 82, 109, 119, 126, 129, 132, 133, 134, 145, 147, 171, 184, 211, 216	21
—	—	—	—	—	—	x	x	—	83, 107, 174, 186	4
—	—	—	—	—	—	—	x	—	31, 43, 62, 70, 153, 154, 175, 176	8
—	—	—	—	—	—	—	—	x	164	1
Total										220

ASPLENIUM MARLOTHII, Hieron. (*Engl. Jahrb.* 46, 357, 1911; C. Chr. *Index Fil. Suppl.* 12) is mentioned by name only on page 174. Since then we have ascertained from the collector, Dr Marloth, that it was found by him on the mountains near Kuruman, British Bechuanaland, in 1886, and that he sent on his specimens to Berlin at that time, without keeping a duplicate. There are consequently no known specimens in South African herbaria and only the type in Berlin. Dr Marloth has favoured us with a copy of Hieronymus' remarks on it, which show that it belongs to the group of *A. pumilum* Sw., and is closely allied to *A. Schimperianum* Hochst., and include the following:

"Rhizome sub-caespitose, with many stalks together, paleaceous when young. Fronds up to 12 cm. long, quite glabrous, deltoid or ovate, sub-bipinnate, at the apex pinnatisect. Pinnae 3—6 each side, the lower ones shortly stalked, mostly deltoid, at the base erose-pinnatisect.

Sori up to 3 mm. long, $1\frac{1}{2}$ mm. wide, attached to the side of the primary lateral veins, the indusium membranous, yellowish-white with a crenulate margin, hardly $\frac{1}{2}$ mm. wide.

Apart from the structure of the paleae, which is quite distinct, one might consider this species as a glabrous and erose variety of *A. Schimperiani*, which cannot be sunk into *A. pumilum* Sw."

Concerning the structure of the scales he says :

"Paleis e basi rotundato vel subtruncato ovatis, et cellulis polyedricis parenchymaticis, parietes internos communes crassos (usque ad 0.02 mm. crassos) ferrugineo-fuscos, et parietes externos tenuissimos hyalino-pellucidos gerentibus, pro conditione paucis seriebus cellularum (supra basin c. 5—7) formatis, margine fimbriato-ciliatis (ciliis utrinque paucis saepe reversis, cellularum seriebus binis prorsus interdum serie unica formatis) in pilum basi cellularum seriebus binis formatum, prorsus serie unica formatum articulatum fimbriis marginis similem sed longiorem desinentibus ; paleis maximis pilo incluso vix ultra 2 mm. longis, c. 3/4 mm. supra basin latis."

We have given Baker's description of *A. pumilum* Sw. (page 148) which includes reference to a small tender African form, *A. tenerrimum* Hochst.

A. Marlothii agrees so closely and differs so slightly that further material is required to confirm its status and to show that the difference in the scales is not due simply to local surroundings.

ADIANTUM AETHIOPICUM Linn. is stated on page 249 not to have been seen from the western province, but since that was printed Prof. Pearson has sent me specimens gathered by Mr J. W. Mathews (Curator of the National Botanic Garden), within the Kirstenbosch estate, about 900 feet above sea level, where it certainly is native.

LYCOPodium HOLSTII Hieron. in Engl. *Pflanzenw. Ost. Afr. C.* p. 90. Reference is made in a paper in the *Botanical Gazette*, July 1914, to this as a South African species. The original description is from specimens from Usambara which is not situated within our district, and inquiry at Kew brings the reply that it is not known there from South Africa. Evidently the writer has put South Africa instead of East Africa, in mistake.

GENERAL INDEX AND GLOSSARY

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Acuminate, taper pointed.	
Adnate, connected for some distance.	
Adpressed, lying close alongside.	
Adventitious buds, buds produced in abnormal positions.	
Albany Museum Herbarium	45
Alternation of generations	10
Anastomosing, uniting so as to form a network.	
Antheridium	7
Archegonium	3, 8
Areolae, the spaces enclosed by anastomosing veins.	
Arista, a bristle point.	
Articulated, having a distinct joint.	
Ascending, with the point turning upward.	
Atherstone, Dr, of Grahamstown.	
Attenuate, drawn out to a long point.	
Auricle, an ear-like lobe, generally at the base of a pinnule.	
Baker, John Gilbert, F.R.S., F.L.S. (Hooker & Baker, <i>Synopsis</i>	
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,, in <i>Annals of Botany</i> (New Ferns)	43
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Barkly, Sir Henry and Lady, revised list of Cape Ferns	40
Bergius, C. W., see "Plantarum Capensium descriptiones ex	
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258, by Schlechtendal	37
Bergius, P. J., "Descriptiones Plantarum e Capite Bonae Spei,	
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Bkr, J. G. Baker.	
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Bory de St Vincent.	
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Brehm, Dr, resided in Uitenhage.	
Brown, Novara Expedition.	
Br., or R. Br., R. Brown, mostly in <i>Prod. Flor. Nov. Holland.</i>	
Buchanan, Rev. John, revised list of Natal Ferns	40
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Burchell, W. J.	37
,, Geographical Catalogue	45
Burke, travelled with Zeyher in Transvaal	38

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Burmah, <i>Flora Indica</i> , 1768	36
Burtt-Davy and Mrs Pott-Leendertz' "Checklist of Transvaal Plants"	43
Capsule	1, 5, 6
Carroid, dry, like the Karroo.	
Caudex, a tree stem.	
Cells	3
Cellular cryptogams	3
Channelled, having a groove down the front.	
Christensen, <i>Index Filicum</i> , and Supplement	44, 57
Ciliated, margin fringed with hairs or scales.	
Circinate vernation	3
Classification (Chapter VIII)	55, 58
Compressed, somewhat flattened.	
Confluent, partly united at the base.	
Connate, united below.	
Contracted, narrowed.	
Cordate, heart-shaped.	
Coriaceous, leathery.	
Costa, mid-rib.	
Crenate, having shallow rounded teeth.	
Cross fertilisation	9
Crown	4
Cryptogams	2
Cultivation (Chapter IV)	12
Cuneate, wedge-shaped.	
Cuspidate, short-pointed.	
Deciduous, falling off at regular seasons.	
Decurrent, having a wing continued some distance down the stem.	
Deflexed, bent downward.	
Deltoid, triangular.	
Denticulate, toothed.	
Desv., Desvaux, <i>Ann. Linn.</i> VI.	
Dichotomous	5
Dimorphous, occurring in two forms.	
Dioecious ferns	8
Distichous, two-ranked.	
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Divergent, spreading in different directions.	
Don, D. <i>Prodr. Fl. Nepalensis</i> .	
Dorsal, on the back.	
Drainage	32
Drège, J. F.	38, 45
East District	54
Ecklon, C. F.	38
E. & Z., Ecklon & Zeyher	38, 45
Elater	343
Emarginate, notched at the apex.	
Endemic, confined to a particular country	347
Engler and Prantl	44
Entire, not toothed.	
Epiphytal, growing upon trees or rocks like parasites, but living on the atmosphere only.	
Erecto-patent, nearly horizontal both from and across the rachis.	

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Klf., Kaulfuss, <i>Enumeratio Filicum</i> .	
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Kze, Linn., Kunze in <i>Linnaea</i>	38
Kunze, <i>Die Farnkräuter in colorirten Abbildungen</i>	38
Laciniated, much cut.	
Lam. = De Lamarck, <i>Flore française</i> .	
Lamina, the green leafy part of a frond.	
Lanceolate, lance-shaped.	
Lax, scattered, or thinly placed.	
Ligulate, strap-shaped.	
Ligule, a scale-like appendage	56
Linear, long and narrow, and of equal width.	
L. or Linn., Linnaeus.	
Link, H. F. <i>Enum. plantarum horti regii botanici Berolinensis altera</i> .	
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Linn. <i>Sp. Pl.</i> , Linnaeus, <i>Species Plantarum</i> .	
Linn. <i>Syst. Veg.</i> , Linnaeus, <i>Systema Vegetabilium</i> , 1774.	
Liverworts	55
Lowe, <i>Ferns, British and Exotic</i>	39
MacOwan and Bolus, <i>Herbarium Normale Austro-Africanum</i>	46
Macrospores, the larger kind of spores among Fern Allies.	
Marginal, along the margin	5
Marloth (Dr R.), <i>The Flora of South Africa</i>	43
McKen's <i>Ferns of Natal</i>	39
Membranaceous, thin like a membrane.	
Mett., Mettenius	39
Microspores, the smaller kind of spores among Fern Allies.	
Milde, <i>Filices Europeæ</i> , and Monograph of Equisetum.	
Moore's <i>Index Filicum</i>	39
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Naked, without scales.	
Oates' <i>Matabeleland</i>	41
Oblong, rather longer than wide.	
Obovate, the shape of an inverted egg.	
Obtuse, blunt.	
Ovum	8
Paleaceous, set with scales.	
Palmate, hand-shaped.	
P. and R., Pappe and Rawson, <i>Synopsis Filicum Africae Australis</i>	38
Parts of ferns	4
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Peltate, fixed by the centre.	
Permanent, not changeable.	
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Persistent, not falling off.	
Petiole, the stalk of a pinnule or frond.	
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Pinna	5

Pinnate	5
Pinnatifid	5
Pinnule	5
Plane, flat with the rachis.	
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Proliferous, producing adventitious buds.	
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Prothallus	3, 7
Pubescence, short soft hairs.	
Pubescent, clothed with short soft hairs.	
Rachis	5
Rawson, Hon. R. W. R.	
Receptacle	6
Reduced, smaller.	
Rehmann's, Dr, collection	45
Reniform, kidney-shaped.	
Reproduction	7
Reticulated, netted.	
Revolute, rolled back.	
Rhizome	4, 9
Root	4
Roth, A. W. <i>Tentamen Florae Germanicae</i> .	
Rufous, rusty-red.	
Scales, protective appendages wider than hairs	6
Scandent, climbing.	
Scarious, having a firm, thin, white margin.	
Schinz, Dr Hans, <i>Transvaal Plants</i>	41
Schk. <i>Fil.</i> , Schkuhr, <i>Icones Filicum</i> .	
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Schl. <i>Adumb.</i> , Schlechtendal, <i>Adumbratio Filicum</i>	38
Schlechter, R.	46
Schrader's <i>Götting. Gel. Anzeig.</i>	37
Schrader's <i>Journal für die Botanik</i>	37
Segments, the lobes of a pinnule.	
Serrate, toothed, with the teeth pointing forward.	
Sessile, not stalked.	
Sim, <i>Ferns of South Africa</i> , 1st edition	41
Sim, <i>Handbook of Kaffrarian Ferns</i>	41
Sim, "Recent information concerning South African Ferns"	42
Simple, undivided	5
Sinuate	5
Sinus	5
Smith, John, formerly Curator of Kew Gardens.	
Smith, Sir J. E., Author of <i>English Flora</i> .	
Sorus	5, 6
Spathulate, circular at the apex and tapering to the base.	
Spermatozoid	7
Sporangium	1, 6
Spores	2, 3, 6, 10
Sporophyte	10
Spr., <i>Systema Vegetabilium</i> , Linnaeus, Ed. 16, edited by Sprengel.	
Spring, in <i>Mémoires de l'Académie Royal de Belgique</i>	45

Spurious venules, venules not connected with the main vein system.	
Stalk	5
Stellate, star-shaped, or with radiating arms.	
Stem	4
Stipe, the stalk of a Fern frond.	
Subtended, extended under.	
Subterranean, underground.	
Subulate, awl-shaped.	
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Superficial, on the surface, <i>i.e.</i> not immersed.	
Suppl. to Schk. <i>Fil.</i> , Supplement to Schkuhr's <i>Icones Filicum</i> by Kunze.	
Sw., Swartz, O., in Schrader's <i>Journal für die Botanik</i>	37
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<i>Syn. Fil.</i> , <i>Synopsis Filicum</i> , Hooker and Baker, 2nd ed.	40
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Tomentose, shaggy with tomentum.	
Tomentum, intermatted woolly hairs	6
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V. d. B., Van der Bosch.	
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Veinlets, the small ultimate veins.	
Veins	5
Veins free, veins not anastomosing.	
Venation, the arrangement of the veins.	
Venules, very small veins.	
Vernation	3
Vessels	3
Villose, with rather long soft hairs.	
West District	54, 347
Willd., <i>Species Plantarum</i> , Linnaeus, 4th ed., edited by Willdenow, 1797-1830	17
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<i>caffra</i> , Pappe	—	256	—	—
<i>calomelanos</i> , Sw.	—	212	—	—
<i>capensis</i> , Thun.	—	265	—	203
<i>catoptera</i> , Kze	—	258	—	—
<i>concolor</i> , L. & F.	—	216	—	—
<i>confluens</i> , Thun.	—	200	—	199
<i>consobrina</i> , Kze	—	203	—	—
<i>cordifolia</i> , Kze	—	265	—	—
<i>costata</i> , Bory	—	253	—	—
cretica , Linn.	126	253	252	20, 23, 347, 350
<i>var. stenophylla</i>	—	254	—	—
<i>cuspidata</i> , Thun.	—	253	—	317
dentata , Forsk.	129	255	252	23, 260
<i>dichotoma</i> , Kuhn	—	251	—	—
<i>dura</i> , Willd.	—	201	—	—
<i>dura</i> , Hk.	—	199	—	—
<i>ensifolia</i> , Sw.	—	253	—	—
<i>farinosa</i> , Forsk.	—	236	—	—
<i>flabellata</i> , Thun.	—	256	—	—
<i>flabellulata</i> , Thun. ...	—	256	—	—
<i>geraniifolia</i> , Raddi ...	—	215	—	—
<i>glabra</i> , Kuhn	—	262	—	—
<i>Goudotii</i> , Kze	—	201	—	—
<i>graminea</i> , Poir.	—	266	—	—

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serrulata, Linn. ...	—	254	—	345
serrulata, Forsk. ...	—	256	—	255
serrulata, Pappe ...	—	255	—	260
spinulifera, Schum. ...	—	260	—	—
tabularis, Thun. ...	—	188	—	—
tremula, R. Br. ...	—	256	—	345
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Kraussiana , A. Br. ...	182	335	33 ¹	—
Mackenii , Bkr	—	338	33 ¹	348
molliceps	183	339	33 ¹	349
pumila , Spr.	182	332	33 ¹	349, 350
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<i>Taeniopsis</i> , J. Sm.	—	268	—	—
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<i>africana</i> , Willd.	—	310	—	—
barbara (Linn.), Moore	169	309	—	30, 52
<i>rivularis</i> , Sieb.	—	310	—	—
Trichomanes , Smith	—	67	60	16
<i>adiantoides</i> , Linn.	—	154	—	—
<i>bipunctatum</i> , Poir.	—	70	—	—
<i>chaerophylloides</i> , Poir.	—	128	—	—
<i>cormophyllum</i> , Klf.	—	85	—	—
<i>digitatum</i> , Sw.	4	70	67	16, 345
<i>Drègei</i> , V. d. B.	—	68	—	—
erosum , Willd.	2	72	67	16, 345, 348
<i>filicula</i> , Bory	—	70	—	—
<i>Harveyi</i> , Carr.	—	68	—	—
<i>incisum</i> , Thun.	—	85	—	—
<i>melanotrichum</i> , Schl.	—	70	—	—
montanum , Hk.	2	71	—	348, 350
var. <i>quercifolium</i> , Hk. & Gr.	2	72	67	16
<i>muscoides</i> , Sw., var.	—	72	—	—
<i>pusillum</i> , Sw.	—	72	—	—
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Trichomanes rigidum Sw.

1. *Trichomanes montanum* Hk.
2. " " var. *quercifolium*.
3. *Trichomanes erosum* Willd.

1. *Hymenophyllum Tunbridgense* Sm. 2. *Hymenophyllum fumarioides* Willd.
3. *Trichomanes pyxidiferum* Linn.

1. *Hymenophyllum Marlothii* Brause.
2. *Hymenophyllum inaequale* (Poir.) Desv.
3. *Trichomanes digitatum* Sw.

1. *Hymenophyllum uncinatum* Sim.
2. *Hymenophyllum lineare* Sw.

Cyathea Drègei Kze.

Hemitelia capensis (L. fil.) Klf.

Cystopteris fragilis (Linn.) Bernh.

Dryopteris orientalis (Gmel.) C. Chr.

Dryopteris Bergiana (Schl.) O. Ktze.

Dryopteris mollis (Jacq.) Hieron.

Dryopteris mauritiana (Fée) C. Chr.

Dryopteris gongylodes (Schk.) O. Ktze.

Dryopteris prolifera (Retz.) C. Chr.

Dryopteris silvatica (P. and R.) C. Chr.

Dryopteris thelypteris (Linn.) A. Gray.

Dryopteris elongata (Ait.) Sim.

Dryopteris inaequalis (Schlecht.) O. Ktze.

Dryopteris alhamantica (Kze) O. Ktze.

Dryopteris Buchanani (Bak.) O. Ktze.

T.R.S.

Dryopteris lanuginosa (Willd.) C. Chr.

Dryopteris crenata (Forsk.) O. Kuntze.

T.R.S.

Dryopteris africana (Desv.) C. Chr.

Didymochlaena truncatula (Sw.) J. Sm.

Aspidium cicutarium (Linn.) Sw.

Polystichum aculeatum (Linn.) Schott.

Polystichum pungens (Klff.) Pr.

Polystichum luctuosum Moore.

Polystichum adiantiforme (Forst.) J. Sm.

T.R.S.

Polystichum aristatum (Forst.) Pr.

Polystichum Macleanii (Bak.) Diels.

Cyrtomium falcatum (Linn. fil.) Diels. (Reduced.)

Leptochilus Heudelotii (Bory) C. Chr.

1. *Oleandra articulata* (Sw.) Pr.
2. *Actiniopteris australis* (L. fil.) Link.

Nephrolepis biserrata (Sw.) Schott.

Nephrolepis cordifolia (Linn.) Pr.

Davallia chaerophylloides (Poir.) Steud.

Microlepia speluncae (Linn.) Moore.

Schizoloma ensifolium (Sw.) J. Sm.

Athyrium filix-femina (Linn.) Roth.

Athyrium Schimperi Mougl.

Athyrium scandicinum (Willd.) Pr.

1. *Asplenium Sandersoni* Hk.

2. *Asplenium Kraussii* Moore.

1. *Asplenium trichomanes* Linn.

2. *Woodsia Burgessiana* Gerrard.

1. *Asplenium platyneuron* (Linn.) Oakes.
2. *Asplenium lunulatum* Sw., var. *minor*.

1. *Asplenium monanthes* Linn.

2. *Asplenium adiantum-nigrum* Linn.

Asplenium lunulatum Sw.

c. *Asplenium lunulatum* Sw., var. *erectum*.

Asplenium lunulatum Sw., var. *erectum*.

Asplenium lunulatum Sw., var. *gracile* P. and R. (reduced).
 c. " " var. *Zeyheri* P. and R.

1. *Asplenium laetum* Sw.

2. *Asplenium varians* Wall.

Asplenium protensum Schrad. (reduced).

Asplenium protensum Schrad., var. *bipinnatifidum* Sim.

Asplenium anisophyllum Kze.

Asplenium unilaterale Lam.

T.R.S.

Asplenium prionites Kze.

Asplenium serra Langs. and Fisch.

1. *Asplenium gemmiferum* Schrad. (much reduced).
2. *Asplenium varians* Wall.

Asplenium gemmiferum Schrad., var. *flexuosum*.

Asplenium gemmiferum Schrad., var. *discolor*.

Asplenium flaccidum Forst.

1. *Nephrolepis exaltata* (Linn.) Schott. 2. *Asplenium Eylesii* Sim.
 3. *Asplenium Mannii* Hk.

Asplenium solidum Kze.

1. *Asplenium Rawsoni* Baker.

2. *Asplenium cuneatum* Lam., var. *angustatum* Sim.

1. *Asplenium cuneatum* Lam.
2. *Asplenium cuneatum* Lam., var. *splendens* (Kze).

Asplenium praemorsum Sw.

Asplenium praemorsum Sw., var. *tripinnatum* Baker.

Asplenium Drègeanum Kze.

Asplenium auriculatum (Thbg) Kuhn.

Asplenium Hollandii Sim. B Fertile segment.

Asplenium abyssinicum Fée.

Asplenium bipinnatum (Forsk.) C. Chr.

Asplenium theciferum (H. B. K.) Mett.

1. *Ceterach cordatum* (Thbg) Desv.
2. " " (grown in shade).
3. " " var. *namaquensis* P. and R.

Blechnum inflexum (Kunze) Kuhn.

Blechnum attenuatum (Sw.) Mett.

1. *Blechnum auriculatum* Cav. 2. *Blechnum attenuatum*, young.
 3. *Blechnum attenuatum* (Sw.) Mett., bipinnate form.

Blechnum punctulatum Sw.

Blechnum punctulatum Sw., bipinnate form.

Biechnum punctulatum Sw., var. *Atherstoni* P. and R.

Blechnum punctulatum Sw., var. *intermedium* Sim.

Blechnum punctulatum Sw., var. *Krebsii* (Kze) Sim.

Blechnum capense (Linn.) Schlecht.

Blechnum tabulare (Thbg) Kuhn (a, b, d much reduced).

Blechnum australe Linn.

Stenochlaena tenuifolia (Desv.) Moore (barren frond).

Stenochlaena tenuifolia (Desv.) Moore (fertile frond).

Gymnogramma argentea (Willd.) Mett.

Ceropteris calomelanos (Linn.) Und. Bull. Torr. Cl.

Pellaea auriculata (Thbg) Fée.

1. *Pellaea dura* (Willd.) Bak.

2. *Pellaea Goudotii* (Kze) C. Chr.

1. *Cheilanthes induta* Kze.

2. *Pellaea lancifolia* Bak.

3. *Cheilanthes multifida* Sw. (pinnule, enlarged).

Pellaea quadripinata (Forsk.) Prantl.

T. R. S.

Pellaea Boivini Hk.

1. *Cheilanthes depauperata* Baker.

2. *Pellaea namaquensis* Baker.

Pellaea involuta (Sw.) Baker.

T.R.S

Pellaea viridis (Forsk.) Prantl (small frond).

Pellaea viridis (Forsk.) Prantl, var. *glauca* Sim.

1. *Pellaea Goudotii* (Kze) C. Chr., var. *major* Sim.
2. *Pellaea viridis* (Forsk.) Prantl, var. *glauca-major* Sim.

Pellaea viridis (Forsk.) Prantl, var. *macrophylla* Sim.

Pellaea hastata (Thbg) Prantl.

Pellaea Swynnertoniana Sim.

Pellaea Doniana (J. Sm.) Hk. (barren frond).

Pellaea pteroides (Linn.) Prantl.

Doryopteris concolor (Langsd. and Fisch.) Kuhn.

T.R.S.

1. *Doryopteris deltoidea* (Kze) Diels.
2. *Doryopteris deltoidea*, var. *laxa* Sim.
3. *Doryopteris robusta* (Kze) Diels.

1. *Adiantopsis capensis* (Thbg) Fée.

2. *Cheilanthes Bolusii* Baker.

1. *Notholaena Rawsoni* Pappe.

2. *Notholaena Eckloniana* Kze.

1. *Notholaena Buchanani* Baker.

2. *Notholaena inaequalis* Kze.

1. *Anogramma leptophylla* (Linn.) Link. 2. *Notholaena bipinnata* Sim.
3. *Ceratopteris thalictroides* (Linn.) Brongn.

Cheilanthes hirta Sw.

1. *Cheilanthes hirta*, var. *contracta*.

2. *Cheilanthes parviloba* Sw.

Cheilanthes parviloba Sw. (large frond).

T.R.S.

Cheilanthes multifida Sw.

Cheilanthes farinosa (Forsk.) Klf.

Hypolepis Bergiana (Schlecht.) Hk.

Hypolepis Schimperi (Kze) Hk.

Hypolepis sparsisora (Schrad.) Kuhn

1. *Adiantum reniforme* Linn., var. *asarifolium* Willd.
2. *Adiantum caudatum* Linn.

TRS

Adiantum lunulatum Burm.

Adiantum Oatesii Baker.

Adiantum capillus-veneris Linn., var. *minor*.

Adiantum capillus-veneris Linn., var. *major*.

1. *Adiantum Poiretii* Wilkstr.

2. Variety of same.

T.R.S.

Adiantum aethiopicum Linn.

Pteris longifolia Linn.

Pteris cretica Linn.

Pteris biaurita Linn.

Pieris brevisora Baker.

Pteris dentata Forsk. (much reduced).

T. R. S.

Pteris Buchanani Baker.

Lonchitis pubescens Willd.

Lonchitis pubescens Willd. (fertile).

Hystiopteris incisa (Thbg) J. Sm.

Pteridium aquilinum (Linn.) Kuhn (much reduced).

T.R.S.

Polypodium vulgare Linn.

Polypodium polypodioides (Linn.) Hitchcock

T.A.S.

Polypodium ensiforme Thbg.

Polypodium phymatodes Linn.

Polypodium lineare Thbg.

Polypodium lineare Thbg, var. *Schraderi*.

1. *Polypodium Pappei* Mett.
2. *Ceterach cordatum* (Thunb.) Desv., var. *pinnatifidum* Sim.

T.R.S

Polypodium lanceolatum Linn.

Polypodium lanceolatum Linn., var. *sinuatum* Sim.

1. *Polypodium lycopodioides* Linn.
2. *Polypodium lycopodioides* Linn., var. *Mackenii* (Bkr) Sim.

1. *Cyclophorus africanus* (Kze) C. Chr.

2. *Polypodium punctatum* (Linn.) Sw.

2 B. " " plant (much reduced).

Polypodium loxogramme Mett.

Elaphoglossum conforme (Sw.) Schott.

Elaphoglossum conforme (Sw.) Schott, var. *latifolium* Sim.

1. *Vittaria isoetifolia* Bory.

2. *Elaphoglossum petiolatum* (Sw.) Urban.

1. *Elaphoglossum spathulatum* (Bory) Moore.
2. *Elaphoglossum petiolatum* (Sw.) Urban, var. *rupestre* Sim.

1. *Elaphoglossum hybridum* (Bory) Moore.
2. *Elaphoglossum lineare* (Fée) Moore.

Elaphoglossum Aubertii (Desv.) Moore.

Acrostichum aureum Linn.

T.R.S.

Platycerium bifurcatum (Cav.) C. Chr. (much reduced).

Platycerium angolense Welw. (plant, much reduced).

Gleichenia polypodioides (Linn.) Sm.

Gleichenia umbraculifera (Kze) Moore.

Gleichenia linearis (Burm.) Clarke.

1. *Schizaea pectinata* (Linn.) Sw.
2. *Monogramma graminea* (Poir.) Schkuhr.

1. *Schizaea teneilla* Klf.

2. *Mohria caffrorum* (Linn.) Desv.

Lygodium scandens (Linn.) Sw. (barren frond).

Lygodium scandens (Linn.) Sw. (fertile pinna). B Fertile segment, enlarged.

Lygodium Kerstenii Kuhn. B Fertile segment, enlarged.

TR5

Ancimia anthriscifolia Schrad.

T.R.S.

Aneimia tomentosa (Sav.) Sw.

1. *Aneimia Drègeana* Kze.

2. *Ophioglossum capense* Sw.

1. *Ophioglossum Bergianum* Schlecht. 2. *Ophioglossum reticulatum* Linn.
3. *Ophioglossum capense* Sw. (small form).

A. *Ophioglossum lusitanicum* Linn. B. *Ophioglossum nudicaule* Linn. fil.
C. *Selaginella depressa* A. Br.

Todea barbara (Linn.) Moore.

Osmunda regalis Linn.

Marsilia macrocarpa Pr. (normal form).

1. *Azolla pinnata* R. Br.
2. *Marsilia macrocarpa*, var. *Burchellii*.
3. *Marsilia macrocarpa*, var. *biloba*.
4. *Marsilia macrocarpa*, var. *capensis*.
5. *Marsilia macrocarpa*, var. *dissecta*.
6. *Marsilia macrocarpa*, var. *lobata*.

Marattia fraxinea Sm.

Equisetum ramosissimum Desv.

Lycopodium saururus Lam.

Lycopodium dacrydioides Baker.

Lycopodium gnidioides Linn. 1. Fertile, 2. Barren.

T.R.S.

Lycopodium verticillatum Linn.

1. *Lycopodium cernuum* Linn.

2. *Selaginella rupestris* Spreng.

Lycopodium clavatum Linn.

1. *Lycopodium carolinianum* Linn.

2. *Psilotum triquetrum* Swartz.

1. *Selaginella Kraussiana* A. Br.

2, 3. *Selaginella pumila* Spring.

Selaginella molliceps Spring.

1. *Gymnogamma aurea* Desv.

2. *Isoetes natalensis* Baker.

3. *Selaginella imbricata* Spring.

Isoetes Wormaldii Sim.

B Sporangium, natural size.

C Macrospore, much magnified.

Vittaria scolopendrina (Bory), Thw.

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