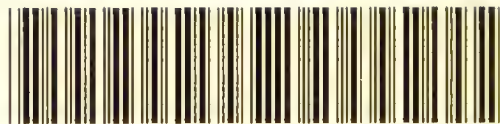




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*J. K. Holliston Esq.
with the Author's kind regards*

THE HANDBOOK
OF
BRITISH FERNS:
BEING
DESCRIPTIONS, WITH ENGRAVINGS,
OF THE
SPECIES AND THEIR VARIETIES.
TOGETHER WITH
INSTRUCTIONS FOR THEIR CULTIVATION.

BY THOMAS MOORE, F.L.S., F.H.S., ETC.,
CURATOR OF THE BOTANIC GARDEN OF THE SOCIETY OF APOTHE-
CARIES, CHELSEA: AND AUTHOR OF "THE FERNS OF GREAT
BRITAIN AND IRELAND, NATURE-PRINTED."
"INDEX FILICUM," ETC.

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P R E F A C E.

IN preparing the HANDBOOK OF BRITISH FERNS, the object of the Author has been to provide a useful and agreeable pocket companion for students and cultivators of these popular plants; and he has reason to believe, from the favour with which the former editions have been received, that his endeavour has not been unsuccessful. It is hoped, that, by the use of the analytical tables of the genera and species, and the wood-cuts, the recognition of our wild Ferns will, in most cases, be rendered an easy task even to the novice; and that these, together with the more detailed descriptions of species, and the short notices of varieties, will serve as useful remembrancers to advanced students.

The classification and nomenclature adopted in the former edition are substantially retained in the present, which has undergone careful revision, much additional information, and many new illustrations, having been interspersed. The

author has continued to follow the system of classification, which is based on the fructification and venation taken in combination, from a conviction that it is the best yet proposed, and, indeed, sufficiently exact and perfect for all useful purposes.

It may be well to explain, since the venation is thus made a prominent feature in the descriptions, that the peculiarities of the veins, in the more compound ferns, are more or less affected in degree of development, by luxuriant growth, as well as slightly varied in this respect, in different parts of the fronds; it should, therefore, be recollected, in making use of the following pages, that their average condition is that which is noted. In general, the basal pinnules on central pinnæ of fronds of average size, have been described.

The author gladly avails himself of this opportunity to thank all those who have kindly favoured him either with criticisms of his statements or with specimens for examination, and trusts for a continuance of similar communications.

CHELSEA, Aug. 31, 1857.

THE HAND-BOOK
OF
BRITISH FERNS.

FERNS constitute so beautiful a portion of the creation, that it seems next to impossible to behold them without experiencing emotions of pleasure. Thus writes a modern historian of the Ferns. Moreover, it is not only when in their native homes, whether located among picturesque ruins, clothing the rude and rocky mountains, or retiring beneath the forest's shade, that they form one of the most beautiful portions of the vegetable creation. The pure botanist, indeed, will most favourably regard the Ferns which he finds clinging to their natural localities, and perpetuating their race without the assistance of man. But another, and perhaps more numerous class of observers of nature, while vying with the strict botanist in the admiration of Ferns, as seen in their natural and wild condition, desire also to render them subservient to the embellishment of home, and would fain ornament their gardens with the elegant forms, which elsewhere they may have seen covering the rugged rock, or tortuous tree-trunk, or skirting the hedgerows with a feathery fringe of vegetation.

To carry out this wish, the scenes and circumstances under and amongst which Nature cultivates her Ferns with so much success, must be imitated ; and hence mimic

rocks and tiny waterfalls have to be called into existence. It may be, that with more extended means at command, the pot-culture of Ferns is preferred. Very elegant and interesting objects, indeed, are they when so treated, whether beneath a covering of glass, or the more homely protection of canvass—this being, moreover, the condition under which very many fern admirers find fern culture most convenient to their circumstances. Those, again, who, in pursuing this fascinating object, may be led to adopt the more refined indoor mode of culture, to which the Wardian case may be made subservient, will find no more beautiful or interesting parlour or window ornament, than one of those cases piled internally with miniature rocks, studded with living ferns.

The cultivation of Ferns is a growing fancy, and one which may well be fostered and encouraged. For whoever admires ferns must be a lover of nature; their simple ungaudy elegance—superlative though it be—having nothing in it to attract those whose eyes can feast only on the pagantry of floriculture. Thus, while flowers may be admired and esteemed for some quality altogether independent of their natural beauty, Nature and Ferns are, as it were, inseparable. Apart, however, from the influences which the contemplation of their simple beauty, and yet their almost endless variety of form, may have upon the mind, the study of their marvellous structure, and the curious changes to be observed in the progress of their development for the dust-like spore, affords both ample scope and abundant recompense for the labour of investigation.

Thus, as with the rest of that work which, unchanged from its primæval state, has been pronounced to be "very good," the study even of the lowly Ferns, is well fitted to

"Lead through Nature up to Nature's God."

THE STRUCTURE OF FERNS.

THE Ferns form a group of aerogenous plants—that is, plants increasing in size by accretion at the apex or growing-point,—having stems and leaves readily distinguishable. The stems bear leaf-like fronds, and these produce their peculiar reproductive organs, either, as is most common, on their under surface or back, or else, as occurs in some instances, on their margin. Ferns have no flowers in the popular sense, but instead of them they produce certain peculiar bodies called spore-cases, containing spores or germinating atoms, which, from their function rather than their structure, may be considered as somewhat analogous to the seeds of flowering plants.

The external parts or organs of ferns are the following: namely, the Root, or fibril; the Caudex, or stem; the Frond, or leaf; and the Fructification, of which the reproductive atoms are the ultimate product.

The true Roots consist of fibres, which are either produced at intervals along the creeping caudex, or, where the caudex is not of this creeping habit, they push out on all sides from among the bases of the decayed or decaying fronds, of which the caudex is mainly constituted. These roots are more or less wiry in texture, sometimes simple, oftener branched, and generally, especially on the younger portions, clothed with fine hairs, producing a velvety or downy surface. These organs, of course, act as absorbents to supply food to the plants.

The CAUDEX, or rootstock, is often erroneously called the root. It is however, a true stem, and assumes

among the ferns, two distinct appearances. Sometimes it becomes lengthened and creeping, either beneath or upon the surface of the soil or rock on which it grows, and then acquires the character of a rhizome. Sometimes it is scarcely or not at all lengthened, but erect and tufted, forming little more than a crown, whence the fronds issue. This latter form of stem, however, occasionally in age becomes considerably elongated, even in some of our native species, and these instances afford an imperfect idea of the manner in which the trunks of the tree ferns of the tropics (which, in some cases, attain fifty or more feet in height) are formed. This elongation of the older caudices, may be observed frequently in the *Osmunda regalis*, and more rarely in the *Lastrea Filix-mas*, *Lastrea Oreopteris*, *Lastrea dilatata*, *Athyrium Filix-femina*, and *Polystichum angulare*. The stems of the *Osmunda* are often met with from one to two feet high. The erect stems or rootstocks vary much in bulk, and in some species branch freely, producing many tufted crowns, but in other species they are very rarely at all divided. It is no doubt to this tendency, in part, that the elevation acquired by the stems of tree ferns is due. When the stem assumes the creeping habit, it is usually tortuous and branching, and extends itself either on the surface, or a few inches below the surface of the earth, becoming, in fact, a branching prostrate stem, from which the fronds spring up individually and distinct, and more or less widely separated. These creeping stems, or rhizomes, are of variable size, sometimes as thick as one's thumb, in other cases as fine as threads; they are often thickly covered with scales, which are variable in size and form. Sometimes the creeping stems of the stronger growing species extend to a considerable distance as well as depth.

The creeping stem, where it exists, affords great facilities for propagation; a portion of moderate length, bearing a frond, when separated from the rest, and placed under proper conditions, producing roots in due time, and forming an independent plant. Whether

erect and tufted, or lengthened and creeping, the growth of these parts, according to Hofmeister, takes place only by a continued multiplication of one apical cell.

The FRONDS are the most conspicuous portion of the plants. Proceeding from the caudex, which is a true stem, they are, in some measure, analogous to the leaves of other plants; and, for this reason, the term *frond* has been objected to as unnecessary, the parts being considered as leaves. The peculiar manner, however, in which the fructification is borne on this portion of the plant, seems to render it desirable to maintain a distinctive name. An analogy has been traced between the fronds and the deciduous branches of other plants; but this does not hold good, because, though the fronds are in some cases articulated with the stem, especially in those of creeping habit, yet they are not so always. The fronds of almost all ferns, are, in their incipient condition, coiled up inwards towards the axis of development, forming a series of convoluted curves. This folding up of the fronds of ferns, as of the leaves of other plants, is termed their *vernation*; and the peculiar form of vernation, just mentioned, is called *circinate*. The only British ferns which differ in this respect, are the *Botrychium* and *Ophioglossum*, in which the parts, instead of being rolled up while undeveloped, are simply folded together. The more compound of the circinate species have the divisions of the frond also rolled up in a similar manner: in this case, the larger divisions first open, and the rest afterwards, in succession. In many species, the partially developed fronds have a very peculiar and graceful appearance.

When the fronds become fully developed two parts are distinguishable. At the base, more or less extending upwards, is a leafless portion, which is called the *stipes* or stalk, or, sometimes, by error, the stem, the latter term properly belonging to the caudex. The stipes is formed of a hard external woody layer, covered by an epidermis,

and enclosing a mass of cellular tissue, traversed by plates or bundles of vascular tissue, disposed in some regular order. The number and position of these vascular bundles have been suggested as characters for discriminating genera and species, but for this purpose they are valueless, as they differ in the same plant at different elevations of the stipes, as well as in stipes of different degrees of vigour at the same points of elevation. The lower part of the stipes, generally, and sometimes even the entire length of the *rachis*, which is the continuation of the stipes through the leafy portion of the frond, is more or less furnished with paleaceous or membranous scales, which are, in some cases confined to a few small bodies scattered sparingly near the base of the stipes, but in other instances are so large and numerous as to produce a shaggy surface. These scales are, no doubt, appendages of the epidermis of the same nature as the hairs and scales found on the surface of other plants; but, whatever their origin, they are constant in their appearance and development in the same species. In most of the creeping-stemmed ferns, the base of the stipes is articulated with the stem, that is to say, it is furnished with a natural joint or interruption of the woody fibres, so that in age it separates spontaneously. This is less frequently the case with the tufted or erect-stemmed kinds. In the more highly compound fronds, the rib which runs through their centre is called the primary rachis, while that which runs through the pinnæ is the secondary rachis, and so on. The stipes and rachis may be either green or coloured; if the latter, it is usually a dark purplish brown.

The upper portion, or lamina of the frond, extending more or less downward, is thinner expanded and green—in fact, leaf-like. This leafy portion offers many states of division, the parts being much influenced in size and number by external circumstances. It is sometimes simple or undivided; sometimes pinnatifid or more or less deeply cleft; sometimes pinnate or divided into distinct leaf-like divisions, called *pinnæ*; sometimes bipin-

nate, that is, the pinnae themselves cut into distinct divisions which are called *pinnules*. In some cases, the fronds are still more compoundly divided, the pinnules being either pinnatifid, or even again pinnate. When the pinnae, or pinnules, are only deeply cleft, they are said to be pinnatifid, as in the case of the frond. The peculiarities of the division of the frond are much employed in distinguishing the species, and are tolerably constant.

In the majority of ferns, the mature fronds are alike fertile, and are similar in their appearance; but in certain species, the habit is to produce some of the fronds wholly barren, and others wholly fertile; in these instances the fertile fronds are more or less contracted.

The outline of the fronds varies greatly, and is distinguished by the terms which are applied to the same forms in other plants; the most common being the lance-shaped, triangular, and oval, variously modified. In their magnitude, also, the fronds of the British species vary greatly—from two or three inches to five or six feet in length, and from less than an inch to two feet or more in width.

In the form of the divisions of the frond, there is an almost endless variety. Their texture and colour afford other differences, some being thin and almost transparent, others thick and leathery, and some even rigid; some pale-green, some deep-green, some blue-green, some brown-green; some smooth and shining, others opaque or hairy. Like the leaves of other plants, the fronds of ferns are variable in their duration. In some species they are persistent, so that either absolutely, or with very slight shelter, the plants become evergreen—those possessing this habit being the most valuable for the cultivator, where a continuous effect is an object. In other species they are fragile, and of short duration, and produced only during the warmer portion of the year, shrinking before the first breath of winter; among these latter, however, notwithstanding the brief existence of their fronds, are comprised some of our most delicately beautiful species.

The woody fibre, or vascular tissue, which is found in the stipes, and continued onwards into the rachis, is carried still further, its ultimate ramifications forming *veins* or ribs, which occur in the substance of the leafy part of the fronds. Thus, the vascular system may be said to form the framework of the entire plant, which is filled out by cellular expansions. Now, it is on some determinate part of the veins just alluded to, that the fructification is borne. The vascular system, or *venation*, has thus a very close connection with the production of the reproductive organs, and its modifications have been very properly used freely as discriminating characters, in some of the modern systems of classification. The part of the vein on which the sorus is seated, is called the *receptacle*. It occurs sometimes at the apex of a vein, when it is said to be *terminal*; sometimes at a point between the apex and the base, when it is *medial*; sometimes transversely continuous, combining, as it were, the adjacent veins crosswise. Sometimes it occurs at a point where two or more veins unite, but there are no examples of this structure among British ferns.

The veins are distinguished by different names, according to their relative position. The central rib, which runs along a simple frond or one of the ultimate portions or divisions of a compound frond, and which is usually, though not always, present, is the mid-vein or *costa*; the branches of this mid-vein are called *veins*; the branches of the veins are *venules*, and the branches of the venules are *veinlets*; so that whilst veins are the first series of branchings from the costa, venules are the secondary, and veinlets the tertiary series.

If there is no costa, the first ribs from the base are called veins, and their branches venules and veinlets, as before. In some ferns the system of venation does not go beyond the development of the first series from the costa—the veins, which are unbranched; and, in others, the costa itself is not present, but the whole venation consists of forked veins, venules and veinlets, as in the Maiden-

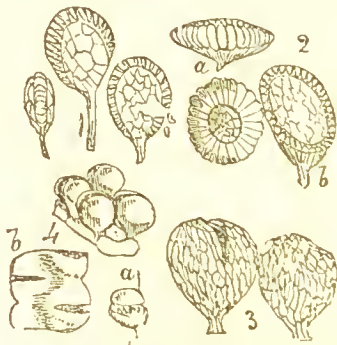
hair and Moonwort. In their modes of branching, veins are either feather-branched (*pinnate*), or fork-branched, (*dichotomous*); and they may have their points free, that is, disunited; or the apices may be joined together so as to form a reticulated or network venation.

The REPRODUCTIVE ORGANS of ferns consist of *spores*, or germinating atoms, and these are enclosed in *spore-cases*, sometimes called *thecæ*, or *capsules*. The spore-cases are mostly furnished with a shorter or longer pedicel, and have extended nearly or quite around them an elastic vertical band or ring (*annulus*), the elasticity of which causes them to burst by an irregular transverse fissure when they reach maturity. It is the force with which the spore-cases thus burst open, that scatters the spores. In some ferns the pedicel is almost wanting, and the ring is oblique, instead of vertical to the axis of the spore-cases; and, in a few instances, the spore-cases are quite sessile, and without the ring, opening by regular valves. From these peculiarities of structure, ferns have been divided into two groups—the *annulate* and *exannulate*. When the fructification is borne on the under surface, or, what is usually called the back of the frond, it is said to be *dorsal*—such ferns being called dorsiferous; but when it is protruded from the edge of the frond, it is said to be *extra-marginal*.

The spore-cases, in all annulate ferns, are collected together into groups of various outline, sometimes forming distinct spots, round or oblong, sometimes forming lines more or less extended, and occupying different positions. These groups or clusters are collectively called *sori*, individually a *sorus*. In the extra-marginal fruited group the spore-cases are collected around the free extremities of the veins, and surrounded by urn-like expansions of the tissue. The exannulate ferns have their spore-cases collected upon the sides or surface of contracted fronds. The spore-cases, in certain of the annulate groups, spring from the surface of the fronds without any cover-

ing; in these the sori are said to be naked. In other groups they are, when quite young, closely covered by a membrane of the same form as the sorus, so that they appear to rise, as it were, from beneath the cuticle, which is pushed up and forms a cover. Sometimes, however, the membrane is beneath the sorus. The membrane itself is called the *indusium*, or cover, when produced over the spore-cases; and the *involucre* when it is seated beneath them. From these peculiarities have arisen the two groups of *indusiate* and *non-indusiate* ferns, into which the annulate series is disposed.

The vertical-ringed spore-cases, when mature, split suddenly with a transverse fissure, thus ejecting the spores. This fissure occurs at a point, which M. Fée calls the *stoma* or mouth, where the joints of the ring become dilated and attenuated. Those which are furnished with a horizontal ring, on the other hand, burst vertically. The spore-cases of the exannulate ferns are regularly two-valved. In *Ophioglossum* there is no spore-case beyond the involute contracted segments of the spore-bearing leaf. The accompanying figures will convey an idea of the external appearance of these organs.



[Spore-cases: 1. Polypodiaceæ 2. Hymenophylleæ, (a) Trichomanes, (b) Hymenophyllum; 3. Osmundaceæ; 4. Ophioglossaceæ, (a) Botrychium, (b) Ophioglossum.]

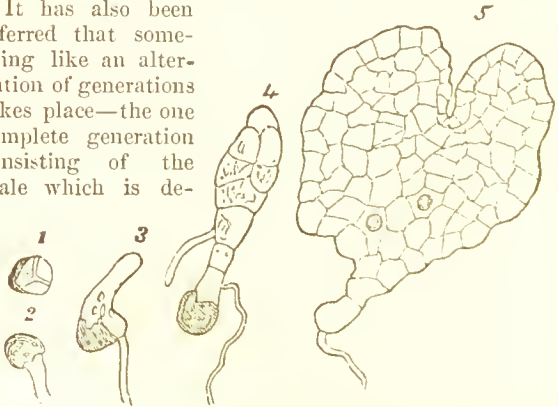
The spore-cases arise directly from the veins, either on the under surface, or projecting from the margin of the fronds. They seem to have been long considered as special organs, not having any very clear analogy with any part of the structure of flowering plants. Dr. Lindley, however, suggests that they may be considered as minute leaves, having the same gyrate mode of development as the ordinary leaves or fronds; their stalk being the petiole, the annulus the midrib, and the case itself the lamina with the edges united. This view appears to have originated in a persuasion that there would be no special organ in ferns to perform a function which, in flowering plants, is executed by modifications of the leaves. The theory, however, is applied only to the gyrate ferns. In those which are furnished with a transverse ring, it is suggested that either the midrib of the young scale, out of which the case is formed, is not so much developed; or the case is a nucleus of cellular tissue, separating both from that which surrounds it, and from its internal substance, which latter assumes the form of sporules, in the same way as the internal tissue of an anther separates from the valves, under the form of pollen.

The spores are minute, roundish angular or oblong, dust-like, brownish or yellowish bodies, arranged without order within their cases. So small, indeed, are they, that when shaken over a sheet of paper, they are scarcely visible to the naked eye, though scattered by thousands amongst the also minute emptied spore-cases. They differ obviously from seeds, in having no special organs, consisting merely of a homogeneous cellular mass; and they differ also in other material respects. In true seeds the radicle or young root, and the plumule or young shoot, are present in the embryo, being developed from determinate points; but nothing of this kind occurs in the development of ferns from the spores, as they have no embryo. On the contrary, they consist merely of a small vesicle of cellular tissue—a vegetable cell—growing

indifferently from any part of its surface, and becoming divided into others, which are again multiplied and enlarged, until they form a small green leaf-like germinal scale, from which, in due time, the proper fronds are produced. They are sometimes smooth, sometimes tuberculated, or even echinate on the surface, and consist of two layers or coatings, enclosing a thickish granular liquid.

The germination of the spores of ferns has lately excited much inquiry, the result of which leads to the inference that something like sexuality exists among all the higher groups of Cryptogamous plants, a kind of fertilisation taking place on the *prothallus* or germ-frond, a development from the spore, which, in the ferns, takes the form of a leaf-like scale, as already mentioned. According to Professor Henfrey, who has closely investigated the subject, the existence of sexes in the ferns is beyond a doubt.

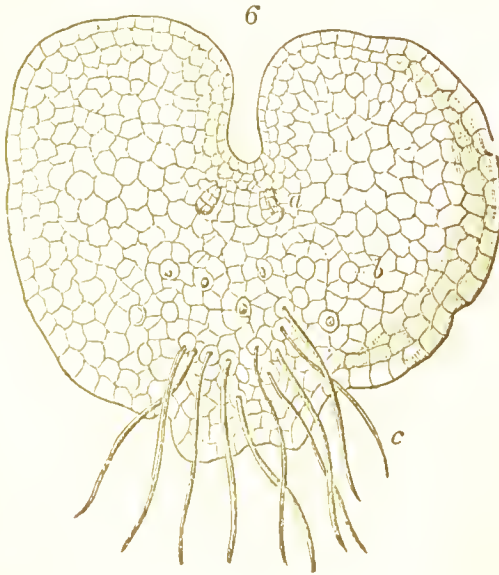
It has also been inferred that something like an alternation of generations takes place—the one complete generation consisting of the scale which is de-



[Figs. 1 to 5. The spore and its stages of development; fig. 5, showing two antheridia.]

veloped from the spore, and bears the parts through which fertilisation takes place; the other, which results from this latter act, being totally different, much more developed, and producing stems, fronds, and spores.

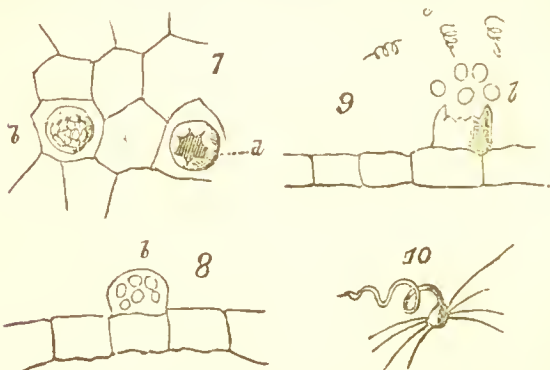
The facts from which these inferences are drawn have been variously, and even conflictingly, stated by different observers. Suminski, who seems to have first detected



[Fig. 6. Prothallus or germ-frond; *a*, pistillidia; *b*, antheridia; *c*, root-fibrils.]

the pistillidia, and to have correctly interpreted the nature of the antheridia previously seen by Nägeli, states, that the spore first produces a filamentous process, in the end of which cell-development goes on until it is converted into a small leafy scale, of very delicate texture,

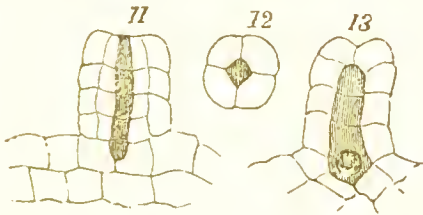
possessing hair-like radicles on its lower surface. Prof. Henfrey describes this development as a bursting of the outer coat of the spore, and a protrusion of its inner coat in the form of a little tubular pouch, the contents of which soon acquire a green colour; this tube becomes divided by cross partitions, as it elongates, until at last the apex enlarges in size by the formation of cells, until it appears as a little leaf-like green plate, which is usually roundish



[Figs. 7 to 10. Antheridia: fig. 7, *b*, containing vesicles; *d*, burst; 8. side view of *b*; 9, the same, discharging the vesicles; which latter discharge the spiral filaments fig. 10.]

heart-shaped, with a deep notch at the broader apical end. The base of the tube gradually withers, but the part of the plate, or prothallus, to which it was joined, thickens and throws out hair-like filaments. At an early period of the growth of the prothallus, a number of small cellular bodies are to be seen on its lower surface. These, which are called *antheridia*, consist of somewhat globular cells, seated on and arising from single cells of the prothallus: they produce each in its interior a number of minute vesicles, containing each a coiled-up spiral filament, consisting of a delicate thread with a thickened vesicular club-shaped extremity, furnished with cilia.

If the antheridia are placed in water when ripe, the globular cell bursts and discharges the vesicles, and the enclosed spiral filaments then make their way out. The antheridia are analogous in their physiological nature to the pollen of flowering plants. At a later period of the growth of the prothallus, appear other larger and more complex cellular bodies which are analogous to the ovules or nascent seeds of flowering plants; these bodies, called *pistillidia*, or *archegonia*, are fewer in number than the



[Figs. 11 to 13. Pistillidia or Archegonia: 11, side view; 12, summit seen from above; 13, vertical section, showing embryo cell in the cavity.]

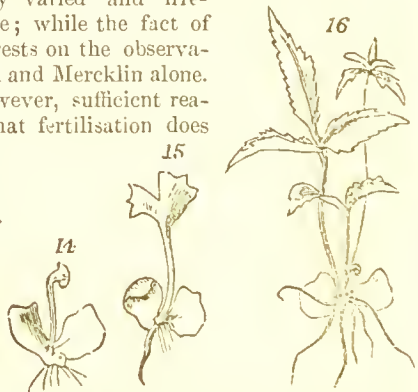
antheridia, and at first appear as little round cavities in the tissue of the prothallus, lying near its centre, and opening on the under side. The mouth of the cavity is bounded by four cells, which grow out from the general surface into a blunt cone-like process; these cells divide and grow out until the whole exhibits externally a cylindrical form, composed of four tiers of cells, the uppermost of which converge and close up the orifice, within which lies a small globular cellule, or germinal vesicle, which becomes fertilized through the agency of the spiral filaments, and is then gradually developed into an embryo plant, possessing a terminal bud, whence the proper stem is developed.

Hofmeister has distinctly observed the young plant, or, rather, the terminal bud of the new axis, produced within the pistillidium, and regards the globular cellule in its centre as itself the rudiment of the stem, the embryo

originating from a free cell produced within it. Mettenius, who has observed a nucleus within the globular cellule, believes the development of the embryo to consist in the division of this into two, which go on dividing to produce the cellular scale-like structure of the first frond. Mercklin states that the spiral filaments swarm round the pistillidium in numbers, and penetrate it, though he saw this very rarely; moreover, he saw, in the tubular portion, almost in every case, at a definite epoch, certain club-shaped granular mucilaginous filaments, in contact with the globular cellule; and he concludes that these are transformed spiral filaments, which have penetrated the pistillidium, and that they contribute to the origin or development of the terminal bud.

The existence of sexes in the Ferns, seems, therefore, to be supported by varied and irrefragable evidence; while the fact of the fertilisation rests on the observations of Suminski and Mercklin alone. There seems, however, sufficient reason to *assume* that fertilisation does really take place.

The production of certain intermediate forms of ferns and allied plants, of the nature of hybrids, suggestive that something like hybridisation does occur among cryptogams, furnishes one of these reasons.



[Figs. 14 to 16. Young plants of *Pteris serrulata* from the spores.]

After the organisation of a terminal bud within the pistillidium, young fronds soon make their appearance. At first these are very unlike those of the matured plant, being of more simple form and more delicate texture;

but they gradually acquire more and more the texture and form peculiar to their species, though, with the exception of a few annual kinds, they are a couple of years, or, in many cases, much longer, in arriving at a perfect state.

In their INTERNAL STRUCTURE, Ferns are the most highly developed of all the aerogenous plants. In the lower of these cryptogamous plants, the whole consists merely of cellular tissue ; but in the more highly developed orders, among which Ferns take the highest rank, vascular and woody tissues are found. The structure of the stems or rhizomes varies greatly. In some, vascular bundles are distributed throughout the whole mass of tissue, while in others they are ranged in some definite order, sometimes forming a closed cylinder, sometimes a single circular series, or ranged on either side of hard plates, or reduced to a central bundle. The larger vascular bundles of the stem are in some instances quite unconnected with those of the stipes. The same kinds of tissues are found in the stipes and rachis, where they occur in the form of detached rounded bundles, or flattened, often curved, plates. Their arrangement and number have been suggested as affording generic or specific distinctions ; but for this purpose they have little value, for they are variable both in number and arrangement in plants of the same species of different degrees of vigour, as well as at different elevations of the same stipes. This vascular system is further carried through the frond, in the ribs and veins which traverse the various leafy parts into which it is divided. It is this connection of the veins of the fronds with the entire vascular system, and the fact that on some part of them the spore cases are borne, which gives to venation its great value in the systematical arrangement of these plants.

In the more highly organised Ferns, the tissues are described by Mr. Berkeley as having the following dis-

position. Round the scars of the stipes are cavities filled with stellate brown tissue. The cortical layer consists of first, cuticle, then parenchym, then a harder layer, consisting sometimes of pareuchymatous, sometimes of prosenchymatous tissue, with thick dotted sides. The enclosed cylinder is filled with softer cellular tissue, containing numerous cysts filled with resinous matter, as well as various bundles of vascular tissue; the larger of these latter are flattened, variously curved, and surrounded by dense tissue, like the inner layer of the bark, and arranged in a circle symmetrically round the axis, with short interspaces, through which the other smaller bundles, dispersed in the central mass, give off branches into the stipes. The vessels, which vary greatly in size, are always scalariform, accompanied by cellular tissue, and surrounded by elongated pale wood cells (pleurenchym), beyond which is parenchym mixed with resinous cysts. The structure of other ferns is more or less in accordance with this, the most highly organised type. The disposition of the bundles and of the hard tissue is, however, greatly varied; while, in some ferns, there is scarcely any distinct cortical layer.

THE DISTRIBUTION AND AFFINITIES OF FERNS.

FERNS are natural hygrometers, their occurrence in a state of luxuriance being a certain indication that the locality is moist, either atmospherically or terrestrially, or both; indeed, the degree of luxuriance attained, is a tolerable index of the degree of moisture, and the presence of these plants in any abundance, is generally to be taken as evidence of abundant moisture. Dampness of the soil and of the atmosphere, thus appears to regulate their development, both as regards their number and their size; and when to these conditions are added the shelter afforded by a wooded country, or the peculiar conditions of a hilly, mountainous, or rocky surface, this development reaches its maximum. Bleakness and exposure are conditions generally unfavourable to them; indeed they rather prefer shelter, if not shade. Notwithstanding that, for many ferns shade, is an indispensable requisite, yet it must be held to be far less important generally than either moisture or shelter. Some ferns even prefer exposure to the sun—both of those which grow naturally on dry rocks, and those which occur in situations where their roots are constantly moistened. When growing in drier and more exposed localities, they follow the law which affects vegetation generally, being in such situations smaller, more rigid in texture, and often, less divided. It is an interesting question, in the present uncertainty about the limits of species, whether variations of appearance thus induced, become permanently fixed characters, transmissible to succeeding generations.

The British ferns are distributed over every part of the United Kingdom, occurring more or less abundantly from north to south, and from east to west, where local peculiarities are favourable to their existence. These are much more congenial to ferns on the damp western shores of our island than on the drier eastern side, and hence ferns are fewer in the latter, and more abundant in the former. The proportion which they bear to the phænogamous portion of the Flora of the British Isles, may be taken in round numbers, as 1 to 35. In Scotland, they are computed to hold the proportion of 1 in 31.

The limits of this volume do not admit of the distribution of the British species being stated in detail. Some attempt, however, may be made under the several species to indicate their range. A more detailed account of their habitats will be found in our *Popular History of British Ferns*; and a general view of their distribution is given in Mr. Watson's *Cybele Britannica*, the latter a most valuable contribution to botanical geography.

The geographical distribution of true Ferns (*Polypodiaceæ*) generally considered, shows an enormous disproportion between them and the rest of the Flora in tropical islands, where moisture abounds. It is consequently in the Islands of the Indian and the Pacific Oceans, and the Gulph of Mexico, that they reach their maximum as to numbers, both of individuals and species. They are less numerous on continents. South America is, however, rich in ferns, on account of its damp climate, though the numerical proportion is less than in the islands alluded to. Of the total number of tropical ferns, there is no estimate which can be taken as approximately correct; but nearly three hundred species have been collected in the Philippine Islands alone. The north temperate hemisphere produces scarcely one hundred species, and no near approach to a tree fern, while in corresponding latitudes of the southern hemisphere there is a luxuriant vegetation of ferns. Arborescent ferns attain their boreal

limit in north lat. 37 deg. (only in the humid valleys of the Himalaya), but various species are found in perfection in south lat. 40 deg. to 50 deg. The arctic limit of ferns is in America, at Minto Inlet, lat. 70 deg. N. and long. 120 deg. W, whence *Cystopteris fragilis* has been obtained; and at Disco, where, in addition, *Polystichum Lonchitis* was found. Europe, according to Dr. Hooker (from whose admirable sketch in "Berkeley's Cryptogamic Botany" many of the foregoing statements are gleaned), contains only sixty species, and temperate continental North America only fifty.

The Adder's tongues (*Ophioglossaceæ*) are most abundant in the islands of tropical Asia; they are found also in tropical America, and in the West Indies, and are not uncommon in the temperate latitudes of both hemispheres.

As regards their AFFINITIES, the Ferns approach flowering plants through the Cycads (*Cycadeaceæ*) a group of Gymnogens, which Lindley considers nearly allied to them, on account (1) of the imperfect degree in which the vascular system of that order is developed, (2) of their pinnate leaves with a gyrate veneration, and (3) of their naked ovules borne on the margins of contracted leaves, as the spore-cases are upon the leaves of *Osmunda* and *Ophioglossum*. He also regards them as being related to Conifers (*Pinaceæ*) another group of Gymnogens, through *Salisburia*, whose leaves might be mistaken for those of a fern; but these resemblances seem merely analogical.

The direct affinity of ferns is among the Acrogens, of which, the Horse-tails (*Equisetaceæ*), Club-mosses (*Lycopodiaceæ*), and Pepper-worts (*Marsileaceæ*), are intimately related to them, by the extreme similarity of their mode of development from the spore, all of these producing on their germination (or their cell-division analogous to germination), a prothallus on which are produced antheridia as well as pistillidia or archeogonia, the latter after impregnation, developing a spore-bearing

plant. In the Horse-tails, the vascular tissue is more highly developed than in ferns, and hence they are regarded as forming a higher type of vegetation. The Club-mosses, which have a closer relationship with the ferns, are distinguished readily by their axillary spore-cases, opening by regular valves, and seated in the axils of stem-leaves or bracts. The Pepper-worts are separated by their radical fructifications.

THE CULTURE OF FERNS.

SPECIAL hints on the treatment applicable to each species will be given when we come to describe them. In this place, however, some general rules may be laid down, in order to avoid subsequent repetition.

Ferns are propagated either by sowing the spores as seeds, or by dividing the plants. When the latter mode is adopted, it is generally best to remove the plant from the soil, and shake away all, or as much as possible, of the soil from the roots, in order that the parts may be clearly seen. Those ferns which have creeping rhizomes, are generally increased, without difficulty, by dividing it so that each portion intended for a plant has one or more fronds, and a portion of the roots retained with it, in an uninjured condition. Such divided portions should be potted in the light soil recommended for the more delicate sorts, and should be kept close in a cool moist frame until established. They must be potted with the rhizome buried, or fixed on the surface, according to the habit of the kind under treatment. Those having a tufted or erect caudex require a different process. If there is more than one heart or crown, (as the tuft of fronds which surround each distinct axis is termed), the point of a knife is to be inserted carefully so as to separate them in such a manner that each crown may retain a portion of the roots. These divided portions are then potted in the soil proper to the species, and kept in a frame until established, as in the other case. Sometimes those which have the erect caudex, form but a single crown, and to attempt to divide this would be to spoil or, perhaps, destroy the plant. In such cases the only

course, if propagation must be attempted, is to destroy, by some gentle process, the axis, or extreme point of growth, to wait patiently until the lateral crowns which *may* thus be forced to develop themselves, have gained some strength, and then to divide as before; only, in this case, very much more care is necessary in the process of division. The spring season, just before growth recommences, is the best time for these operations.

Another extremely easy mode of propagating ferns, such as the Hart's tongue, in which the living fleshy bases of the decayed fronds surround the older parts of the caudex, has been discovered by Mr. Jackson, of Guernsey. Each of these small portions, cut away with a portion of the rind of the caudex, and planted like root-cuttings, will, if aided by a little warmth, organise buds from the cut edges, and so produce young plants. In this way a single old plant may be made to yield progeny by dozens.

The most interesting mode of propagation, however, is by the spores. The conditions chiefly necessary for their germination, are, sufficient heat and abundant moisture; that is to say, a calm moist atmosphere, accompanied by the degree of heat proper to each species. Those which inhabit cold climates require only a cold close frame; the species of temperate regions are best reared beneath a hand-glass in a greenhouse; and the tropical species should be placed in a hothouse. A convenient way of managing them is the following:—Half-fill some shallow wide-mouthed pots with broken crocks, and on this put a layer of about two inches of turfy peat soil and mellow loam, mixed with soft sandstone, broken into small lumps of the size of peas; this compost should not be much consolidated. Next, shake or brush gently over a sheet of white paper, a frond of the species to be propagated; the finest dust thus liberated consists of the spores, in greater or less quantity, intermixed more or less with the much larger though dust-like spore cases. This dust is to be regularly and thinly scattered over the rough

surface of the soil, which is immediately to be covered with a bell-glass, or any flat glass fitting down close to the pot. The pots are at once to be set in feeders, and these filled up with water; they are then to be placed under a hand-glass in a cold frame, or in a greenhouse, or in the stove, as may be most proper. The first indications of germination will consist in the appearance of little semi-transparent green scales. The supply of water must be kept up, and the glasses kept over the young plants. When two or three fronds are developed, the glasses should be tilted on one side for a short time every day, and, ultimately, entirely removed, the pots still being retained under a hand-glass. After a week or two they may be taken up, carefully separated, and potted singly in small pots. The young plants should still be kept under a hand-glass until established, and then gradually inured to the degree of exposure proper for the mature plants. Perhaps the greatest risk in rearing ferns from spores lies in sowing them too thickly, in which case the germ-fronds die away for want of space to develop themselves. Fern spores spring up in myriads on the surface of the soil, or on any undisturbed continually moist surface, about the growing plants, from which they are dispersed as they ripen on the fronds. In hothouses this is so much the case, that they sometimes become troublesome weeds.

The mode above described suffices for the purpose of raising Fern spores for the mere purpose of propagation. Where, however, it is desired to watch the progress of development, either in a cursory way, or, more minutely, by means of a microscope, the plan adopted by Mr. Deane, of Clapham, and described by him in Mr. Ward's valuable book on the growth of plants in the close glazed cases, may be recommended. Mr. Deane made use of a peculiarly fine and soft sandstone, which was prepared by breaking it into pieces of from one to two inches square, and less than one inch thick, the faces being rendered parallel and smooth by rubbing on a flat stone.

The object of thus adjusting the size and smoothness of the pieces of stone, was to facilitate their being placed for observation on the stage of a microscope. Before sowing the spores, the prepared pieces of stone were baked in an oven to destroy any organic matters which might be lurking about them. They were then moistened with distilled water, and covered with bell-glasses, preparatory to receiving the spores. The spores were obtained by laying recently-gathered fronds, with mature fructification, between sheets of white paper, which were pressed slightly to keep them in place, and in three or four days were found to contain an abundance of spores discharged from the spore-cases. The spores were attached to the damp surface of the stones by inverting the latter on them, care being taken that they did not lie too thickly. The stones were kept moist, and covered by glasses. In this way many species were raised without a failure; and by this process the kinds sown were raised with certainty, which is often not the case in the ordinary garden process, stray spores in most cases intruding themselves in some unsuspected way, and often leading to disappointment. Any one who makes a garden of this kind under a bell-glass, must observe that the material used is so porous that the requisite amount of moisture may pass to the top by capillary action, when applied to the bottom of it; it is also necessary that while allowing an abundance of light, the sun must not shine directly on the surface of the stones.

Nearly all Ferns like the soil more or less sandy. A mixture suitable for all the purposes of pot-culture may be thus compounded: Take of fibry mellow loam, light spongy peat, and well-decayed pure leaf-mould, equal parts, and mix them with sand. For all the stronger-growing species, use the soil in the rough state to which it will be reduced by merely chopping it fine with the spade, and add to it an eighth part of clean but coarse sharp sand. For all the smaller and more delicate species, rub the soil through a sieve with half-inch square

meshes, and be careful to rub through as much of the fibry portion as possible; add to it a sixth part of clean silver sand. In both cases mix up with this compost a fourth part of crushed sandstone, broken to the size of walnuts and smaller for the vigorous growers, and of the size of hazel-nuts and smaller for the more delicate sorts.

Pot Ferns must always have thorough drainage. One fourth of the depth of the pot should be occupied by drainage material, which may consist of potsherds broken up to the sizes of nuts and walnuts, rejecting the finer portions. On this a thin layer of sphagnum moss should be spread, to prevent the soil washing or settling down among the drainage. Then, in potting, lay a little soil on the moss, spread out the roots as much as possible, and fill in the soil gradually, shaking and working it with the fingers well among the roots. When the pot is filled, consolidate it by a few smart taps on the potting-bench, and press firmly with the fingers, so that the soil may be settled down close and firm, and fill the pot to within from half an inch to an inch of the level of the rim. The soil should be in a half-dry state when used—never wet, or approaching an adhesive condition. The small ferns seldom require pots larger than five inches in diameter, and good plants of the large ones may be had in pots from twelve to eighteen inches in diameter. From March to May is the best time for re-potting. If the soil is open, and the pots not too full of roots, avoid re-potting, for the less ferns are disturbed at the roots, provided those roots are in a suitable condition, the better. If, however, the texture of the soil has become too close from the decay of its fibry particles, if the drainage has become imperfect, or, if the pots are too full of roots, re-pot by all means; in the former cases shaking away as much of the old soil as possible, and rectifying the errors; and, in the latter, affording a larger pot, if the limit has not yet been reached. If space cannot be given for a larger pot, then reduce the

roots without bruising those retained, or divide the plant, and re-pot in the same sized pot, or a smaller one, according to circumstances.

All Ferns love moisture; therefore, while they are growing, they should be well supplied. The supply to the roots must vary according to the habits of the species; but through the growing season, or from May till September, the plants will be benefited by a daily syringing over the fronds, repeated in the evening of all hot days. Dryness at the root, or in the atmosphere, is, in a general way, very hurtful to them. At the same time, it is to be remembered that if, by reason of continued dull or damp weather, the amount of water supplied is producing, or seems liable to produce, anything like a soddening—continued *wetness*, as distinguished from mere dampness, of the soil, the supply must be checked, for no ferns, except the few which are naturally bog plants, will thrive in soil approaching this condition. Soft, or, at least, aerated, water should always be used, and the water used for syringing should be scrupulously clean, or the fronds will soon become disfigured by it. If the amount of dampness in the atmosphere is producing mouldiness in the fronds, give more air and less moisture until the tendency is checked.

Pot Ferns are best kept in a cool shady frame or pit. In such a place they may stand during winter, with just enough water to prevent dryness of the soil, and no more; and in such a place, the atmosphere, being kept moist, by the free use of water, they will in summer reach their full perfection of growth. In winter nothing but watering occasionally need be done, except covering just to exclude severe frosts. In summer no sunshine should reach the growing plants, which must be shaded with scrupulous exactness if it is desired to preserve that delicacy of tint and texture which, in the ferns, is so much prized. In summer, allow a free circulation of air, limited, so that, on the one hand, the temperature does not rise much beyond that of a shady wood, and, on the

other, the atmosphere does not become at all parched. Many of the strong-growing kinds, though more beautiful when kept in a pit or frame, do not absolutely require to be so treated, but may be set in a cool shady place out-doors; and if so, the pots should be plunged as a protection to the roots against sudden drought. Most of the British ferns will bear a little moist heat, when they are making their growth; but it must not be too high, nor should it be too long continued.

The close-glazed cases invented by Mr. Ward are invaluable aids in Fern-culture; and besides this, they are, when well-filled with living plants, very instructive and suggestive ornaments in the comfortable parlours of the affluent. By their aid, too, the culture of a few plants,—and none better adapt themselves to this treatment than the ferns—may be made to throw a gleam of satisfaction across the often cheerless path of the town-imprisoned poor. There is no obstacle except that of size, to prevent all our British ferns being grown in glass cases suitable to occupy the window of a living-room; and all the smaller species are admirably suited for such a structure.

The form of a Wardian case, and of the stand which supports it, may be various; but its principle, so far as our present subject is concerned, is, that a closely-glazed covering, surrounding the plants, shall admit of the supply of the necessary moisture in the atmosphere in which they are kept, which cannot be the case in the ordinary atmosphere of a living room. Such cases should be nearly air-tight, but need not be strictly so; indeed, it is better to have them provided with means of ventilation to be used in moderation. The bottom of the case should be a deep zinc or other metal tray, through which the moisture cannot penetrate: this for the sake of cleanliness. At its lowest part a vent should be provided, which vent is to be kept stopped by a plug or valve, except when it is required to let off the superfluous mois-

ture after watering. In this tray, a miniature rock, with receptacles for soil, should be built with sandstone and cement. The ferns are then to be planted in the places provided for them, and watered thoroughly, the vent being kept open for a few days. The glazed covering must be closed after planting, and need not be opened until the plants are thoroughly established. If there is any symptom of too much moisture, when they begin to grow, it may be opened for an hour daily. The soil must not be suffered to get wet; it should only be just moist. When the plants get too large, or require re-arrangement, they may be taken up, divided and replanted, or young plants substituted. This is best done in spring, just before growth recommences.

An out-door fernery should occupy a shady position, in the neighbourhood of water. It should consist mainly of natural or artificial rock, on which the ferns may be planted, with water here in mimic cataracts dashing its spray around; there in glassy pools; and meandering among the bases of the rocks, and, by evaporation, yielding the moisture so essential to the well-being of the ferns. A few ivy-covered pollard stumps, and some pathways winding to the most important points, complete the arrangements necessary to a complete hardy fernery, in the disposition of which it is obvious there is ample scope for taste or fancy. Any such scenery, however, covered by a glass-roof, would form an admirable fernery, in which many species, from temperate climates, might be associated with the natives of our own country. Such a covering of glass, while it facilitates the cultivation of the more delicate species, adds much even to the gracefulness of the hardy and free-growing kinds, and renders the charms of all much more enduring than is possible if they are exposed to the vicissitudes of our climate, as well as more enjoyable because accessible at all seasons.

THE CLASSIFICATION OF FERNS.

THE characters by which ferns were originally brought into groups, somewhat similar to those now called genera, were derived from the shape and division of the fronds. This feature, however, as the knowledge of species became extended, was found to produce vague and unsatisfactory associations. Then the generic, or family characters, were sought for in the organs of reproduction, the shape of the sori, *i. e.*, the clusters of spore-cases, being taken as the most obvious feature. This, too, in its turn, though affording better discriminative marks than the former, proved to be insufficient. The presence or absence of an indusium, or cover to the sori, and the form and attachment of this cover when present, were then included among the characteristic marks which should determine genera; and this combination was found to indicate much more satisfactory and natural, as well as more convenient groups, than the characters which had been previously employed. But, as the number of known species became multiplied, a still more discriminating mode of arrangement had to be sought, and this was at length found in the peculiarities of structure presented by the venation, or vascular system of the frond, and in the connection of these veins with the sori. Among the earliest proposers of these features, as characteristic of important differences, the names of Robert Brown, in connection with existing ferns, and Adolphe Brogniart, with fossil remains, stand pre-eminently; and the subsequent labours of various botanists, especially of Presl, in Germany, and of Mr. J. Smith, in this country, led to its very wide adoption. This

character is made the basis of most modern systems of classifying ferns; and, when taken in conjunction with the peculiarities of the fructification, little further change is necessary, or to be desired. Not, indeed, that this method is perfectly free from anomalies, or without its difficulties, but these are not greater than occur in the application of our imperfect knowledge to the classification of other classes of plants; nor, indeed, are they so difficult to overcome as those presented by all the other methods which have been proposed.

Mr. Smith has recently proposed to classify ferns according to the mode in which their fronds are developed from the caudex or rhizome. The facts upon which this arrangement is founded have been already explained (pp. 3—6). Those ferns whose stems produce fronds laterally, that is to say, from their sides, not their apex, and these articulated at their base, form the division (1) *Eremobrya*; while those which bear terminal fronds, that is, fronds from their apex, not their sides, and these adherent at the base, united with the axis, constitute the division (2) *Desmobrya*. There has been, as yet, only a partial application of this mode of classification, but there is no doubt it would in many instances lead to the breaking up of groups and genera as now recognised. The adoption of such a method of classification would thus introduce another element of confusion in the already difficult and involved nomenclature of this race of plants. All such radical changes, at least in the case of plants so well classified as the ferns, and all other unnecessary alterations in the grouping or naming of genera or species, ought, we think, to be deprecated, as producing more evil by bringing the study of plants into disrepute, than any supposed advantages can counterbalance. It is, indeed, probable that the necessity which has been felt for such changes, has sometimes arisen from a habit of dwelling too much on matters of detail, and from the absence of clear generalized perceptions of important differences. It must, on the other side, be admitted, that

under the system now in use, difficulties and objections here and there arise, but these are not more important than those which are constantly occurring in other departments of botanical science, nor more insurmountable than those which would be likely to occur in the application of any other set of characters by the light of our present limited and ever-varying knowledge. There is, moreover, no real physiological difference, as has been claimed, between the two apparently different modes of development which have been made the basis of this mode of classification. In both the axis is a stem, assuming in one case the form of a rhizome, in the other, more or less that of a caudex or trunk—both being equally, forms of stem. Neither is the development of the fronds in the one case really terminal, though apparently so, for, in the very nature of things, the axis must be developed before the part it supports. The mere habit of growth, again, cannot be admitted in the ferns any more than in the flowering plants, to possess a higher generic value than characters derived from the reproductive organs. The original suggestion, at first sight, appears to produce a natural division, in some measure equivalent to the exogens and endogens among flowering plants, but such a contrast is, in reality, inadmissible, the whole race of cryptogams going to make up the group of acrogens, which is the real equivalent to the groups of endogens and exogens among phænogams.

Mr. Newman, following up the suggestion of Mr. Smith, at first proposed to form four groups: (1) *Eremobrya*—ferns whose fronds are produced from any part of the rhizome except its point, and always articulated with it; (2) *Chorismobrya*—ferns whose fronds are produced as in the preceding, but not articulated; (3) *Desmobrya*—ferns whose fronds are produced only at the point of the erect or suberect corm-like rhizome, and not articulated; (4) *Orthobrya*—ferns having the vernation straight. This scheme has been subsequently curtailed, and the following plan substituted:—The *Filicales*, or

ferns having the spore-cases encircled by a ring, are divided into two groups:—(1) *Rhizophyllaceæ*, in which the fronds are attached to a rhizome, or trunk; and (2) *Cormophyllaceæ*, in which they are attached to a corm or trunk. The *Osmundales*, or ferns which have their spore-cases detached from the leaves, and not encircled by a ring, comprise:—(1) *Osmundaceæ*, with circinate leaves, and woody trunk; and (2) *Ophioglossaceæ*, with straight vernation, and succulent trunk.

For the reasons we have already briefly indicated, we adhere to that system of classification which is based on the vascular system of the frond, taken in conjunction with its fructification.

The FERNS or FILICES—using these terms in the wider sense, as including all vascular acrogenous plants which bear on the back or edges of their leaves or fronds one-celled spore-cases, containing spores of one kind only—comprise the primary groups or natural orders, POLYPODIACEÆ, MARATTIACEÆ, and OPHIOGLOSSACEÆ, of which the first and last only have representatives among the British species. The first of these, comprises several subordinate groups, of which, however, the *Polypodineæ*, *Trichomanineæ*, and *Osmundineæ* only contain British species. The *Polypodineæ* are again separated into lesser groups, of which the *Polypodieæ*, *Gymnogrammeæ*, *Aspidieæ*, *Asplenieæ*, *Blechnæ*, *Pterideæ*, *Adiantææ*, *Cystopterideæ*, and *Woodsieæ*, have British representatives.

The groups, and their subordinate divisions, including those of genera and species, will be indicated in the tabular forms following, by brief distinguishing characters, which will be amplified in subsequent pages. The exact sequence of the groups in the case of the small number of species which occur in Britain, is unimportant. We here follow that which we adopted in the *Nature-printed Ferns of Great Britain and Ireland*,—which differs but little from that of the previous edition of this *Handbook*:—

ORDERS AND TRIBES.

I.—POLYPODIACEÆ—Ferns having their vernation circinate, and their spore-cases furnished with an elastic jointed ring.

(1) **Polypodieæ**.—Dorsal-fruited ferns; spore-cases without valves bursting irregularly and transversely; ring vertical nearly complete.

i. Polypodieæ.—Sori round, without proper indusia, or scale-like covers.

ii. Gymnogrammeæ.—Sori linear naked, *i.e.*, without indusia.

iii. Aspidieæ.—Sori invested by scale-like indusia, roundish in outline, and springing from the back of the veins.

iv. Asplenieæ.—Sori covered by scale-like indusia, oblong or elongated in form, and springing from the sides of the veins.

v. Blechneæ.—Sori linear, covered by special indusia, transverse, *i.e.* longitudinally borne between the midrib and margin of the divisions of the frond.

vi. Pterideæ.—Sori transverse continuous lines of spore-cases covered by the reflexed margin of the frond, altered in texture, inlusioid.

vii. Adianteæ.—Sori transverse oblong, borne on the under surface of the indusia, which are formed of reflexed lobes, altered in texture.

viii. Cystopterideæ.—Sori covered by ovate indusia, affixed posteriorly to the roundish sori, and inflected hood-like over them.

ix. Woodsieæ.—Sori involucrate, *i.e.*, with the scale-like membrane fixed beneath the sorns.

(2) **Trichomanineæ.**—Extorse - marginal - fruited ferns; spore-cases without valves bursting irregularly, clustered around veins (receptacles) projecting from the frond, and surrounded by urn-shaped or two-valved involuercs; ring horizontal or oblique complete.

(3) **Osmundineæ.** — Marginal-fruited paniculate ferns; spore-cases two-valved, opening at top; ring rudimentary near the apex, consisting of a few parallel striæ.

II.—OPHIOGLOSSACEÆ.—Ferns having their vernation plicate; their two-valved spore-cases having no elastic ring.

BRITISH GENERA.

I. (1) i.—Polypodieæ.

Sori circular, exposed **1. Polypodium**

Sori circular, becoming laterally
confluent, beneath the scarcely
attenuated reflexed margins **2. Allosorus**

I. (1) ii.—Gymnogrammeæ.

Sori linear forked **3. Gymnogramma**

(*Ceterach* with linear sori, has the
indusium obsolete. See *Asplenieæ*.)

I. (1) iii.—Aspidieæ.

Sori beneath circular peltate indusia,
attached at their centre..... **4. Polystichum**

Sori beneath reniform indusia, at-
tached at the notch on their in-
dented side..... **5. Lastrea**

I. (1) iv.—Asplenieæ.

Sori beneath oblong curved, *i.e.*,
 lunate, sometimes horse-shoe-
 shaped indusia, attached along
 their concave edge, the free
 margin fringed; venules free ... **6. Athyrium**

Sori beneath simple linear or oblong
 oblique straight indusia; venules
 free..... **7. Asplenium**

Sori double, *i.e.*, in proximate ob-
 lique parallel pairs face to face,
 beneath elongate straight indusia,
 which open along the centre of
 the double sorus; venules free... **8. Scolopendrium**

Sori simple oblong scattered, all
 except the lowest on each pinna
 growing from the anterior side of
 the veins, hidden among imbric-
 ated chaffy scales; indusium
 obsolete; venules reticulated..... **9. Ceterach**

I. (1.) v.—Blechneæ.

Sori forming continuous lines paral-
 lel with the midrib, and within
 the margin..... **10. Blechnum**

I. (1) vi.—Pterideæ.

Sori forming a continuous marginal
 line covered by the reflexed edge
 of the ultimate divisions of the
 frond, altered in texture **11. Pteris**

I. (1) vii.—Adianteæ.

Sori transverse, growing on the re-
 flexed apices of the lobes which
 are altered in texture **12. Adiantum**

I. (1) viii.—Cystopterideæ.

Sori beneath cucullate or hooded indusia, attached by their broad base **13. Cystopteris**

I. (1) ix.—Woodsiaæ.

Sori within inferior involucre, whose margin is divided into incurved capillary segments..... **14. Woodsia**

I. (2).—Trichomanineæ.

Receptacles exserted, surrounded at the base by urn-shaped involucre of the same texture as the frond **15. Trichomanes**

Receptacles included, surrounded by two-valved involucre of the same texture as the frond **16. Hymenophyllum**

I. (3).—Osmundineæ.

Fructification forming irregular, densely-branched panicles, at the apex of the fronds..... .. **17. Osmunda**

II.—Ophioglossaceæ.

Fructification forming irregularly-branched panicles terminating a separate branch of frond **18. Botrychium**

Fructification forming two-ranked simple spikes terminating a separate branch of frond **19. Ophioglossum**

BRITISH SPECIES AND VARIETIES.

. The more important varieties only are here enumerated.

I.—POLYPODIUM.

- Fronds oblong pinnatifid 1. **vulgare**
 segm. pinnatifid, lobes serrate
 crowded barren v. **cambricum**
 low. segm. pinnatifid, upper serrate
 fertile v. **semilacerum**
 Fr. pinnate below, pinnae pinnatifid 2. **Phegopteris**
 Fr. bipinn. lanceol., pinnul. pinnatif. 3. **alpestre**
 fr. flaccid, narrow, pinnae short
 deflexed..... v. **flexile**
 Fr. ternate deltoid smooth, stipes
 glabrous..... 4. **Dryopteris**
 Fr. sub-ternate elong. delt. glandular-mealy, st. glandular 5. **Robertianum**

II.—ALLOSORUS.

- Fr. dimorphous, bi-tri-pinnate..... 1. **crispus**

III.—GYMNOGRAMMA.

- Fr. fragile, bi-tri-pinnate 1. **leptophylla**

IV.—POLYSTICHUM.

- Fr. pinnate, pinnae spiny-serrate,
 auricled very rigid..... 1. **Lonchitis**
 Fr. bipinnate
 rigid, pnls. sessile, attach. by the
 acute-angled wedge-shaped
 base, prickly serrate
 fr. broader, pnls. ovate acute
 sub-falcate aristate auricled 2. **aculeatum**
 fr. narr., pnls. nearly all confluent,
 not auricled v. **lobatum**

Fr. bipinnate, *continued*:—

- lax, pnls.* with obtuse-angled
base attach. by a slender
pedicel **3. angulare**
- (1.) fr. normal :
- fr. narr. lanc., pnls. roundish-obl.
imbric., rach. proliferous ... **v. imbricatum**
- fr. lanc., pnls. decurrent with the
winged rach. **v. alatum**
- fr. lanc.-ovate bi-tri-pinn., pnls.
atten. distant, rach. prolif... **v. proliferum**
- fr. lanc., pnls. mostly subpinnate **v. subtripinna-**
tum
- fr. lanc., pnls. imbric., anter. basal
one much enlarged pinnate,
its pinnulets stalked **v. tripinnatum**
- (2.) fr. monstrous :
- fr. lanc., fr. and pinnæ multifold-
crispated at apex **v. cristatum**

* Basal pinnules of lower pinnæ.

V.—LASTREA.

- Sori sub-marginal on either branch of
vein. (Indus. small fugacious)
fronds pinnato-pinnatif. without
glands, caudex creeping ... **1. Thelypteris**
- fr. pinnato-pinnatif. glandular be-
neath, caudex tufted..... **2. montana**
- Sori sub-central, on anterior basal
venule. (Indus. prominent)
- (a) Serratures not spinose-mucron.
Indusium plain, or not margined
with stalked glands
- (1) fr. normal :
- pnls. oblong-obt. with broad at-
tachm. or connected, serrato-
crenate **3. Filix-mas.**

- pnls. pyram.-obl. distinct deeply lobed, lobes serrate..... **v. incisa**
- pnls. oblong-obl. with broad attenuated serrato-erenate subglauc. beneath; indus. incurved, rachis densely-scaly **v. paleacea**
- pnls. broad obt. confluent erenatolob.; dwarf, glandul; sori usually uniserial, indusium beaded with glands..... **v. abbreviata**
- pnls. small obtuse confl. convex (pinnae eoneave), sori usually uniserial; indus. inflected beaded with glands **v. pumila**
- (2) fr. monstrous:
fr. and pinnae mult.-erisp. at apex pinnae narrowed grad. to the tassel, (paleacea type) ... **v. cristata**
pinnae parall.-sided, abruptly narrowed below tassel, (incisa type) **v. polydactyla**
- Indusium fringed with stalked glands **4. rigida**
- (b) Serratures spinose-mucronate
(1) Scales of stipes ovate; indus. without marginal glands
fr. erect nar.-linear pinnate, pinnae short triang.; pnls. oblong all connected, basal ones nearly equal, crenato-serrate or lobed with aristate teeth **5. cristata**
- fr. erect; fertile nar.-lin.-lance. bipinn. below; pnls. obl.-acute mostly adnate, inciso-serrate or lobed with aristate teeth; basal ones nearly equal; segm. of ster. and autumn. fert. fr. broader ... **v. uliginosa**

(b): (1) *continued*:

- fr. erect nar.-obl.-lanc. bipinn.;
 pnls. obl.-acute, poster. basal
 ones much longest, all lobed
 or pinnatif. with aristate
 teeth **v. spinulosa**
- (2) Scales of st. lanc. entire or fimb.;
 ind. with stalked marg. glands.
 * Scales distinctly two-col., the
 centre dark
- fr. lanc.-ovate or subtriang.-ovate,
 bi-tri-pinnate **6. dilatata**
- fr. ample triang. tripinn., indus.
 small, slightly glandular ... **v. tanacetifolia**
- fr. small ovate bipinn., ind. small
 evanesc. slightly glandular **v. nana**
- fr. nar. ovate elongate bipinn.,
 pnls. obl.-obt. lobed, lobes
 obt. serrate at end, teeth
 coarse acuminate **v. collina**
- fr. lanc. narrowed below, cauda-
 to-elong. at apex; pinnæ
 distant, the lowest only un-
 equal; pnls. oblong-obt. dis-
 tant, pinnatifid, the lobes
 coarsely toothed..... **v. Chanteriæ**
- fr. lin.-lanc. bipinnate, pin. short
 deltoid very unequal **v. angusta**
- fr. nar. lin.-lanc. membran. scales
 broader paler, sori large, ind.
 small evanesc. ragged **v. alpina**
- * Scales whole-coloured or in-
 distinctly two-coloured, pale
- fr. dwf. obl.-ovate or triang. bi-
 pinn., very glandular; pnls.
 obl. with coarse teeth; scales
 broad-lanc. fimbriate..... **v. dumetorum**

- fr. ample lanc.-ovate or oblong-lanc. tripinn. below, very glandular, scales broad lanc.-ovate semi-appressed..... **v. glandulosa**
- (3) Scales of st. lanc. crumpled or lacin.; ind. with sessile marg. glands (fr. hay-scented) **7. æmula**

VI.—ATHYRIUM.

- Fr. lanceolate, bi-tri-pinnate, very variable **1. Filix-fœmina**
- (1) narrow erect; pnls. convex distinct linear; sori short num. near midrib **v. rhæticum**
- (2) broader, pnls. flat, normal:
fr. erect oblong-lanc., pnls. ovate stalked gashed imbr.; sori 1-serial distant from midrib **v. latifolium**
- fr. spread. ellip.-lanc. much narr. at base; pnls. oblong-obt. connected, crowded, shallow-toothed; sori short num. often much curved **v. marinum**
- (3) monstrous or abnormal:
tall, fr. and pin. symmet. multifid at apex, the tassels crispy (rhæticum type)..... **v. multifidum**
- tall, fr. and pin. symmet. multifid at apex, the tassels plane (incisum type) **v. polydactylon**
- tall, fr. and pin. corymbosely subsym. mult. at apex, the tassels large crispy **v. corymbiferum**
- tall, fr. and pin. unsymmet. multifid at apex, the tassels crispy, segm. depaup. **v. depauperatum**
- dwf., fr. branched, apices dilated and multifid-crisped **v. crispum**

VII.—ASPLENIUM.

- Ultimate divisions with a midvein
- Fr. bipinnate, rarely sub-bipinnate, lanceolate: sori short, *i.e.*, oblong
- small narrow, primary rachis smooth **1. fontanum**
- larger broader, bipin. ; pnls. distinct, primary rachis sealy **2. lanceolatum**
- pin. sub-pin. or only lobed at base, wavy, pnls. mostly confluent **v. microdon**
- Fr. bi-tri-pinnate ovate or deltoid; sori linear, *i.e.*, elongate
- fr. bi-tri-pinnate, segm. euneato-oblong, or subtrapezoid shallowly lobed or toothed, teeth acute (fr. and pin. acute or acum.) **3. Adiantum-nigrum**
- fr. tripinn., segm. nar. lanceolate ineiso-pinnatifid, lobes linear very acute (fr. and pinnae caudate) **v. acutum**
- fr. bipinn., pinnae bluntish, pnls. ovate, their blunt apices toothed **v. obtusum**
- Fr. pinnate, rarely sub-bipinnate rachis winged..... **4. marinum**
- pin. sub-pin. at base, deeply pinnatif. throughout **v. subbipinnatum**
- rachis not winged, black throughout
- (1) fr. normal:
- pnls entire or crenate **5. Trichomanes**
- pnls. pinnatifid-ineised **v. incisum**

- (2) fr. monstrous or abnormal:
 symmet. multifid-cripsed at
 apex, rachis undivided **v. cristatum**
 rachis bi-tri-dichotomous in
 upper parts, the apices
 multifid crisped **v. multifidum**
 rachis not winged, green above **6. viride**

Ultimate divisions wanting a mid-
 vein—

- fr. deltoid bipinnate; pnls. cune-
 ate, the ant. marg. evenly-
 toothed; indusium crenulate **7. Ruta-muraria**
 fr. linear pinnate, rarely bipin.,
 pinnae alternate, unequally
 toothed at apex; indusium
 entire **8. germanicum**
 fr. nar. simple, or of two or three
 rachiform segm., with dis-
 tant linear marg. teeth; in-
 dusium entire..... **9. septentrionale**

VIII.—SCOLOPENDRIUM.

. The vars. here given mostly represent groups of sub-vars.

- Fr. oblong strap-shaped, normal in
 outline
 entire, the base cordate (type)... **1. vulgare**
 narrow, subtruncate at base,
 obtuse, irregularly lobed,
 slightly wavy, fertile..... **v. polyschides**
 narrow, irregularly lobed, the
 lobes with uniform blunt
 teeth, midrib not reaching
 the blunt apex **v. obtusidentatum**
 enate or lobed, obtuse, the mid-
 rib excurrent horn-like be-
 low the apex **v. cornutum**

- narrow, truncate at base, inciso-lobate, margin double, *i.e.*, epidermis of under surf. devel. into a lobed excurrent membrane, which, as well as the frond, bears sori **v. marginatum**
- normal below, crenato-lobate above, suprasoriferous **v. crenato-lobatum**
- much undulated, the base strongly auriculato-erodate, usually barren **v. crispum**
- Fr. irregular, plane:
variable, usually with a reniform branch or reniformly-lobed below, sometimes consisting of two renif. branches only **v. variabile**
- Fr. with longitud. excurrent memb. on upper surf. **v. supralineatum**
- Fr. muricate or papillose on upper surfacee **v. muricatum**
- Fronds multifidly dilated, usually short and broad:
furcately divided, many times, the divisions plane or variously multifid-crisped, usually fertile; stipes sometimes ramose; (numerous sub-varieties) **v. multifidum**
- strap-shaped or (on same pl.) broadly-ovate; marg. inciso-lobate, lobes unequally prolonged sometimes crisped, apex multifid-erisped, basal lobes often enlarged, multifid-crisped **v. laceratum**

IX. CETERACH.

- Fr. coriaceous sinuato-pinnatifid, densely scaly beneath **1. officinarum**

X.—BLECHNUM.

- Fronde dimorphous, the fertile contracted
 normal, linear-lanc. pectinato-pinnatifid **1. Spicant**
 rachis divided, apices multifid.-crisped **v. ramosum**
 rachis divided, apices repeatedly forked, flat, divisions acutely prolonged **v. multifurcatum**

XI.—PTERIS.

- Fr. bi-tri-pinnate, pnls. pinnatifid... **1. aquilina**
 pinnules entire **v. integerrima**
 fr. and pinnae (or pinnules) multifid.-crisped at apex.. **v. multifida**

XII.—ADIANTUM.

- Fr. bi-tripin., pnls oblique cuneate **1. Capillus-veneris**

XIII.—CYSTOPTERIS.

- Fr. lanceolate bi-subtri-pinnate, pinnae lanceolate:
 pnls.* ovate acute pinnatifid, teeth acute **1. fragilis**
 pnls. lanc. pinnatif., teeth longer narrow acute **v. angustata**
 pnls. oblong or obl.-ovate
 distinct, pinnatifid, teeth blunt **v. dentata**
 imbricate, lobed, with shallow blunt teeth, pinnae deflexed **v. Dickieana**
 Fr. lanceol. subtripinnate, pinnae ovate, segm. linear with short blunt retuse teeth **2. regia**
 Fr. triangular tripinnate, caulex creeping **3. montana**

* Pinnules of the middle of the frond

XIV—WOODSIA.

- Fr. obl.-lanceol subulato-squamose,
pin. oblong or ovate-obl. obtuse,
stipes and rach. crinite chaffy **1. ilvensis**
- Fr. linear, slightly hairy, not scaly,
pin. triang.-ovate obt., st. and
rach. slightly hairy **2. alpina**

XV.—TRICHOMANES.

- Fr. tri-quadri-pinnatif., ovate-lanc.,
or triang.-ovate..... **1. radicans**
- fr. narr. lanc. ovate, prim. di-
visions narrow, distant **v. Andrewsii**

XVI.—HYMENOPHYLLUM.

- Pinnae sub-vertical pinnatif.; invo-
lucres compressed serrate, ses-
sile, erect **1. tunbridgense**
- Pinnae decurv. sub-unilateral, digi-
tately pinnatif.; invol. inflated
entire, stalked, dcurved in an
oppos. direction to the segm. **2. unilaterale**

XVII.—OSMUNDA.

- Fr. bipin., fruct. paniced at top ... **1. regalis**

XVIII.—BOTRYCHIUM.

- Fr. two-branched; ster. obl. pin-
nate; pinnae lunate **1. Lunaria**
- ster. branch deltoid pinnate; pinnae
linear pinnatif. **v. rutace**

XIX.—OPHIOGLOSSUM.

- Fr. larger, solitary, two-branched;
ster. br. memb. ovate obtuse... **1. vulgatum**
- Fr. small, often 2-3 together, two-
branched; ster. branch linear or
linear-lanc. small fleshy **2. lusitanicum**

THE BRITISH FERNS.

Genus 1. **POLYPODIUM**, *Linnaeus*.

POLYPODY.

Sori non-indusiate, globose or ovoid, superficial or immersed, the *receptacles* terminal or medial on the free veins. *Veins* simple or forked, from a central costa (or simple costæform in the ultimate segments—in exotic species); *venules* free.

Fronde coriaceous herbaceous or membranaceous, simple pinnatifid pinnate or bi-tri-pinnate, the stipes articulated or continuous with the rhizome, the pinnae sometimes articulated with the rachis. *Rhizome* creeping; short, erect or decumbent; or caudiciform.—Name from the Greek *polys*, many; and *pous*, *podos*, a foot.

The type of this genus is the common Polypody, which Mr. Newman separates with the name *Ctenopteris*, thus removing to a new genus the typical species. The other species form his genera *Gymnocarpium* and *Pseudathyrium*, both without satisfactory distinctive characters. *Polypodium* is known by its dot-like naked masses of spore-cases.

(1.) **Polypodium vulgare**, *Linnaeus*. — Common Polypody.—Fronde deeply pinnatifid, linear-oblong or ovate-oblong, acuminate; lobes linear oblong, obtuse or acute, obscurely serrate, the upper smaller.

POLYPODIUM VULGARE, *Linnaeus*. *Schkuhr*, *Crypt.* t. 11. *Eng. Bot.* t. 1149. *Bolt. Fil.* 32, t. 18. *Sm. Eng. Fl.* iv. 267. *Hook and Arn. Brit. Fl.* 566. *Bab. Man.* 408. *Deak. Florig. Brit.* iv. 37. *Moore, Nature Printed Ferns*, t. 1. *Sowerby, Ferns*, 9. t. 1.—P. VITERBIENSE, *Boccone*.—P. VIRGINIANUM, of gardens.—P. BOREALE, *Salisbury*.—P. OFFICINALE, *Guldenstadt*.—P. PINNATIFIDUM, *Gilibert*.—CTENOPTERIS VULGARIS *Newm. App.* xxix; *Id. Hist.* 41.

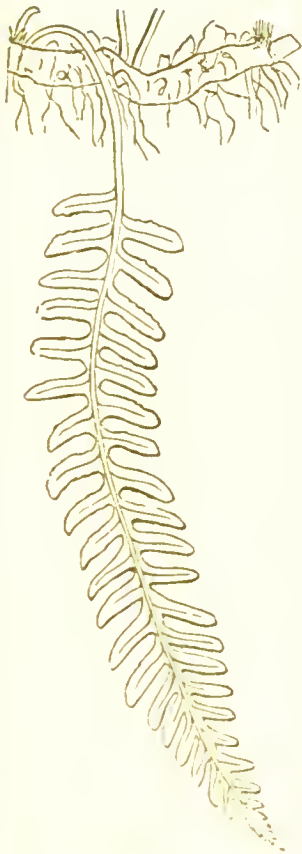
Var. semilacerum: fronds pinnatifid and fertile above, bipinnatifid below; lobules distinct, linear, acute, serrate.

POLYPODIUM VULGARE SEMILACERUM, Link. Moore, Nat. Print. Ferns, t. 2.—P. v. HIBERNICUM Moore, Handbk. ed. 2. 44. Sowerb. Ferns, 10.—P. v. SINUATUM, Francis, Anal. 24.—P. v. SERRATUM, Herb. Mus. Brit.—P. v. CAMBRICUM, Sm. Eng. Fl. iv., 268 (part).

Var. cambricum: fronds barren, bipinnatifid throughout; lobules crowded, linear or linear-lanceolate, acuminate, serrate.

POLYPODIUM VULGARE CAMBRICUM, Willdenow. Bolt. Fil., t. 2., f. 5 a. Moore, Nat. Print. Ferns, t. 3.—P. CAMBRICUM, Linnæus.—P. LACINIATUM, Lamarek.—P. CAMBRICUM, v. CRISPUM, Desvaux.

Rhizome perennial, creeping, branched, as thick as a swan's quill, densely clothed while young with rust-coloured, taper-pointed, deciduous scales, at length becoming bare and green, furnished with hairy branching fibrous roots. *Vernation* circinate. *Stipes* usually nearly equal in length to the leafy portion of the frond, at the base distinctly articulated with the caudex. *Fronde* lateral, narrow, elongate-oblong, or more or less ovate in outline, from three to twelve, or eighteen inches in length, subcoriaceous, erect or drooping, deeply pinnatifid. *Lobes* flat, linear-oblong, parallel, shorter towards the apex of the frond, obscurely serrated, and blunt-pointed, occasionally acute. *Venation* of each lobe, consisting of a tortuous prominent mid-vein, alternately branching; the lateral veins again branched into 3-5 branches (venules) of which the lowest anterior one reaches about mid-way to the margin, and terminates, when fertile in a sorus or cluster of spore-cases, when barren in a transparent club-like apex; the other venules also terminate in club-like heads, which form a line near the margin of the lobes. *Fructification* dorsal, *i. e.*, on the back of the frond, usually confined to its upper half. *Sori* circular, rarely sub-oblong, entirely without indusia, often becoming crowded and confluent. *Spore-cases* tawny or orange-coloured. *Spores* muriculate,

[*Polypodium vulgare*.]

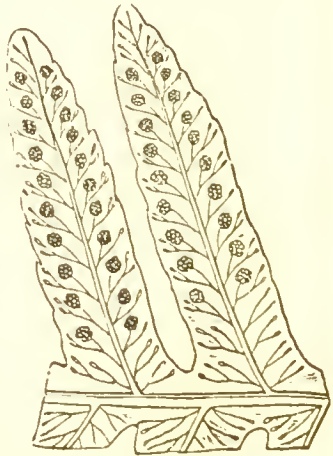
oblong or kidney-shaped, yellow.

This very common species, which is ever-green in sheltered places, and is found growing on decaying stumps, on the trunks of living trees, on old thatched roofs, on walls, moist rocks, and shady banks, is generally distributed throughout Great Britain and Ireland. It is also found all over Europe; in the Canaries and the adjacent isles; in Algiers and South Africa; in Siberia, extending eastwards to Kamtchatka, and westwards to Armenia; in North-west America, e. g., Sitka, Columbia; in Canada and the United States; while the same, or a closely-allied plant, occurs in California, and a form, hardly a variety, in Mexico and Guatemala.

The *var. SEMILACERUM* is a very elegant plant. Its peculiarity consists in the lower segments being barren, and deeply pinnatifid, while the upper ones are crenate and fertile. It belongs to a

series of forms remarkable for a tendency to develop breadth rather than length in the fronds, and also remarkable in being paler and of a sub-glaucous green beneath. The best forms of this variety have been found in Ireland, at Killarney, and by the Dargle, Wicklow; but others less marked have been found in Monmouthshire and Carnarvonshire, in Devon, Norfolk, and Kent. It is often known as the Irish Polypody.

The *var.* CAMBRICUM, or Welsh Polypody, is of denser growth, ovate, or ovate-oblong, and bipinnatifid throughout; the lobes crowded narrow below, acuminate, much widened in the centre; the whole margin, except the very base and apex, cut into narrow, sharp-pointed, serrated, crowded lobules. Like the Irish Polypody, it is quite constant; but, unlike that, it is always barren. It was originally found in Wales, and has been recently obtained near Maccles-



[*Polypodium vulgare.*]

field. This, and the Irish Polypody, are two of the most beautiful of evergreen hardy ferns.

There are many other variations recognised by cultivators, which we can only briefly record; of these the following belong to the narrow or typical form of the species:—

acutum: in this the tips of the segments are narrowed to a longish taper point; found in the south of England.

(Nat. Print. Ferns, t. 1, E.)

bifidum: has the lobes generally bifid or two-cleft, but

sometimes three or four-cleft, all the lobes being seldom alike affected; not unfrequent. Of this, *ramosum* is a more developed form, often branched in the rachis. (Nat. Print. Ferns, t. 1, F.).



[*P. v. cambricum.*]

interruptum: has the lobes interrupted or irregular, here and there wanting, some irregularly bifid, or multifid, or laciniated; rare.

sinuatum: is allied to *interruptum*; the lobes sinuous or waved, irregularly lobed. the lobules sharply serrate; rare.

laciniatum: has the lobes of different lengths, and simply but irregularly notched, and somewhat crisped.

marginatum: has the epidermis of the under surface split away, as it were, from the margins of the lobes, and receding towards the mid-vein; rare.

serrulatum: has the teeth of the lobes minutely serrate; it is a dwarf form; rare.

multifidum: has the apex of the frond bifid or multifid, and belongs either to the normal or the serrate form.

auritum: has more or fewer enlarged lobules at the ante-

rior base of the lobes, forming an ear or auricle; rather rare.



[*Polypodium vulgare* vars:—*a* acutum; *b* bifidum; *c* serratum; *d* auritum; *e* crenatum; *f* semilacerum.]

✓ *serratum*: has the lobes sharply and deeply serrate; the sori are sometimes oblong; it occurs occasionally with

broader fronds, and rounded enlarged teeth or lobules approaching *crenatum*; not uncommon. (Nat. Print. Ferns, t. 2, B.)

The following belong to the broader form of the species:—

ovatum: has the fronds nearly exactly ovate, coriaceous, obscurely-toothed or erenulate; rare.

denticulatum: has the frond broad-oblong, less coriaceous, abrupt and caudate at the apex, the lobes distantly and finely sharp-toothed; rare.

crenatum: has large broad ovate fronds, the segments erenate, or erenato-lobate, often undulated; somewhat variable; rare. (Nat. Print. Ferns, t. 3 B.)

truncatum: has the lobes deeply serrated or lobed, the lobules minutely serrated; the fronds are sometimes truncate or cut short, the leafy parts wanting, and the veins projecting, forming irregular points; rare. Another curious form belonging to this type is *multiforme*, which has fronds very diverse, variously truncate, bifid or multifid, or with irregularly exaggerated pinnae or auricles; it was found by Mr. Clowes, at Windermere.

omnilucrum: has the lobes irregularly pinnatifid in the way of *cambricum*, the lobules being narrow and jagged, but less crowded; it is fertile. This rare variety was found by Mr. Bennett, near Ross, Herefordshire.

The Polypody is invested with an antiquated medicinal reputation. The rhizome has a sweetish taste, which, by long boiling, is said to become bitter; an infusion of it, when fresh, is considered as a mild laxative. A decoction of the fronds has been used in country places as a cure for colds and the hooping cough, in children; for this purpose the matured fruitful fronds gathered in the autumn are dried, and when required for use are slowly boiled with coarse sugar. Polypody is used as a demulcent by the Italians, as we learn from Dr. Deakin. The fronds also yield a considerable quantity of carbonate of potass on being burnt; this is obtained by boiling the ashes in water, the liquor being strained and evaporated until the crystals are formed.

This fern is well adapted for planting on artificial roekwork, and among rustic work formed of the stumps of old trees, especially delighting to extend its creeping stem over a decaying mossy tree-stump. Its fronds, depending from the trunks and exposed roots of old trees, on deep shady banks, under which circumstances it is often seen naturally, are decidedly ornamental. Light porous soil, or a thoroughly-drained medium for its roots, are essential; and it does not appear to thrive in a London atmosphere. It is readily increased by dividing the branched rhizome.

✓ (2.) **Polypodium Phegopteris**, *Linnaeus*.—Mountain Polypody, or Beech Fern.—Fronds ovate-triangular, acuminate, pinnate below; pinnæ lanceolate, the lower pair distinct sessile, usually deflexed, pinnatifid; lobules linear oblong, blunt; upper pinnæ united.

POLYPODIUM PHEGOPTERIS, *Linnaeus*. *Bolt. Fil.* 36. t. 20. *Schkuhr, Crypt.* t. 20. *Eng. Bot.* t. 2224 (and t. 1018 as *Thelypteris*). *Sm. Eng. Fl.* iv. 269. *Hook. and Arn. Brit. Fl.* 566. *Bab. Man.* 408. *Deak. Florig. Brit.* iv. 41. *Moore, Nat. Print. Ferns*, t. 4. *Sowrb. Ferns*, 11, t. 2.—*P. CONNECTILE*, *Michaux*.—*P. LATEBROSUM*, *Salisbury*.—*POLYSTICHUM PHEGOPTERIS*, *Roth*.—*LASTREA PHEGOPTERIS* *Bory. Newm. Nat. Alm.* 1844, 17; *Brit. F.* ed 2, 13.—*GYMNOCARPIUM PHEGOPTERIS*, *Newm. App.* xxiii.; *Id. Hist.* 49.—*PHEGOPTERIS POLYPODIOIDES*, *Fée*.—*PHEGOPTERIS VULGARIS*, *Mettenius*.

Rhizome perennial, extensively creeping, slender, dark-coloured, slightly scaly, producing black fibrous roots. *Vernation* eireinate. *Stipes* as long as, or frequently longer, than the frond, brittle, erect, pale green, furnished below with a few narrow scales, above with minute reversed hairs; distant and lateral on the rhizome, adherent. *Fronds*, ovate-triangular, tapering to a longish point, from four to twenty inches in length; hairy, membranaceo-herbaceous, pale green, pinnate below, pinnatifid above. *Pinnæ* deeply pinnatifid, those near the apex becoming entire, linear-acuminate, usually opposite, sometimes alternate, the lower pair lanceolate, deflexed,

sessile, attached by the midrib; the next pair more or less adnate at the base, the remainder united to the rachis by their whole width, so that, when opposite, a cruciform



[*Polypodium Phegopteris.*]

figure is formed by the contact of the basal segments. In the upper part of the frond, the decurrent bases of the pinnae are continuous along the rachis. *Lobes* oblong-

obtuse, entire or slightly crenate-dentate. *Venation* of the ultimate lobes consisting of a slender flexuous mid-vein, scarcely thicker than the veins, which are alternate, mostly unbranched, and extending to the margin; those near the base of the segments bear a small sorus near their extremity. *Sori* circular, almost marginal. *Spore-cases* small, pale brown. *Spores* ovate, smooth.

This species, which produces annual fronds, renewed in May, though somewhat local, is common in some localities, and widely dispersed in Great Britain, occurring in moist mountainous situations, in damp woods, and in the vicinity of waterfalls. It occurs in the southern, western, and northern districts of England; in Wales;



[*P. Phegopteris*.]

rather generally in Scotland, and rarely in Ireland. The species is also distributed throughout Europe, from Iceland to Italy. It is found in Algeria; in Unalaska, Kamtchatka, and the Altai mountains; and is widely dispersed in North and North-west America.

This is a free-growing plant, requiring a very abundant supply of moisture, both about its roots and fronds. The soil, however, should be well drained, that this moisture may not become stagnant. It requires shade and a moist atmosphere to secure the most perfect growth under artificial circumstances. If planted on artificial rockwork, it should be placed where these conditions may be secured, and where it will also enjoy shelter in other respects. As a pot plant it should be planted in turfy peat soil, mixed with decayed tree leaves, broken sandstone and sand; the pots being well drained. In the summer it succeeds best in a cold frame, shaded from bright sunshine. The spray of a waterfall, in which the plant delights, may be imitated, by suspending over them a small vessel of water, which, furnished with a coarse worsted-thread

siphon, may be made to supply a succession of water-drops, to fall on a stone near the plant, and thus keep it constantly sprinkled.

(3.) **Polypodium alpestre**, *Sprengel*.—Alpine Polypody.—Fronds lanceolate, herbaceous, suberect, bipinnate; pinnæ narrow lanceolate from a broad base, spreading or ascending; pinnules ovate-oblong, or subfalcately ovate-lanceolate, pinnatifid; segments oblong bluntish serrate; stipes short; secondary rachis narrowly winged; (sori rarely spuriously indusiate).

POLYPODIUM ALPESTRE, Sprengel. Moore, Nat. Print. Ferns, t. 7. Henfr. Franc. Anal. 5 ed. 28, supp. pl. f. 2 A. Sowerb. Ferns 84, t. 49.—P. RHÆTICUM, Pallas: Ledeb.: Fries: Woods; not of Lindæus.—ASPIDIUM ALPESTRE, Hoppe. Schkuhr, Crypt. 58, t. 60.—A. RHÆTICUM, Swartz.—PSEUDATHYRIUM ALPESTRE, Newm. App. xiv.; Id. Hist. 199.—ATHYRIUM ALPESTRE, Nylander.—PHEGopteris ALPESTRIS, Mettenius.

Var. flexile: fronds slender, flaccid, narrow-lanceolate, bipinnate; pinnæ short, ovate-lanceolate, spreading or deflexed; pinnules oblong, obtuse or acutish, narrowed below, sessile or adnate, distantly lobed or toothed; stipes very short.

POLYPODIUM ALPESTRE, v. FLEXILE, Moore, Nat. Print. Ferns, t. 7 D.E.—P. FLEXILE, Moore, ed. 2, 225. Henfrey, Franc. Anal. 5 ed., 29, supp. pl. f. 2 B.—PSEUDATHYRIUM FLEXILE, Newman, Phytol. iv. 394; Id. Hist. 203—ATHYRIUM ? FLEXILE, Moore, Hb.

Caudex perennial, short, erect or decumbent, having a tendency to become divided into several scaly crowns or distinct axes, to which the adherent fronds are terminal. *Vernation* circinate. *Stipes* short, one-sixth to one-fourth the length of the frond, stoutish, clothed sparingly with ovate-lanceolate pale brown scales; *rachis* stout, rounded behind, that of the pinnæ furnished with a narrow leafy wing. *Fronds* from one to three feet and upwards, usually a foot and a half in height; erect or ascending, herbaceous, dark green,

[*Polypodium alpestre*.]

lanceolate, the base narrowed about equally with the apex, bipinnate or subtripinnate. *Pinnæ* broadly linear or lanceolate acuminate, spreading. *Pinnules* ovate oblong, sometimes ovate lanceolate or oblong ovate, acute, with a narrow attachment, but connected by the wing of the rachis, deeply pinnatifid, or sometimes almost again pinnate; *segments* oblong obtuse, sharply serrate, especially at the apex and on the anterior margin. *Venation* of the pinnules, consisting of a tortuous mid-vein, which throws off into each segment a pinnate branch, or vein, whose ramifications, the venules, are simple, and extend almost to the margin; the lowest anterior venule, which is directed towards the lowest anterior tooth, usually bears a sorus, some distance below its apex, the sori then forming a single series on each side the mid-vein; sometimes however, especially in the larger pinnules, other of the lower venules, bear sori, about four being the average number on each lobe. *Sori* at first distinct, small, and circular, naked or spuriously indusiate, sometimes crowded and becoming confluent. *Spore-cases* brown, numerous. *Spores* somewhat muriculate, roundish or oblong.

This fern, which produces annual fronds renewed in April or May, and has much resemblance to *Athyrium Filix-femina*, has, so far as regards the United Kingdom, been found only in the Highlands of Scotland, in the counties of Aberdeen, Forfar, Inverness, and Perth, where it is abundant at from 3,000 to 4,000 feet elevation, and occurs, though less plentifully, down to 2,000 feet. The same fern is widely dispersed in Europe, occurring in Norway, Sweden, Lapland, and Russia, in Switzerland, and in Germany. It is also found in the Caucasus, and a very similar, perhaps identical species, has been gathered at Sitka.

The *var. FLEXILE*, or Flexile Polypody, is a very distinct variety, differing in being more slender and flaccid, and of narrower outline, consequently having shorter pinnæ, with a considerably reduced number of

pinnules; in the form of the pinnules, which are oblong, narrowed below, sessile or adnate, and distantly toothed; in the very short, or almost obsolete stipes, and in a tendency to bear perfect sori at the base of the frond, while the apex is barren. The stipes is not, however, constantly wanting, but is always very short. *Fronde* six to twelve or eighteen inches in length. *Pinnæ*, spreading or more or less deflexed, short, with about six or eight pairs of pinnules. *Sori* few, six or eight on a pinnule, usually distinct; in the cultivated plants, numerous in the lower half and scarcely extending upwards beyond the middle of the frond, but often dispersed over the whole surface; sometimes the spore cases appear to be attached to the side of the vein, and the sori are thus slightly elongated



[*P. alpestre* v. *flexile*.]

of the vein, and the sori are thus slightly elongated

rather than circular, indicating an affinity with *Athyrium*; and occasionally a peculiar membranaceo-filamentous development occurs in the position of an indusium again indicating affinity with the ciliated indusia of *Athyrium*, but the more perfect sori are without trace of this indusoid growth, and truly polypodioid. This has been found only in Glen Prosen, Clova, by Mr. Backhouse.

The Alpine Polypody occurs in many forms, analogous to those which the Lady Fern assumes. The most marked are the following:—

lanceum: fronds large, stout, subtripinnate; pinnules elongate, ovate-lanceolate or sometimes sublinear, sub-falcate, deeply pinnatifid, with obtuse serrated segments, the lower of which are almost separated.

tripinnatum: fronds large, stout, tripinnate, pinnules 1—1½ inch long, oblong-ovate, with oblong secondary pinnules, the upper united by the wing of their rachis, the lower distinct to the base.

The plant known as *Athyrium Filix-femina præmorsum*, very probably belongs to this species.

We have mentioned the supposed covers to the sori occasionally found in this species, as spurious indusia. These we have noticed both in living plants of the species, and in dried specimens of the variety *flexile*, but they are only occasional, and even rare, and appear never to occur in company with the more perfect sori, but only where the spore cases are much fewer in number. To us they have the appearance of thin lacerated membranaceo-filamentous expansions of those points of the veins which form the receptacles; and they appear to arise from some cause, perhaps inherent, which limits the power of producing spore cases to the side or base of the receptacle, while on the upper side its cells are directly prolonged into the indusoid membrane; but in no case do they appear to be of the nature of true indusia. Whilst, therefore, so many of the sori—not only the majority, but all, with few exceptions, and those exceptions having

so much the character of abnormal growths—really appear to be the round naked masses of *Polypodium*, we have no alternative but to retain the plant in that genus.

This fern is perfectly hardy, and, though not comparable for delicacy with some states of the Lady fern, is not inelegant. In the hardy rockery, or in pots, it will grow readily in well drained porous loamy soil; and it may be increased by dividing the tufted caudex.



[*Polypodium Dryopteris*.]

(4.) ***Polypodium Dryopteris***, *Linnaeus*.—Smooth three-branched Polypody, or Oak fern.—Fronds pentangular-deltoid, ternate, smooth, membranaceous; branches pinnate; pinnæ deeply pinnatifid, sometimes pinnate at

the base; lobules (or pinnules) oblong, obtuse, crenate or crenato-lobate; stipes glabrous.

POLYPODIUM DRYOPTERIS, Linnæus, Schkuhr, Crypt. 19, t. 25. Bolt. Fil. 52, t. 28. Sm. Eng. Bot. t. 616; Eng. Fl. iv. 269. Ik. and Arn. Brit. Fl. 567. Bab. Man. 409. Deak. Flor. Brit. iv. 42. Moore. Nat. Print. Ferns, t. 5. Sowerby, Ferns, 11, t. 3.—P. FULCHELLUM, Salisbury.—POLYSTICHUM DRYOPTERIS, Roth.—LASTREA DRYOPTERIS, Bory. Newm. Nat. Alm. 1844, 15; Id. Hist. 2 ed. 13.—GYMNOCARPIUM DRYOPTERIS, Newm. App. xxiv; Id. Hist. 57.—PHEGOPTERIS DRYOPTERIS, Fée.

Rhizome perennial, extensively creeping, branched, slender, dark-coloured, slightly scaly, and producing black fibrous roots. *Vernation* circinate, the branches rolled up separately, so that the undeveloped fronds resemble three little balls set on slender wires. *Stipes* longer than the fronds, frequently twice or thrice their length, erect, brittle, slender, dark-coloured, and with a few pale-brown lanceolate scales at the base, otherwise smooth,



[P. Dryopteris.]

green; lateral, distant, and adherent to the rhizome. *Fronde* bright green, smooth, membranaceo-herbaceous, four to twelve inches high, including the stipes; deltoidly-pentangular in outline, three-branched, the branches triangular, stalked, the central one largest, equal-sided, its rachis deflexed, the lateral ones set at an obtuse angle, larger on their lower side, thus obliquely-triangular. *Branches* pinnate at the base, pinnatifid above; *pinnæ* usually opposite; pinnate below, pinnatifid above, acute and nearly entire at the apex. *Pinnules* and ultimate *lobes* oblong, obtuse, crenate or crenato-lobate; sometimes pinnatifid. The basal pair of pinnules of each pinnæ when opposite, are placed crosswise, the two towards the apex being nearly parallel, and smaller than the other two which are divergent. *Venation* of the crenato-lobate pinnules consisting of a flexuous mid-vein, with alternate

veins proceeding to each lobe, these veins pinnato-furcately branched, the venules extending to the margin; the crenate pinnules have fewer venules. *Sori* borne over the whole frond, on the anterior basal venules, below their apex: small, circular, often numerous, and ranged in a series on each side the mid-vein. *Spore-cases* small, dark-brown. *Spores*, ovate, granulated.

This species, which has annual fronds renewed about April, and growing up in succession, is almost entirely confined to wild and mountainous rocky districts, occurring in the drier parts of wet woods, and in the neighbourhood of waterfalls; sometimes growing on limestone in company with *P. Robertianum*. It is found in the south-western, central, and northern parts of England, in Wales, in Scotland as far north as Sutherland; and rarely, in Ireland. It occurs generally over Europe, from North Cape to Gibraltar and Italy; it is recorded from Africa; again, from Siberia and Kamtschatka; while, in America, it is found from Labrador and Greenland, to Columbia and Sitka, as well as throughout the United States.

This species is a moisture-loving plant, and also a lover of shade and shelter; indeed, its delicate texture would render it liable to injury if much exposed. It is, however, an excellent dwarf rock fern, and very hardy. It is a very free-growing pot plant, preferring light loamy soil, and may be readily increased by the division of its creeping rhizomes.

- ✓ (5.) **Polypodium Robertianum**, *Hoffmann*.—Limestone Polypody.—Fronds erect, rigid, glandulose, pentangular-deltoid, subternate; lower branches (or pinnae) bipinnate at the base, stalked, their pinnulets (or lobulets) oblong, obtuse, crenate or nearly entire; the rest sessile; stipes glandulose.

POLYPODIUM ROBERTIANUM, Hoffmann (1795). Moore, Nat. Print. Ferns, t. 6.—P. CALCAREUM, Smith, Fl. Brit. 1117 (1804); Eng.

Fl. iv. 270 ; Eng. Bot. t. 1525. Hook and Arn. Fl. 567. Bab. Man. 409. Deak. Florig. Brit. iv. 43. Newm. Hist. 2 ed., 131. Sowerby, Ferns 12, t. 4.—*P. DRYOPTERIS* VAR. Bolt. Fil. 53, t. 1.—*NEPHRODIUM DRYOPTERIS*, Michaux.—*LASTREA CALCABEA*, Bory. Newm. Nat. Alm. 1844, 17.—*L. ROBERTIANA*, Newm. Hist. 2 ed. 17.—*GYMNOCARPIUM ROBERTIANUM*, Newm. App. xxiv ; Id. Hist. 63.—*PHEGOPTERIS CALCABEA*, Fée.



[*Polypodium Robertianum*.]

Rhizome perennial, extensively creeping, branched, thicker than a straw, dark brown, scaly, furnished with

dark-coloured fibres. *Vernation* circinate, the pinnae separately convolute. *Stipes* longer than the frond, often twice as long, stoutish and succulent, becoming stiff, erect, with pallid lanceolate scales about the base, pale green, minutely glandular; lateral and adherent to the rhizome; rachis also clothed with very minute stalked glands, which occur more or less over the whole frond, giving it a dull mealy aspect. *Fronde* deep dull grayish green, erect, firm herbaceous, glandulose, six to eighteen inches high; deltoidly-pentangular, somewhat elongated at the point, bipinnate, or partially three-branched, the lateral branches, however, small, compared with the



[P. Robertianum.]

central one, and like mere enlarged pinnae. *Pinnæ* opposite, the lower pair largest, obliquely triangular, shortly stalked, the stalk always shorter and more slender than the main rachis, bipinnate in vigorous fronds; the next pair stalked or sessile, pinnato-pinnatifid; the upper all sessile, pinnate or pinnatifid, becoming less divided towards the point. *Pinnules* of the lower pinnae larger on the posterior side, of the other pinnae nearly equal; pinnulets or lobulets oblong, obtuse, entire or crenated. *Venation* of the lower posterior pinnules, consisting of a stout midvein, with a flexuous vein passing up the centre of each lobule, and alternately branched; venules simple or forked, extending to the margin, the venule, or its anterior branch (veinlet), bearing a sorus near the margin. *Sori* scattered over the fronds, small, circular, forming a submarginal series. *Spore-cases* pale brown. *Spores* ovate or oblong, muriculate.

This species, which has annual fronds, renewed about April or May, is confined to limestone districts, chiefly in the western, central, and northern parts of England, and,

in Wales, occurring in rocky exposed mountainous tracts. It is found in other parts of Europe, *e. g.* Norway, France, Switzerland, Germany, Hungary; and, in Asia, on the Himalaya Mountains. In America, it is found both in the United States and Canada.

This species is closely allied to *P. Dryopteris*, but is sufficiently distinguishable, by its stouter growth, its mode of veneration, the composition of its fronds, and its glandular-mealy surface.

A hardy and free-growing plant, and bearing exposure to sun better than many of the herbaceous ferns. It prefers loamy soil, and a most essential condition is thorough drainage. It is easily managed as a pot plant, and is, perhaps, benefited by the addition of a portion of chalk or limestone to the soil, which should, by all means, be kept open by drainage; as indeed ought to be the case in the culture of all ferns not absolutely aquatics. It is increased by dividing the creeping rhizome.

Genus 2. **ALLOSORUS**, *Bernhardi*.

Sori spuriously-indusiate, rotundate, covered by the revolute sub-herbaceous margin of the pinnules, at length confluent into a transverse line (parallel to the margin), often becoming effuse; the *receptacles* punctiform. *Veins* in the fertile fronds, simple or forked, from a central costa; in the more divided sterile fronds, simple or forked in the ultimate segments; *venules* free.

*Fronde*s dimorphous, dwarf, herbaceous, bi-tri-pinnate, the fertile contracted, *i. e.*, with revolute siliculiform pinnules. *Rhizome* short, decumbent.—Name from the Greek *allos*, various; and *sorus*, a heap.

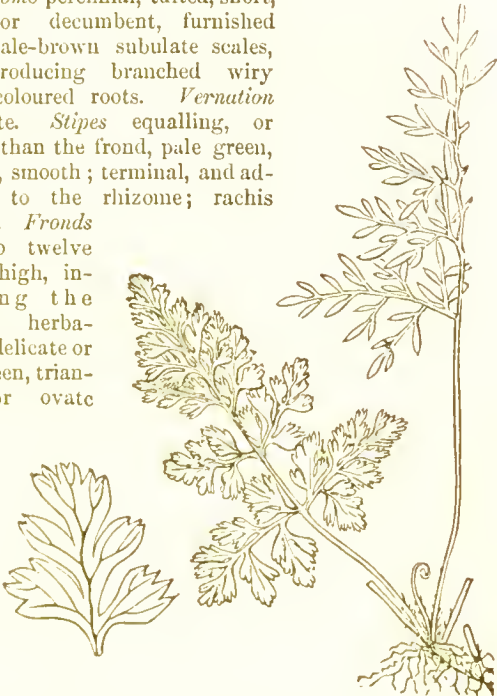
The only British species of this genus is an elegant little plant, somewhat resembling parsley. The genus has, at first sight, considerable resemblance to *Pteris*, from which, however, its polypodioid fructification, punctiform receptacles, and nonindusiate roundish sori, readily distinguish it.

- ✓ (1.) **Allosorus crispus**, *Bernhardi*.—Rock Brakes, or Mountain Parsley Fern.—Fronde of two kinds, ovato-deltoid, bi-tri-pinnate; ultimate divisions of sterile fronds, obovate, wedge-shaped, often bifid; of the fertile linear-oblong.

ALLOSORUS CRISPUS, *Bernhardi*. Bab. Man. 408. Deak. Florig. Brit. iv. 47; Newm. Hist. 35. Sowerby, Ferns. 69, t. 39. Moore. Nat. Print. Ferns, t. 8.—OSMUNDA CRISPA, Linn. Bolt. Fil. 10, t. 7.—O. RUPESTRIS, Salisbury.—PTERIS CRISPA, Linn. MS.: Sm. Eng. Fl. iv. 306; Eng. Bot. t. 1160. Schkuhr

Crypt. 90, t. 98.—*P. TENUIFOLIA*, Lamarck.—*CRYPTOGRAMMA CRISPA*, R. Brown. Hk. and Arn. Br. Fl. 575.—*PHOROLOBUS CRISPUS*, Desvaux.—*ACROSTICHUM CRISPUM*, Villars.—*ONOCLEA CRISPA*, Hoffmann.—*STEGANIA ONOCLEOIDES*, Gray.—*S. CRISPA*, R. Brown.—*STRUTHIOPTERIS CRISPA*, Wallroth.—*BLECHNUM CRISPUM*, Hartmann.

Rhizome perennial, tufted, short, erect or decumbent, furnished with pale-brown subulate scales, and producing branched wiry dark-coloured roots. *Vernation* circinate. *Stipes* equalling, or longer than the frond, pale green, slender, smooth; terminal, and adherent to the rhizome; rachis smooth. *Fronde* four to twelve inches high, including the stipes; herbaceous, delicate or pale green, triangular or ovate



[*Allosorus crispus*.]

triangular, dimorphous, *i. e.*, of two forms, the sterile and fertile dissimilar. *Sterile fronds* usually about as long as their stipes, bi-tri-pinnate, smooth; *pinnæ* alternate,

or subopposite, triangular-ovate, spreading, the lower ones largest; *pinnules* ovate, largest on the posterior side, pinnate or pinnatifid, the pinnulets or lobes ovate or obovate-cuneate, the smaller ones cut into linear acute teeth, the larger into cuneato-linear bifid lobules, having acute incurved teeth. *Fertile fronds* contracted, about half as long as their stipes, tri-quadri-pinnate; *pinnæ* ovate, spreading; *pinnules* ovate in outline, pinnate, pinnato-pinnatifid, or bipinnate in different parts of the frond, the ultimate divisions stalked, obtuse, linear or oblong from the involution of the margins, which are crenated, and indusoid. *Venation* in the ultimate divisions of the fertile fronds, consisting of a flexuous mid-vein, which produces alternate veins, or venules, which are simple, or rarely

[*Allosorus crispus*.]

forked, and extend nearly to the margin; in the sterile fronds, the veins are repeatedly furcately branched, so that a veinlet runs up the centre nearly to the front of each segment, simple where the segment is simple, and forked where it is bifid. *Sori* concealed by the reflexed somewhat bleached margins of the pinnules, which nearly meet over the midrib, small, roundish, near the extremity of the venules, at first distinct, but soon becoming confluent, which has led to their being described as forming two dense linear masses. *Spore-cases* small. *Spores* smooth, roundish-oblong, or bluntly-triangular.

This comparatively rare and local species produces annual fronds, renewed about May. It is a mountain rock plant, occurring chiefly in rough stony places, but occasionally locating itself on walls. It is most abundant in the north of England, and in Scotland, and is also found in the midland and western districts of England, and in Wales. In Ireland it is a rare species. It is widely dispersed over Europe, extending from Lapland and Norway, to Spain and Italy. It is also found at Sitka, in North-west America. The Eastern (Indian) species, *A. Brunoniana*, is very doubtfully distinct from the European plant.

This little fern is a free-growing plant, and very elegant. It is naturally a stone-loving plant, and hence is well adapted by its natural habits for planting on masses of artificial rockwork. It also succeeds remarkably well under pot-culture. When planted out on rock-work, it should be fixed in situations where all superfluity of water, which must be freely supplied, may soon drain away. It grows best when shaded; indeed, under artificial culture, the delicate texture for which the ferns are generally so much admired, is favoured by a moderate degree of shade. The potted plants must be kept drier in winter than in summer; in the latter season they ought to be pretty freely supplied with water, but the moisture should never become stagnant about them. It is propagated by division of the plant.

Genus 3. **GYMNOGRAMMA**, Desvaux.

Sori non-indusiate, linear, sometimes elongated, simple or forked, *i.e.*, bipartite, oblique, often at length confluent; the *receptacles* elongate above, or continued below the forks of the veins. *Veins* simple or forked, from a central costa, or the costa sometimes indistinct; *venules* free.

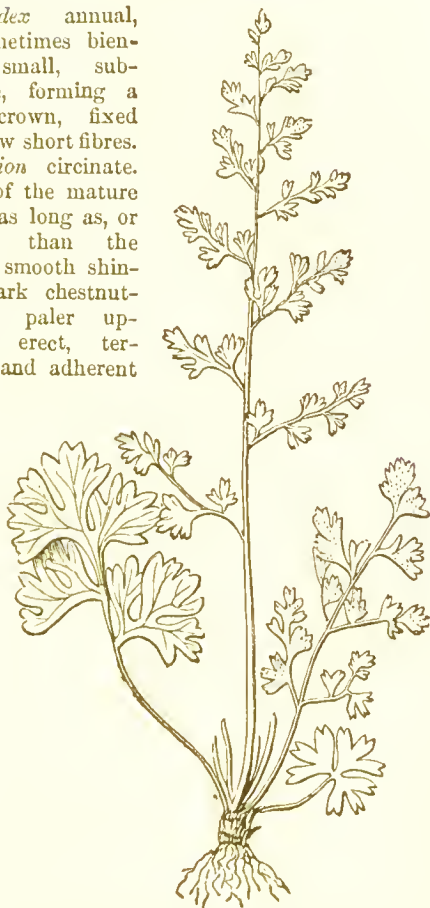
*Fronde*s lobed pinnate or bipinnate, herbaceous, often farinosely ceraceous, sometimes lanate beneath. *Rhizome* short, erect, sometimes annual.—Name from the Greek *gymnos*, naked; and *gramme*, a line.

This genus consists principally of tropical ferns, and includes those beautiful species whose fronds, covered beneath with a golden or silvery powder, are familiarly known as Gold and Silver Ferns. The only British species is a diminutive, delicate annual plant. The genus is nearly allied to *Grammitis*, differing only in having forked sori.

✓ (1.) **Gymnogramma leptophylla**, Desvaux.—Small-leaved Gymnogram.—Fronde s oblong-ovate, bi-tri-pinnate, glabrous, fragile; pinnæ ovate; pinnules ovato-cuneate, usually three-lobed, the lobes blunt bidentate.

GYMNOGRAMMA LEPTOPHYLLA, Desvaux. Hook. and Grev. Icon. Fil. t. 25. Newm. Hist. 12. Sowerby, Ferns, 83 t. 48. Moore, Nat. Print. Ferns, t. 43 B.—G. PALLISERENSE, Colenso.—G. NOVÆ-ZELANDIÆ, Colenso.—POLYPODIUM LEPTOPHYLLUM, Linnæus. Schkuhr. Crypt. t. 26.—ACROSTICHUM LEPTOPHYLLUM, De Candolle.—GRAMMITIS LEPTOPHYLLA, Swartz. Syn. 23. t. 1., f. 6.—OSMUNDA LEPTOPHYLLA, Lamarck.—ASPLENIUM LEPTOPHYLLUM, Cavailles.—HEMIONITIS LEPTOPHYLLA, Lagasca.—ANOGRAMMA LEPTOPHYLLA, Link.—DICRANODIUM, Newm.

Caudex annual, or sometimes biennial, small, subglobose, forming a little crown, fixed by a few short fibres. *Vernation* circinate. *Stipes* of the mature fronds as long as, or longer than the fronds, smooth shining, dark chestnut-brown, paler upwards; erect, terminal and adherent



[*Gymnogramma leptophylla*.]

to the caudex. *Fronde*s delicately membranaceo-herbaceous, fragile, pale yellowish green, slightly hairy when young, afterwards smooth; the earlier developed from the prothallus are small, fan-shaped, half an inch high, divided into two or three lobes, the lobes again dichotomously-lobed, with blunt bifid lobules; to these succeed one or two which are pinnate, an inch or two long, having obliquely fan-shaped three-lobed pinnæ, tapering to the base and decurrent, divided as the former; both these forms are spreading, more expanded than the rest, and usually barren. *Mature fronds* two or three in number, larger, erect, from three to six or eight inches high, oblong-ovate, bi-tri-pinnate; *pinnæ* alternate, ovate-triangular.

Pinnules alternate, ovate-cuneate, wedge-shaped at the base, and scarcely stalked, subdecurrent, three-lobed, the lobes obovate, slightly and bluntly notched at the apex, so as to become two-toothed. *Venation* of the pinnules, consisting of a vein so dichotomously branched, as to form a venule for each lobe, and a veinlet for each tooth.



[*G. leptophylla*.]

Fructification occupying the whole frond. *Sori* linear, forked; spore-cases attached along the ultimate veinlets, and extending below the fork, or simple in undivided lobes; at first distinct, often becoming confluent. *Spore-cases* numerous, brown. *Spores* roundish, or bluntly triangular, faintly striato-punctate, dark brown-purple.

This interesting little fern is found in Jersey, and hence becomes (politically, rather than geographically) British. It there grows in several localities, principally in the neighbourhood of St. Lawrence, St. Aubin's, and St. Haule. It is found on moist banks, having a south-western aspect, and is surrounded by liverworts and mosses, which are sufficient evidence of abundant moisture. We learn that in these situations the pro-

thallus is developed in the damp late autumnal months, being perfectly formed in November; by January three or four fronds have been produced; about April or May the growth is mature; and by August the plants have perished. Sometimes, in cultivation, the fronds are not produced till the second year.

This little fern is remarkable for its wide dispersion. In Europe, it ranges from Jersey, France, and Switzerland, into Germany, extending to Spain, Portugal, and Gibraltar, on the one hand, and to Italy, Sicily, and Greece, on the other. It is found in India, and in the Islands of the Persian Gulf; in Algiers, Morocco, Abyssinia, the Atlantic Isles, and the Cape of Good Hope; at Vera Cruz, in Mexico; in Victoria, at Swan River, as well as in Tasmania, and New Zealand.

This fern is properly a greenhouse or half-hardy species, requiring a moist, calm atmosphere, and a shady situation, such as a close shady frame. It will, however, readily accommodate itself to a much higher temperature, and may be cultivated with good success in a hot-house, where, in company with *G. cheerophylla*, an annual West Indian species, it will scatter its spores, and grow up without care, if any suitable situation in the house is left undisturbed. Any light sandy soil will suit it, and if grown in pots, several plants should be associated in the same pot. Its small size, quick as well as free growth, and delicate structure, will render it both suitable and interesting for a Wardian Case.

Genus 4. **POLYSTICHUM**, (Roth) Schott.

SHIELD FERN.

Sori indusiate, globose; the *receptacles* medial or rarely terminal on the venules. *Indusium* orbicular, peltate. *Veins* pinnato-furcate or simply forked, from a central costa; *venules* free; the lower anterior one usually, sometimes more, fertile.

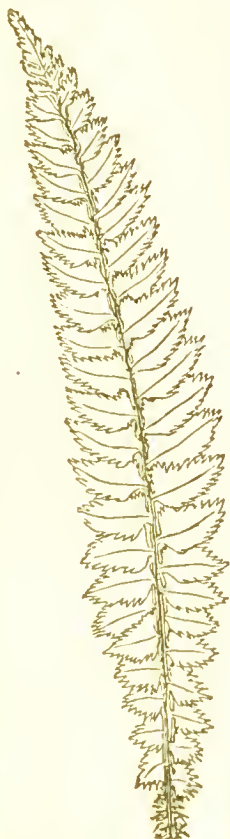
*Fronde*s simple pinnate or bi-tri-pinnate, rigid, coriaceous, the margins usually mucronato-serrate. *Rhizome* short, thick, erect.—Name from the Greek *polys*, many; and *stichos*, order.

This genus embraces several ferns, of which the extremes are of very dissimilar appearance, but so closely connected by intermediate forms, as to give rise to much difference of opinion, as to what should be regarded as distinct. The group being the most typical portion of the native species of the old genus *Aspidium*, it is proposed to retain for it the English name, Shield Fern, belonging to that genus.

✓ (1.) **Polystichum Lonchitis**, Roth.—Alpine Shield Fern, or Holly Fern.—Fronde narrow, linear-lanceolate, rigid, pinnate; pinnae falcately - lanceolate, acute, spinosely-serrate, auricled at the base above, obliquely wedge-shaped, or rounded, below, the lowest often with both anterior and posterior auricle.

POLYSTICHUM LONCHITIS, Roth. Schott, Gen. Fil. t. 9. Deak. Flor. Brit. iv., 89. Bab. Man. 411. Sowerby, Ferns 30, t. 15. Newm. Hist. 103. Moore, Nat. Pr. Ferns. t. 9.—POLYPODIUM LONCHITIS, Linnæus. Bolton, Fil. 34, t. 19. Smith, Eng. Bot. t. 797.—ASPIDIUM LONCHITIS, Swartz. Schkuhr, Crypt. 29, t. 29. Sm. Eng. Fl. iv. 271. 11k. and Arn. Brit. Fl. 568. A. ASPERUM Gray.

Caudex thick, erect or decumbent, scaly above, with a stout woody central axis, and dark rigid wiry roots. *Vernation* circinate.



[*Polystichum Lonchitis*.]

Stipes usually short, sometimes 2-3 inches long, with large ovate or broadly lanceolate fuscous chaffy scales; terminal and adherent to the caudex; the *rachis* with numerous narrower lanceolate and subulate scales. *Fronde* 6-18 inches, rarely two feet in length, deep green, rigid, erect or pendulous, linear-lanceolate, pinnate. *Pinnae* numerous, crowded, often imbricated, the upper margin deflected, sometimes distant below; very rigid, having hair-like scales beneath; short-stalked or sessile, lanceolate-falcate, about an inch long, acute; the anterior base acutely auricled, the posterior obliquely sloped or rounded; the margin with spiny serratures, and minute intermediate teeth between them. *Venation* often indistinct; midvein extending to the apex, a principal branch or vein extending to the apex of the auricle, this branch pinnately forked; the other veins 2-4 times pinnately forked, *i. e.*, branched with the branches at each ramification nearly equal, and but slightly

diverging; a venule or veinlet is directed into each

of the marginal teeth. In smaller specimens there are fewer ramifications. *Fructification* dorsal, usually confined to the upper half of the frond. *Sori* round, indusiate, ranged in a line on each side the midvein half-way to the margin, and also on each side the principal vein of the auricle; medial on the anterior branch of each fascicle of veins, often confluent in age. *Indusium* membranaceous, orbicular, peltate, *i. e.* attached to the receptacles by a short central stalk. *Spore-cases* numerous, globose, stalked, deep brown. *Spores* small, round or oblong, muriculate.



[*P. Lonchitis*.]

Asia Minor, in Kashmir, and on the Altai mountains, extending to Kamtchatka, whence it passes to North-west America. The *P. munitum* of California and Nootka Sound, is very doubtfully distinct.



[*P. Lonchitis*.]

This rare northern species, of perennial duration, with persistent fronds, is found in the fissures of rocks towards the summits of some of our loftiest and bleakest mountains. It occurs in the Highlands of Scotland, in Yorkshire, and the lake district in North Wales, and in the four provinces of Ireland. It is also found throughout Europe from Iceland and Lapland to Italy, Spain and Greece. It grows in

This is a plant of shy growth, and very tardy increase. It may be kept in good health, if potted *firmly* in well-drained soil, and placed in a cool, moist frame, in which, when established, it will grow with tolerable vigour. Exposed on out-door rockwork, it rarely has a prolonged existence, unless the damp but well-drained

condition of its natural localities can be tolerably imitated. In removing plants of this, as of the other less easily managed ferns, from their natural habitats for the purposes of cultivation, it is not only proper to take all possible precaution not to injure the roots, but also decidedly advantageous to select the smaller plants in preference to the larger, as the former are much more easily established than are the latter. It cannot, however, be regarded as a plant of easy culture, and probably objects to the denser atmosphere of lowland situations.

(2.) **Polystichum aculeatum**, Roth. — Common Prickly Shield Fern.—Fronds lanceolate or broad linear-lanceolate, rigid, bipinnate; pinnules distinct, attached by their wedge-shaped base, or obliquely-decurrent or confluent; the anterior basal ones largest, all prickly serrate; sori infra-medial.

POLYSTICHUM ACULEATUM, Roth. Deak. Flor. Brit. iv. 91. Bab. Man. 411. Sowerby, Ferns 32, t. 17 (incor. veins). Newm. Hist. 111 (in part). Moore. Nat. Print. Ferns t. 10.—P. LOBATUM, Presl.—P. AFFINE, Presl.—POLYPODIUM ACULEATUM, Linnæus.—ASPIDIUM ACULEATUM, Swartz. Sm. Eng. Bot. t. 1562; Eng. Fl. iv. 277. Hk. and Arn. Br. Fl. 568.—ASPIDIUM LOBATUM, Schkuhr, Crypt. 42, t. 40.—ASPIDIUM DISCRETUM, Don.—A. AFFINE, Wallich.

Var. lobatum: fronds narrow-lanceolate, very rigid; pinnules (except the larger basal ones) elliptic, not auricled, nearly all decurrent or confluent, prickly serrate.

POLYSTICHUM ACULEATUM *v.* LOBATUM, Moore, Handbk. ed. 2, 86; Id. Nat. Print. Ferns t. 11.—P. ACULEATUM, Link. Newm. Hist. III. (in part).—P. ACULEATUM β and γ . Deak. Flor. Brit. iv. 91.—P. LOBATUM, J. Smith. Sowerby. Ferns, t. 16.—P. PLUKENETHI, De Candolle.—P. OCELLATUM, Schott.—ASPIDIUM LOBATUM, Swartz. Sm. Eng. Bot. t. 1563; Eng. Fl. iv. 278. Hk. and Arn. Br. Fl. 568.—A. ACULEATUM, Schkuhr, Crypt. 41, t. 39.—A. PLUKENETHI, Steudel.—A. LENTUM, Don.—A. OCELLATUM, Wallich.—A. INTERMEDIUM, Sadler.—A. MUNITUM, Sadler.—POLYPODIUM LOBATUM, Hudson.—P. ACULEATUM, Bolt. Fil. 48, t. 26.—P. PLUKENETHI, Loiseleur.

✓ *Var. argutum*: fronds lanceolate; pinnules distinct, long, narrow, sharply spine-toothed.

POLYSTICHUM

ACULEATUM *v.* ARGUTUM, Moore, Nat. Print. Ferns. t. 10. B.

Caudex thick, tufted, erect or decumbent, becoming woody in age, scaly above, with coarse branched dark brown roots.

Vernation circinate, the main rachis becoming recurved before the unfolding of the frond is completed; the pinnæ convolute. *Stipes* 3-4 inches long, densely scaly, with broad ovate-lanceolate membranaceous fuscous scales; terminal and adherent to the caudex. *Rachis* stout, scaly, the scales fewer, and almost hair-like above. *Fronde*s 1-3 feet high, rigid, smooth,



[*P. aculeatum*; *b argutum*.]

dark green, spreading or somewhat drooping, lanceolate, bipinnate. *Pinnæ* numerous, obliquely linear-lanceolate,



acuminate, pinnate at the base and for a part of their length, or sometimes the basal pinnules only distinct. *Pinnules* ovate-falcate or elliptic, acute and aristate at the apex; all, or the basal ones only, auriculate on the anterior side, the auricle acute and mucronato-aristate; subsessile and attached by the wedge-shaped base, or decurrent, the basal portion entire, obliquely incised on the posterior side, the margin otherwise toothed with unequal adpressed mucronate serratures; the basal anterior one on each pinnæ generally larger, often much larger, than the rest, and more strongly auricled, forming a conspicuous row next the rachis, all more or less convex. *Venation* (pinnules) consisting of a flexuous midvein, with alternate veins, which are again furcately branched alter-

[*Polystichum aculeatum lobatum*.]

nately, the lower veins producing 3-4, the upper 2-3 venules, of which the lowest anterior one is sori-ferous. In the auriculate portion the vein gives off a greater number of venules, some few of which may become fertile. *Fructification* dorsal, usually confined to the upper half of the frond. *Sori* round, indusiate, seated much below the apices of the venules in a line on each side the midvein and of the vein of the auricles, often crowded, sometimes becoming confluent; attached to the lowest anterior venule of each fascicle of veins; or at the auriculate base, to the venules on either side the vein, but there also to the anterior branch if forked. *Indusium* membranaceous, orbicular, peltate, umbilicate. *Spore-cases* numerous, dark brown, roundish-obovate, stalked. *Spores* very slightly muriculate.

The *var.* **LOBATUM** differs from the typical form of



the species in the narrow-lanceolate outline of its fronds, and in having its pinnules all decurrent or more or less confluent. The pinnules are rarely slightly auricled, but usually both the anterior and posterior margins are rounded, so that they are more ovate than lunate. In other respects, in its subevergreen fronds adherent to the tufted caudex; in its rigid texture and shining surface; in the prickly serratures of its pinnules, and in the enlarged anterior basal pinnule on each pinna, it quite agrees with *P. aculeatum*, from which the numerous intermediate stages, and above all the interchanges observed under cultivation of *lobatum* to *aculeatum*, and *vice versa*, forbid its being separated as a species. It is equally common, or more so, than the typical form.

[*P. aculeatum lobatum.*]

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The var. ARGUTUM differs in the narrower, longer, and straighter pinnules, which are quite distinct and aurieled, and sharply spine-toothed. It was found in Buckinghamshire by Mr. Lloyd.

This species is common in hedge-banks and similar situations throughout the United Kingdom, and is also found in the Channel Isles. It is also abundant almost all over Europe; and is found in various parts of India, and in Asiatic Russia from Colchis to Lenkoran; in Africa, on the northern coast of Algiers, and again in the South, as well as in Madeira; and in America from the Eastern United States to Columbia on the north-west coast. Besides these, there are various South African, Australasian, and Antarctic plants, which are scarcely, if at all, distinguishable from this species.

P. aculeatum and its varieties are easily grown, and are ornamental plants either for rock-work, or for pot-collections. They should be planted in well-drained sandy loam, and prefer a moderately shady situation.

(3.) **Polystichum angulare**, Presl. Angular or Soft Prickly Shield Fern.—Fronds lax, herbaceous, lanceolate, bipinnate; pinnules distinct, acute or obtuse, with an obtuse-angled base, attached by a distinct stalk, lobed or serrated, the serratures tipped by soft bristles; sori terminal or subterminal.

POLYSTICHUM ANGULARE, Presl. Newm. Hist. 117. Bab. Man. 412. Deak. Flor. Brit. iv. 95. Sowerby, Ferns, 34, t. 18. Moore, Nat. Print. Ferns, t. 12 A.—P. SETIFERUM, Moore, Nat. Print. Ferns. (obs.)—P. AFFINE, Wollaston, MS; Id. Phytol. n.s. i. 439.—P. ACULEATUM, A. Gray, and of many British botanists.—ASPIDIUM ANGULARE, Kitaibel MS; Willdenow. Sm. Eng. Fl. iv. 278. Sowerby, Supp. Eng. Bot. t. 2776. Hk. and Arn. Br. Fl. 568.—A. ACULEATUM, Kunze.—A. ACULEATUM β , Sm. Fl. Brit. 1122. A. HASTULATUM, Tenore.—A. LOBATUM v. ANGULARE, Mettenius.—POLYPODIUM APPENDICULATUM, Hoffmann.—POLYP. SETIFERUM, Forskal.—POLYP. ANGULARE, Fries.—POLYP. ACULEATUM, Hudson.—HYPOPELTIS LORULATA, Bory.

Var. *imbricatum*: fronds linear lanceolate; pinnæ

[*Polystichum angulare*.]

short, bluntish; pinnules roundish-oblong, imbricated; rachis proliferous.

POLYSTICHUM ANGULARE
v. *IMBRICATUM*, Moore, Nat.
Print. Ferns, t. 12 E.

Var. alatum: fronds lanceolate, rather small; pinnules decurrent with the winged secondary rachides; teeth rounded; bristle-pointed.

POLYSTICHUM ANGULARE
v. *ALATUM*, Moore, Nat.
Print. Ferns, under t. 12; t.
10 C.—*P. ACULEATUM*, v.
ALATUM, Moore, Handbk.
ed. 2, 86.

Var. proliferum: fronds lanceolate, lax, bi-tripinnate; pinnules narrow attenuated, distinctly stalked, usually deeply lobed, the lobes widely separated; rachis proliferous, and very scaly.

POLYSTICHUM
ANGULARE var.

PROLIFERUM, Moore, Nat. Print. Ferns, t. 13 C.—P. A. ANGUSTATUM, Moore, Handbk. ed. 2, 91.

Var. subtripinnatum: fronds ample lax, subtripinnate, the basal pinnules deeply pinnatifid or subpinnate,

POLYSTICHUM ANGULARE v. SUBTRIPINNATUM, Moore, Handbk. ed. 2, 91; Id. Nat. Print. Ferns, t. 13 A.—ASPIDIUM ANGULARE β (subtripinnate), Hk. and Arn. Fl. 568.

Var. tripinnatum: fronds ample lanceolate; pinnæ crowded; pinnules imbricated, the anterior basal one much elongated, distinctly pinnate the greater part of its length, its pinnulets stalked.

POLYSTICHUM ANGULARE v. TRIPINNATUM, Moore, Nat. Print. Ferns, t. 13 B.

Var. cristatum: fronds and pinnæ multifid-crisped at apex.

Caudex perennial, thick, tufted, scaly, erect or decumbent, sometimes becoming lengthened and trunk-like. *Vernation* circinate, the main rachis becoming recurved when the fronds are about half developed; the pinnæ convolute. *Stipes* rather lengthened, usually 4-6 inches long, sometimes longer; densely scaly, with long lanceolate-acuminate and linear-lanceolate reddish-tawny chaffy scales; these intermixed with numerous smaller hair-like and adpressed ciliated scurf-like scales, which are continued over the *rachis*; terminal and adherent to the caudex. *Fronds* 2-4 feet high, herbaceous or subrigid, full green, usually lax, spreading, and more or less arched or drooping, numerous, arranged in a circlet around the crown, lanceolate, bi-tri-pinnate. *Pinnæ* numerous, narrow linear-lanceolate tapering towards the apex, the basal ones usually diminishing in length, but sometimes longest. *Pinnules* somewhat crescent-shaped, *i. e.*, ovate-falcate, with a strong anterior auricle or projecting lobe, flat; acute or bluntish, distinctly often deeply serrated, the serratures tipped with a slender rigid bristle, which is more strongly developed at the apex of the pinnule and of the auricle; the base somewhat rounded on the posterior side, truncate but with a convexity on the side pa-

parallel with the rachis, thus forming an obtuse angle with slightly curving sides, attached by a short but distinct slender stalk. The basal anterior pinnule is usually somewhat, often much, larger than the rest, sometimes deeply pinnatifid or even pinnated, and occasionally other of the pinnules near the base are divided more or less deeply.

Venation (pinnules) consisting of a flexuous midvein, with alternate veins which are furcately-branched, producing 2-3 or more venules, the anterior venule of the fascicle bearing the sorus at or very near its apex. The auricle has a stronger vein, which is pinnately branched, producing several simple or forked venules, of which 3-4 bear sori.



[*P. angulare*.]

Fructification dorsal, generally occupying the whole upper two-thirds of the fronds, but sometimes confined on this portion to the apical part of the pinnæ. *Sori* small, numerous, round, indusiate, forming a line on each side the midvein and the vein of the auricle, often crowded and sometimes becoming confluent; attached to the anterior venule of the fascicle, whenever the veins are forked, but in the auricle several of the simple venules bear sori. *Indusium* firm membranaceous, orbicular, peltate, umbilicate. *Spore-cases* numerous, brown, roundish-obovate. *Spores* roundish-ovate, muriculate.

The fronds are persistent, and remarkably elegant, retaining their verdure throughout the winter, the old undecayed fronds of preceding years, though dead and entirely discoloured, being usually found about the base of the plants. The whole plant is softer, more lax and delicate in texture, and more shaggy than in the nearly allied *P. aculeatum*. The base of the pinnules in *P. angulare*, instead of forming an acute angle, as described under *P. aculeatum*, forms a very obtuse angle, the point of the angle being not attached directly to the rachis as in that, but connected therewith by a short and slender but distinct stalk.

The *var. IMBRICATUM* is remarkable for having narrow linear-lanceolate fronds; the pinnae short, linear-oblong, bluntish; the pinnules crowded, imbricated, roundish oblong, scarcely narrowed at the apex, strongly spinulose-serrated, sub-auricled at the anterior base; the basal anterior pinna large, and all connected with the rachis by a short, somewhat winged petiole. The stipes and lower part of the rachis is proliferous. It was found in Somersetshire by Mr. Elworthy.

The *var. ALATUM* is a most remarkable form. Its peculiarity consists in the pinnules being all connected by a very obvious wing on both sides the secondary rachides, on which they are thus decurrent. The pinnules are more pointed than usual, the anterior side most developed, and the margin cut into rounded teeth tipped by a bristle. This



[*Polystichum angulare*, vars.—
a. alatum; *b. subtripinnatum*;
c. tripinnatum.]

plant was found in Somersetshire by Mrs. Areher Thompson, and since, in Devonshire, by Mr. Wollaston.

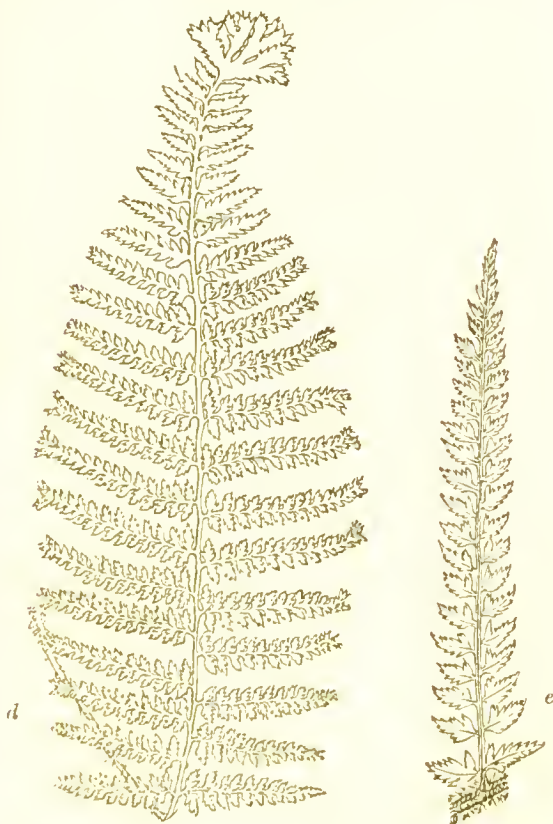
The *var. PROLIFERUM*, of which two forms have been found, is, in its best state (*subvar. WOLLASTONI*), very graceful, of lax habit, with narrowed attenuated semi-depauperated, yet not distorted, distantly-lobed, deeply-divided pinnules, the segments of which are sometimes quite separate, so that the fronds are tripinnate. The less elegant form is still remarkable for its very narrow and acute pinnules, which are in both, rather more distinctly stalked than in the common forms of *P. angulare*. This variety is further remarkable in being always viviparous in the axils of the lower pinnae. The better known form was found by Mr. Choules, and the more elegant one by Mr. Wollaston, in Devonshire.

The *var. SUBTRIPINNATUM*, is one of the more highly developed states of the species. All the lower pinnules (the basal ones in particular) are deeply pinnatifid, the segments sometimes becoming almost or quite distinct. Thus being somewhat more deeply divided, and usually of larger growth than the ordinary *P. angulare*, it is a more lax and elegant plant. It is not uncommon.

The *var. TRIPINNATUM*, is a stout rigid form, with crowded imbricating pinnules; its chief peculiarity is that the anterior basal pinnule is very much larger, nearly twice as large as the rest, and distinctly pinnate nearly its whole length, the little pinnulets being stalked. It was found in Cornwall, and was brought under our notice by Mr. E. J. Lowe.

The *var. CRISTATUM*, is a very beautiful plant, in its general features resembling the crested varieties of the Male Fern and the Lady Fern; *i. e.* the apex of the frond and the apices of the pinnae all form multifid curly tufts, those of the pinnae, however, much less developed than those of the fronds. In other respects it is nearly like the normal form of the species. It has been found in different degrees of development; first near Bristol by a collector named Hillman, this plant being in possession

of Messrs. Garaway, Mayes and Co.; subsequently in Devonshire, by the Rev. J. M. Chanter and Mr. Wollaston; and again in Somersetshire by Mr. Elworthy, who has



[*P. angulare*, vars.:—*d*, *cristatum*.—*e*, *hastulatum*.]

found two somewhat differing and well developed forms. One of the latter is in the possession of Mr. Veitch, of Chelsea.

Besides the foregoing, several slighter, though tolerably well-marked varieties have been noticed; these we can only briefly record:—

hastulatum: has small distinct acutish pinnules, very distinctly stalked, and with a prominent acute auricle. Surrey, Devon. (Nat. Print. Ferns. t. 12, B.)

✓ *acutum*: has acute narrowish falcate, strongly auricled, distinctly stalked pinnules, but longer than in the last. Sussex, Hants, Devon.



✓ *aristatum*: has the bristly points of the serratures more developed than usual and turned up; the stipes, moreover, is prolific. Sussex, Mr. Wollaston.

✓ *intermedium*: robust fleshy-looking and rigid, resembling *aculeatum*; pinnules short, crowded, subtrapeziform, strongly auricled, deeply ineiso-serrate, the segments biserrate and more aristate than usual. Kent, Mr. Sim; and elsewhere. There are several slightly differing forms found in Sussex,

P. angulare, vars: —*f*, *inbricatum*; *g*, *biserratum*; *h*, *intermedium*.]

Wales, &c., which we associate under this name.

biserratum: this is biserrate, and of nearly the same outline in the pinnules as *intermedium*, but it is of lax habit, and frequently has a very long stipes. Brentford, Mr. Gray; Jersey, Mr.

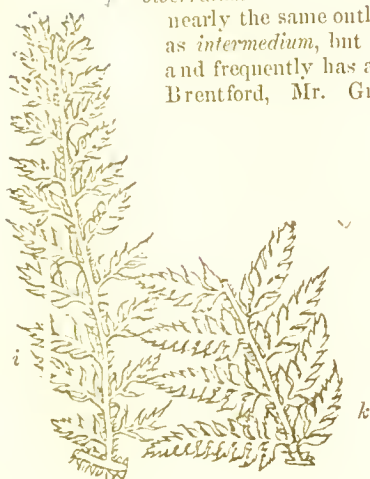
J a c k s o n.

(Nat. Print.

Ferns t. 12

D.)

præmorsum: a small growing form; the pinnae irregular lacinate; the pinnules truncate margined and verrucose. Ireland, Dr. Allchin.



[*P. angulare*, vars:—*i. proliferum*
Wollastoni; *k*, *decompositum*.]

dissimile: proliferous, and in the more perfect parts resembling *intermedium*, but the fronds are constantly here and there more or less depauperated, and in the parts thus affected, the pinnae are irregularly deformed, truncated, or suppressed, or pinnuloid, and the pinnules themselves very irregular in shape and size; the serratures are very conspicuously bristle-pointed, and the whole profusely scaly. Kent, Mrs. Delves.

irregulare: bears variable and unequally inciso-lobate pinnules on the lower pinnae, while the upper fertile pinnae are somewhat depauperated, and more irregular in size, outline and tothing; when more normal it approaches *biserratum*. Somersetshire, Mr. Elworthy. (Nat. Print. Ferns, t. 12 c.)

depauperatum: dwarf; the fronds depauperated, so as often to become mere skeletons, little but the ribs remaining, and these irregularly developed; but some fronds are less affected when the pinnules are wedge-shaped at the base, and above serrated with long subulate teeth. It is also prolific. Ireland, Dr. Kinahan.

✓ *confluens*: a small form and depauperated, but the pinnae are symmetrically changed, the upper to a linear falcate outline, deeply serrate, and with a very large auricle, the pinnules being entirely confluent; the lower more divided, with irregular cuneate subauriculate aristate pinnules. Ireland, Mr. S. Foot; communicated by Mr. D. Moore.

✓ *grandidens*: fronds, dwarfish, narrow-lanceolate; pinnules small, obliquely-cuneate, conspicuously inciso-dentate; the terminal pinnule of the lower pinnae is enneato-flabellate, and uniform in size with the rest; those of the upper pinnae confluent upwards. Devonshire, Mr. R. Penwell; communicated by Mr. Hodges of Cheltenham.

✓ *densum*: sub-erect; the pinnules small, crowded oblique-oblong, obtuse, finely aristate-serrate, the anterior basal lobe roundish-obovate and quite distinct; rachides and veins densely hair-sealy. Surrey, Mr. Morse.

✓ *incisum*: large; pinnules dissimilar, those of the lower part of the frond resembling *subtripinnatum*, the upper ones more incised and irregularly laciniated or jagged, their segments again serrated. Sussex, Mr. Wollaston.

✓ *decompositum*: the most divided form; it is tripinnate, *i. e.* there are distinct pinnae, pinnules, and pinnulets; the pinnulets are lobed, and the lobes serrated; the pinnae are miniatures of fronds of *P. aculeatum*; it is a more-divided state of *subtripinnatum*, and exists in various degrees of development. Ireland, Mr. D. Moore.

This beautiful Fern, which prefers lowland sheltered woods and hedgebanks, where the soil is moist, extends over the whole of England and Wales, appearing most plentiful in the south and southwest of England, and in Ireland. In Scotland it seems rare, being only recorded

from Berwickshire and Argyleshire. The same species, in some of its forms, is plentiful over the middle and south of Europe, extending as far north as Sweden and Norway, and southwards to Spain, Italy, Greece, and the Black Sea coast. In Asia it is found in Georgia; again in India, in the valley of the Indus, in Madras, and from Kashmir to Nepal. In Africa it grows in the Canaries, Azores, and Madeira, in Abyssinia, and at Natal. In America it occurs in the United States, and at Sitka. In addition there occur South American plants—in Guatemala, Mexico, New Grenada, and Caraceas; and Asiatic ones—common over India, Java, Singapore, &c., which are barely if at all distinguishable; these tropical forms, moreover, render it almost impossible to distinguish *P. aculeatum* from *P. angulare*, though the British forms of these plants appear sufficiently different.

No fern is more easily cultivated; it grows freely in any light loamy soil, especially such as is enriched by decaying leaves. Altogether it is one of the most ornamental of our hardy species, and its evergreen habit is a great additional recommendation. It should be planted in well-drained loamy soil, and a shady situation. It is readily cultivated in pots, requiring, however, a considerable share of pot-room.

Genus 5. **LASTREA**, (Bory) Presl.

BUCKLER FERN.

Sori indusiate, globose; the *receptacles* medial or rarely terminal, or sub-terminal on the venules. *Indusium* roundish-reniform, or sometimes small and irregularly reniform, plane or fornicate, fugacious or persistent, the basal sinus at which it is affixed, variously deep, narrow; broad, or shallow. *Veins* simple, forked or pinnate, from a central costa; *venules* free, the anterior usually (sometimes more) fertile.

*Fronde*s herbaceous or coriaceous, pedate pinnate or bitripinnate, the fertile sometimes contracted. Rhizome short, thick, erect or decumbent, or elongately creeping.— Name given in honour of M. Delastre of Chatellernut, a zealous botanist and microscopist.

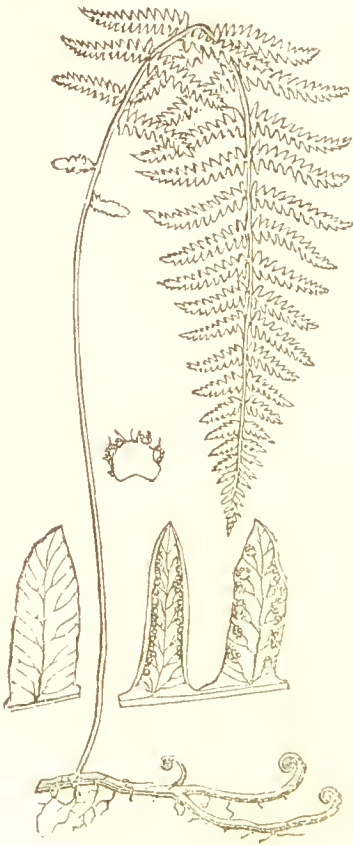
Bory de St. Vinent, who originally gave the name of *Lastrea* to a group separated from *Polypodium*, and including the greater part of the bipinnatifid and bipinnate species, points out *Polypodium Oreopteris*, *Thelypteris*, and *unitum*, all belonging to the *Aspidiæ*, as the typical species. Presl subsequently adopted the name for one of his genera of *Aspidiæ*, which includes the greater part of the British species which were referred to the *Aspidium* of Swartz. The Common Male Fern may be regarded as the type. The English name of Buckler Fern is here adopted as an equivalent for Shield Fern; that, which was the common name of the old *Aspidium*, being properly restricted to the more typical genus *Polystichum*.

(1.) **Lastrea Thelypteris**, *Presl*—Marsh, or Female Buckler Fern.—Fronds lanceolate with a broad base, pinnate, glandless; pinnae linear-lanceolate, deeply pinnatifid; lobes oblong, the edges revolute in the fertile fronds, the lobes of which thus appear contracted, and more acute; caudex creeping.

LASTREA THELYPTERIS, Bory. Presl. Deak. Flor. Brit. iv. 96. Bab. Man. 409. Newm. Hist. 183. Sowerby. Ferns 16, t. 7, Moore, Nat. Print. Ferns, t. 29.—ASPIDIUM THELYPTERIS, Swartz. Schkr. Crypt. 51, t. 52. Sm. Eng. Fl. iv. 272. Hook. and Arn. Brit. Fl. 569.—A. PALUSTRE, Gray.—ACROSTICHUM THELYPTERIS, Linnæus. Bolt. Fil. 78, t. 43, 44.—POLYPODIUM THELYPTERIS, Linnæus.—P. PALUSTRE, Salisbury.—POLYSTICHUM THELYPTERIS, Roth.—NEPHRODIUM THELYPTERIS, Stempel.—ATHYRIUM THELYPTERIS, Sprengel.—THELYPTERIS PALCSTRIS, Schott.—HEMESTHEUM THELYPTERIS, Newm. App. xxii.; Id. Hist. 124.—DRYOPTERIS THELYPTERIS, A. Gray.

Caudex perennial, slender, dark-coloured, extensively creeping, sparingly branched, producing fronds at intervals, scaly at the growing point, and having numerous dark-brown roots. *Vernation* circinate. *Stipes* as long as or longer than the leafy portion in the fertile fronds, shorter and slighter in the barren, smooth, the base ebony-coloured, pale green upwards; lateral and adherent to the caudex; *rachis* smooth. *Fronds* 6-8 inches to four feet in height including the stipes; lanceolate scarcely narrowed at the base, delicate green, membranaceous, erect, pinnate. *Pinnæ* sub-opposite or alternate, spreading, linear-lanceolate, deeply pinnatifid. *Segments* oblong, obtuse, or sometimes acute, straight or falcate, entire or slightly sinuate-lobed, the basal ones, especially those on the anterior side, often longer than and quite distinct from the rest. The fertile fronds, which appear about July, differ in having the margins of their segments revolute, thus appearing narrower and more acute; and

iu being taller, with a stouter stipes. *Venation* (lobes) consisting of a stout midvein, flexuous above, producing



[*Lastrea Thelypteris*]

veins, which are once or twice forked near the base, the venules or veinlets extending to the margin. *Fructification* dorsal, occupying the whole surface of the distinct fertile fronds. *Sori* small, round, situated near the base of the venules, *i. e.* just above the fork of the vein, and forming a line on each side the midvein, midway between it and the margin, though apparently submarginal from the involution of the edge of the frond; they often become confluent, and sometimes effused over the whole of the small space between the rolled-up margins. *In-*

dasium a small delicate roundish membrane, attached posteriorly, lacerate and glandular at the margin. *Spore-cases* numerous, brown, obovate. *Spores* oblong or reniform, strongly muricate.

This species, which has annual fronds, is rare, or rather local in its occurrence, though widely dispersed, only growing in boggy and marshy places; when present, it is generally abundant, being a free grower, and rapidly extending itself by its long creeping caudex. It is dispersed over the whole of England, and occurs in both North and South Wales, and in all the Irish provinces; in Scotland it is only recorded from Forfarshire. Beyond the limits of the United Kingdom, it is known to occur all over Europe, and it is recorded from Algiers, in Africa, and from the Caucasus, and the Altai mountains in Asia, while it is not unfrequent in North America. A scaly plant, which is no doubt a variety of this species, is found at the Cape of Good Hope and in New Zealand; and a gigantic one is met with in Sikkim Himalaya.

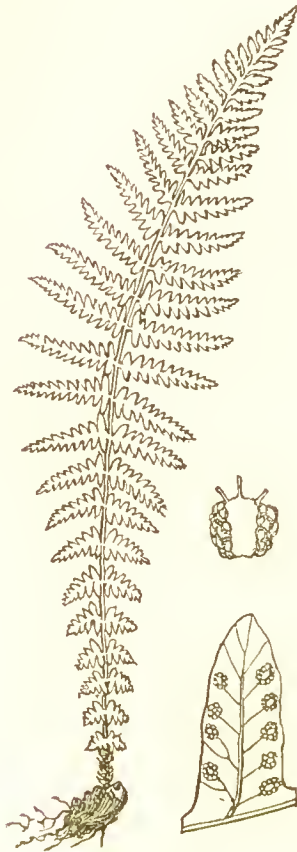
This fern grows freely under cultivation, requiring peat soil mixed with decaying tree leaves, and kept in a moist state. It should be planted about the base of rock-work where its boggy habitat may be imitated. Its long creeping stems are generally too much restricted within a garden pot, and a wide shallow pan is consequently more in accordance with its habits. It propagates readily by division of the caudex.

2. **Lastrea montana**, Moore.—Mountain Buckler Fern.—Fronds lanceolate, much narrowed below, pinnate, resinoso-glandular beneath; pinnae linear-lanceolate, widest at the base, deeply pinuatifid; lobes oblong flat; sori marginal; caudex tufted.

LASTREA MONTANA, Moore, Handbk. ed 2, 100. Newm. Hist. 3, ed. 130.—L. OREOPTERIS Bory. Presl. Bab. Man. 410. Deak. Flor. Bri. iv. 98. Newm. Hist. 2, ed. 188. Sowerby, Ferns, 17, t. 8.

Moore, Nat. Print. Ferns, t. 28.—*ASPIDIUM OREOPTERIS*, Swartz. Schkuhr, Crypt. 37, t. 35, 36. Sm. Eng. Fl. iv. 273. Hk. and Arn. Brit. Fl. 569.—*A. ODORIFERUM*, Gray.—*POLYPODIUM MONTANUM*,

Vogler.—*P. OREOPTERIS*, Ehrhart. Sm. Eng. Bot. t. 1019.—*P. THELYPTERIS*, Hudson. Bot. Fil. 40, t. 22.—*P. FRAGRANS*, Hudson.—*P. PTEROIDES*, Villars.—*P. LIMBOSPERMUM*, Allioni. *POLYSTICHUM OREOPTERIS*, De Candolle.—*POLYSTICHUM MONTANUM*, Roth.—*HEMESTHECUM MONTANUM*, Newman.—*NEPHRODIUM OREOPTERIS*, Desvaux.—*PHEGOPTERIS OREOPTERIS*, Fée.



[*Lastrea montana*.]

Caudex perennial, stout, tufted, decumbent and slowly creeping, scaly above, and having stout brown roots. *Vernation* circinate, the pinnæ not convolute. *Stipes* short, stout: terminal and adherent to the caudex; glandular, furnished with ovate-lanceolate membranaceous scales; *rachis* glandular, scaly

below, the scales finer and hair-like upwards. *Fronde* 1-3 feet or more in height, numerous, erectish, bright green, often yellowish, profusely clothed with small sessile resinous glands which give out a balsamic fragrance; lanceolate, much tapered below and leafy nearly to the base; pinnate. *Pinnæ* opposite or alternate, numerous, the lower ones more distant obtusely triangular, above linear-lanceolate tapering to a long point, the upper ones shorter and narrower, all deeply pinnatifid. *Lobes* flat, oblong, obtuse, entire, slightly falcate, the basal ones longest. *Venation* (lobes) consisting of a flexuous midvein, producing alternate veins, which are simple or forked, the venules extending to the margin, and bearing the sori near the apices. *Fructification* dorsal, most abundant on the upper half of the frond. *Sori* circular, forming a submarginal series, often confluent, sometimes without indusia. *Indusium*, when produced, small, thin, misshapen, jagged, evanescent. *Spore-cases* numerous, brown, obovate. *Spores* roundish or oblong, muriculate.

This species, which has annual fronds, is an inhabitant of mountainous heathy districts, and of moist woods. It is particularly abundant in Scotland, where, in many parts of the Highlands, it is the common fern of the hills and way-sides. It is scattered all over England and Wales, more or less abundantly, and is found in all the Irish provinces. The same plant is met with throughout Europe, from Norway and Russia in the north, through France, Holland, Germany, and Transylvania, to Spain, Italy and Greece. It is reputed to have been found in the Azores, and in North America, but these habitats require confirmation. An allied plant, differing in being slightly hairy, does, however, occur in Chili; and the *L. boreboracensis* of North America, is another nearly related species.

Few varieties have been noticed; there are, however, the following:

4 *truncata*: this has the apices of the fronds and pinnæ ter-

minating abruptly, while the rachis is carried on beyond the leafy portion, producing the appearance of the leafy portion having been eaten away at the point leaving only the ribs. Tunbridge Wells, Mr. Wollaston.

crispa: pinnules undulated or wavy, giving the frond a crisped appearance. Clova Mountains, Dr. Balfour.

The Mountain Buekler Fern is one of the few fragrant species of fern; its odour is balsamic and very agreeable. The plant is not generally at all easy of pot-cultivation. Mr. Wollaston recommends planting in pure loam, and keeping quite *wet* at all times; and his success warrants the recommendation. It grows better on shady rockwork in favourable, *i. e.* not smoke-poisoned localities; and is propagated by division or by spores. Naturally it no doubt grows in wet situations, but where the water is constantly passing away; and it is one of those species which seem especially to require, and to flourish only in, a pure atmosphere.

v (3.) **Lastrea Filix-mas**, Presl. — Male Fern, or Common Buekler Fern. — Fronds lanceolate, sub-bipinnate or bipinnate; pinnules oblong, obtuse or acute, serrate crenate or ineiso-lobate, the basal ones more or less distinct, the upper confluent; serratures not spinulose; indusium convex persistent (and except in vars. *abbreviata* and *pumila*), without glands on the margin.

—(type) subbipinnate; pinnules obtuse, oblong, distinct with a broad attachment, or connected at the base, crenato-serrate, green beneath; venules forked or three branched; sori occupying the lower half of pinnule.

LASTREA FILIX-MAS, Presl. Deak. Flor. Brit. iv. 103. Bab. Man. 410. Newm. Hist. 2 ed. 197. Sowerby, Ferns 19, t. 9. Moore, Nat. Print. Ferns, t. 14.—POLYPODIUM FILIX-MAS, Linnæus. Bot. Fil. 44, t. 24.—P. NEMORALE, Salisbury.—ASPIDIUM FILIX-MAS, Swartz. Schknh. Crypt. 45, t. 44. Sm. Eng. Bot. t. 1458, and t. 1949 (excl. text.); Eng. Fl. iv. 275 Hk. and Arn. Brit. Fl. 569.—A. NEMORALE, Gray.—POLYSTICHUM FILIX-MAS, Roth.—DRYOPTERIS FILIX-MAS, Schott. Newm. Hist. ed. 3. 184.—LOUPODIUM FILIX-MAS, Newm. App. xx.

Var. incisa: fronds robust, bipinnate; pinnules elongate or pyramidate-oblong, acutish, deeply inciso-lobate, the lobes serrate; sori usually occupying nearly the whole pinnule.

LASTREA FILIX-MAS, *v. INCISA*, Moore. Phytol. 1848, 137; Id. Nat. Print. Ferns t. 15. Bab. Man. 410.—L. AFFINIS, Moore MS (Nat. Pr. F.)—L. EROSA, Deakin, Flor. Brit. iv. 101.—ASPIDIUM FILIX-MAS *v. EROSUM*, Hk. and Arn. Brit. Fl. 569 (excl. syn. *Asp. erosum*, Schkr. t. 45, according to fig.)—A. DEPASTUM, Schkuhr, Crypt. t. 51 (monstrous).—A. AFFINE, Fischer and Meyer.—POLYPODIUM HELEOPTERIS, Borkhausen (Deakin).—POLYSTICHUM AFFINE, Ledebour.—LOPHODIUM EROSUM, Newm. App. xxi.—DRYOPTERIS AFFINIS, Newm. Hist. 187.—D. FILIX-MAS, *v. AFFINIS*, Newm. Hist. 187.

Var. paleacea: fronds sub-bipinnate; pinnules oblong truncately-obtuse, serrate at the apex, paler sub-glaucous and hair-scaly beneath; sori distinct, often small; margin of indusium much inflected; stipes and rachis shaggy with lustrous golden brown scales, which are long and narrow above, broader below.

LASTREA FILIX-MAS, *v. PALEACEA*, Moore, Handbk. ed. 2, 110. Id. Nat. Print. Ferns. t. 17 A.—L. PALEACEA, Moore MS. (Nat. Pr. F.)—L. PSEUDO-MAS, Wollaston, Phytol. n. s., i. 172.—L. PATENTISSIMA, Presl.—L. PARALLELOGRAMMA Liebman: Kunze.—L. TRUNCATA, Braeknridge.—L. F-M, *v. BORRERI*, Johnson, Sow. Ferns 20.—ASPIDIUM PALEACEUM, Don.—A. PATENTISSIMUM, Wallich.—A. DONIANUM, Sprengel.—A. WALLICHIANUM, Sprengel.—A. CRINITUM, Martens and Galeotti.—A. PARALLELOGRAMMUM, Kunze.—NEPHRODIUM AFFINE, R. T. Lowe.—DICHASIMUM PATENTISSIMUM, A. Braun.—DRYOPTERIS BORRERI, Newm. Hist. 189.—D. F-M, *v. BORRERI*, Newm. Hist. 189.

Var. Pinderi: fronds narrow elongate lanecolate, attenuated at the base and apex; pinnules, sori, and scales, as in *paleacea*.

LASTREA FILIX-MAS, *v. PINDERI*, Moore, Pop. Hist. Brit. Ferns, ed. 2, 315.

Var. abbreviata: fronds dwarfish, glandular, sub-bipinnate, the pinnae concave, scarcely pinnate; pinnules large (comparatively), broad obtuse, mostly decurrent,

unequally crenate or erenato-lobate, the lobes with blunt teeth; sori usually uniserial on each side the midrib of pinnae; indusium fringed with glands.

LASTREA FILIX-MAS, *v.* ABBREVIATA, Balington, Man. 410. Johnson, Sow. Ferns 20. Moore, Nat. Print. Ferns under t. 14. —L. ABBREVIATA, Moore MS. (Nat. Pr. F.).—POLYSTICHUM ABBREVIATUM, De Candolle. —LOPHODIUM ABBREVIATUM, Newm. App. xxi.—DRYOPTERIS ABBREVIATA, Newm. Hist. 192.—D. F.-M. *v.* ABBREVIATA, Newm. Hist. 192.

Var. pumila: fronds dwarf, glandular, sub-bipinnate; pinnae deflexed, eoneave; pinnules small, convex, mostly confluent, bluntly creuato-serrate; sori usually confined to the lowest anterior venule of the lowest pinnules—thus arranged in a single series on each side the midrib of pinnae; indusium somewhat inflected, and beaded with short-stalked (? deciduous) glands.

LASTREA FILIX-MAS, *v.* PUMILA, Moore, Nat. Print. Ferns t. 17 B.—L. PUMILA, Moore MS. (Nat. Pr. F.)—L. ABBREVIATA, Wollaston, Phytol. n. s. i. 172.—L. F.-M. *v.* ABBREVIATA, Moore, Handbk. ed. 2, 103.—ASPIDIUM FILIX-MAS, *v.* RECURVUM, Francis, Anal. 38.—A. F.-M. *v.* PUMILUM of gardens.

Var. cristata: fronds and pinnae symmetrically multifid-erisped at the apex; the pinnae narrowed gradually towards, and much constricted near the tassel; (*paleacea* type, *i. e.* with blunt pinnules, sub-glaucous beneath, and golden sealy rachis).

LASTREA FILIX-MAS *v.* CRISTATA, Moore and Houlst. Gard. Mag. Bot. iii, 317. Moore, Handbk. ed. 2, 106; Id. Nat. Print. Ferns, t. 16 A.

Var. polydactyla: fronds and pinnae multifid-erisped at the apex; the pinnae narrowed suddenly near the tassel; (*incisa* type, *i. e.* green with elongated incised pinnules.)

LASTREA FILIX-MAS, *v.* POLYDACTYLA, Moore, Nat. Print. Ferns, t. 16 B.

Caudex perennial, large, tufted, erect or decumbent, often in age becoming considerably elongated, sealy; with strong coarse dark-coloured roots. *Vernation* circinate,

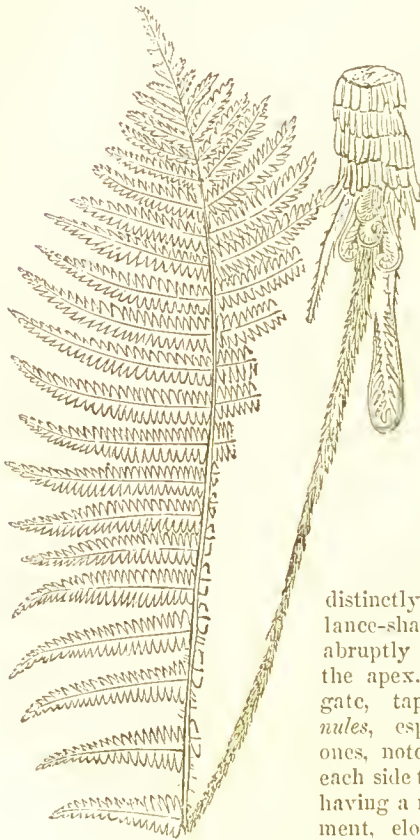
the apex being liberated before the unrolling is completed, assuming a curve like a shepherd's crook. *Stipes* about one-third the entire length of the frond, densely clothed with large narrow lanceolate chaffy pale-brown scales, intermixed with smaller ones; terminal and adherent to the caudex; *rachis* clothed sparingly with subulate scales. *Fronde*s averaging 2-3, sometimes 4-6 feet in height, erectish, often arranged in a circlet around the crown, herbaceous, smooth, deep green, somewhat paler beneath, broadly lanceolate gradually narrowed upwards, or sometimes oblong-lanceolate suddenly acuminate; bipinnate. *Pinnæ* numerous, alternate or nearly opposite, linear, gradually narrowing to the acute apex, the lower ones more distant. *Pinnules* at the base of the pinnæ distinct, notched on both sides at the base, but with a broad attachment; or sometimes slightly connected; the rest generally attached by the entire width of their base, more or less combined, and having a narrow sinus; oblong obtuse, crenated at the sides, serrated around the blunt apex, the teeth acute but not spinulose. *Venation* (pinnules) consisting of a flexuous midvein, bearing alternate veins, which are furcately branched, the venules extending nearly to the margin; one branch extended towards the point of each marginal tooth. In the larger varieties the veins are forked oftener than in the smaller. *Fructification* dorsal, rarely extending below the upper half of the frond. *Sori* numerous, distinct,



[L. Filix-mas.]

roundish-reniform, confined in the normal form to the lower half of the pinnules, attached to the anterior venule at a short distance above its source, and much below its termination, thus medial, forming two short lines nearer the midvein than the margin. *Indusium* firm, convex, persistent, reniform, *i. e.*, roundish with a posterior notch, affixed by the notch or sinus, the margin entire, *i. e.*, without marginal glands (ex-

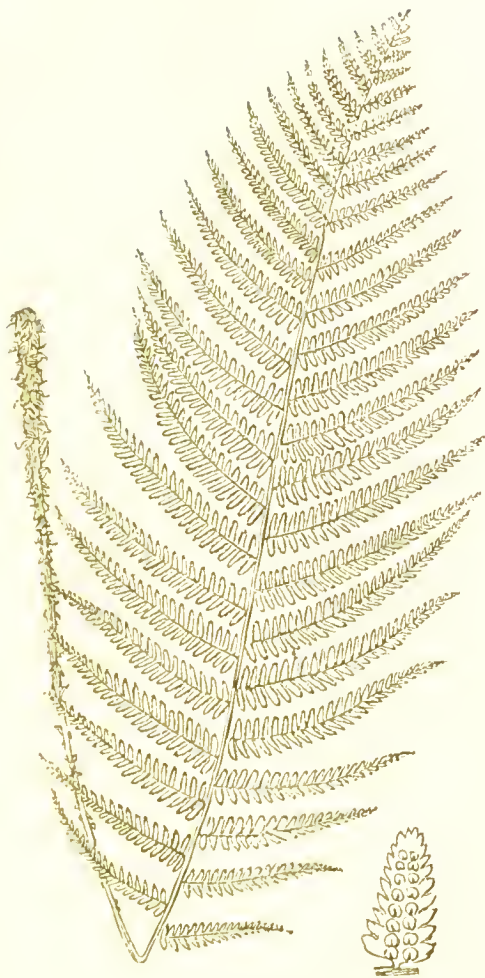
cept in the vars. *abbreviata* and *pumila*), and of a greyish or leaden hue. *Spore-cases* reddish-brown, obovate. *Spores* oblong, muriculate.



[*Lastrea Filix-mas.*]

The var. *INCISA*, or Incised Male Fern, may be considered as a more highly developed condition of the species, more robust in habit, averaging 3-4 feet, and sometimes growing six feet high; and in unfolding becoming liberated in the shepherd's crook-like form. *Fronds*

distinctly bipinnate, lance-shaped, not abruptly contracted at the apex. *Pinnae* elongate, tapering. *Pinnales*, especially basal ones, notched deeply on each side their base, thus having a narrow attachment, elongately pyramidal-oblong, narrowed to the rounded apex; the rest more broad



[L. Filix-mas v. incisa.]

attached and more equal in width; deeply inciso-lobate, the lobes with 2-5 teeth. *Venation* more highly developed; a vein extending up each lobe, and producing several venules, the basal lobes having the most numerous venules. *Sori* borne only by the lower anterior venule, forming a line on each side the midrib, commonly extending nearly to the apex of the pinnule. *Indusium* convex, persistent, without marginal glands. Irregular monstrous developments of this variety constitute the *Aspidium depastum* of Schkuhr, of which the fronds are broader, with large deeply lobed oblong pinnules occurring along with smaller deformed ones. The variety *incisa* is probably equally common with the type form; and appears as widely dispersed, being found in the Southern, South-western, Midland, and Northern parts of England, in Wales, in the East and South-west of Scotland and in Ireland.

The *var. PALEACEA*, or Golden-scaled Male Fern, differs materially from the normal form, in the abundance of golden-tinted scales, in its subglaucous undersurface, and in the very much inflected margin of the smaller indusia. *Fronds* broad lanceolate, 1-5 feet high, often yellowish green, but also frequently deep green, and always with a paler sub-glaucous under surface; the *stipes* and *rachis*, and under surface of the ribs densely scaly, the scales of the stipes broad-lanceolate, those of the rachis narrower, those of the pinnules hair-like. *Pinnæ* pinnate only at the base. *Pinnules* flat, oblong, obtuse, with a broad attachment, serrated towards the apex, the margin usually entire (but in some Scotch forms lobate, and the pinnules subundulate). *Veins* tinged with purple. *Indusium* distinct, usually rather small, the margins much inflected, so that when reversed they seem to form little pouches. The plant, which is not at all uncommon, is probably as widely dispersed as the typical and incised forms. The same fern, varying a little in the hue of its scales, occurs over Europe, in Madeira, India, Mexico, and the Sandwich Islands.

The *var.* PINDERI is a remarkable form of the *paleacea* type, peculiar in its narrow elongate lance-shaped outline. The fronds are three feet high, not more than $5\frac{1}{2}$ inches wide in the broadest part, tapering upwards into a long slender point, and narrowed in a similar way below, the stipes being short. The scales pinnules and sori are exactly those of *paleacea*. It was communicated in 1855 by the Rev. G. Pinder, by whom it was found near Elter Water, in the Lake country.

The *var.* ABBREVIATA is a permanently small form, and, perhaps, along with *pumila*, constitutes one subalpine species. It is larger than that, with larger and broader pinnules, and consequently a coarser appearance, the pinnules somewhat recurved, though less so than in *pumila*. It is also similarly glandular and fragrant. It occurs about Snowdon, and is found also in the north of England, and, according to Mr. Babington, in Gloucestershire.

The *var.* PUMILA is a dwarf plant rarely exceeding a foot in height, and remarkable in having the pinnæ curved backwards so that the upper surface is concave. We are inclined to regard it as a distinct species, its differences consisting in its involute venation while unrolling; in its mignonette-like fragrance when fresh, arising from the glands on its surface; in its inflexed indusium beaded with glands; and in its constantly small size. Its general features, on the other hand, agree with small examples of the Male Fern. *Stipes* short. *Fronde* lanceolate pinnate. *Pinnæ* $1\frac{1}{2}$ -2 inches long, bluntish, pinnatifid, rarely pinnate, pinnules or lobes connected at the base, one or two of the lowest only cut down nearly to the rachis; small, oblong, obtuse, obscurely-crenated, convex, but recurved at the points. *Venation* resembling that of the lobes of *var. incisus*; the midvein producing alternate veins, of which the lower are forked, the upper simple. *Sori* usually on the lowest anterior venule, forming scarcely more than a single line on each side the rachis, about even with the sinus of the pinnules;

one or two of the basal pinnules sometimes producing two or three sori. *Indusium* convex, persistent, its margin somewhat inflected, and beaded with short-stalked probably deciduous glands. This rare variety, originally brought, it is said, from Snowdon, was again found in



[*L. Filix-mas* vars. :—*a. cristata* ; *b. polydactyla*.]

1851 near Llyn Ogwen, Carnarvonshire, by Mr. S. O Gray.

The *var.* CRISTATA is perhaps one of the handsomest ferns in existence, and though a monstrosity, is, like many other of the monstrosities that occur among the ferns, reproduced almost or quite without variation from the spores. *Fronde* narrow lanceolate. *Pinnæ* rather distant, narrow, tapering from the base upwards. The apex of the frond and of every pinnæ is symmetrically multifidly-forked, and developed into a tasselled tuft of crisped segments. It belongs to the *paleacea* type, *i. e.*, its pinnules are oblong obtuse, sub-glaucous beneath, and its stipes, rachis, &c., is golden-sealy. It was found at Charleston, near St. Austell, in Cornwall.

The *var.* POLYDACTYLA is another tasselled form, but belongs to the *incisa* type; *i. e.*, its pinnules are elongated and incised, and of a green colour, not glaucous beneath; they are also of nearly equal length almost up to the tassel, contracting suddenly just below it, instead of being gradually but very much narrowed all the way up to the tassel, as occurs in *cristata*. It is, perhaps, not so constantly tasselled. The pinnæ are usually tufted, and the apex of the frond generally more or less so; but in some fronds the latter is more divided, and the former less affected, while sometimes all parts of the frond are grotesquely lacerated. It was found at Bromsgrove, Warwickshire, and communicated by B. Maund, Esq.

The other less striking varieties which have been noted are as follows:—

elongata: a large handsome form of the *incisa* type, with elongately-acuminate, almost caudate pinnæ, and longer and narrower pinnules, distant, unequal, and somewhat falcate. Isle of Wight, Mr. A. G. More.

producta: another striking modification of *incisa*; large; pinnules deeply-pinnatifid, elongate and narrowed upwards, thin, narrow, cone-shaped or pyramidal, the basal ones with a very narrow attachment; lobes obscurely serrated. Wrekin, Shropshire, Rev. W. A. Leighton.

- deorso-lobata* is a form of *incisa*, more or less marked, in which the basal pinnules have a conspicuously enlarged lobe at their posterior base. It appears common, and merges into *incisa*.
- triangularis*: is of the *incisa* group; fronds stiff, narrow, erectish; lower pinnæ (a few pairs) unequally triangular, the fronds having a slight resemblance to *Lastrea cristata*. Kent, Dr. Allebin. I. of Wight, Mr. A. G. More.
- subintegra*: probably allied to *pumila*; fronds dwarf, glandular, narrow lance-shaped, pinnate; pinnæ short, very obtuse, pinnatifid halfway down into blunt oblong lobes; sori large, forming a single line each side the midvein. Found long since at Ennis, by Rev. J. Baird, and preserved in Mr. Winch's herbarium, in possession of the Linnæan Society.
- palcacco-lobata*: a large form of the *paleacea* group, with the pinnules inciso-lobate and subundulate. This form, which stands in the same relation to *paleacea* as *incisa* does to the type form, we found at Tarbet, Dumbartonshire.
- Jervisii*: a multifid variety of the typical form of the species, the fronds and the pinnæ all terminating in dichotomous dilatations, forming moderately developed but only slightly crispy tassels. Staffordshire, Mr. S. Jervis.
- multifida* and *dichotoma* are sub-permanent varieties, the former belonging to the normal, the latter to the *palcacca* type; they are, as the names imply, bifid or multifid at their apices.
- monstrosa*: appears to be a dwarf form, multifid-erisped in the way of *cristata*, but much broader in the parts, and developed irregularly, the fronds in young plants (which only we have seen) often forming a curly bunch broader than long. It was communicated by Mr. M'Nab of Edinburgh.
- interrupta*: in this the pinnæ or pinnules, or both, are here and there depauperated, producing irregularity in the fronds, as occurs in the interrupted varieties of

other species. Windermere, Mr. F. Clowes. Other interrupted or more or less depauperated or contracted varieties, have been found by Miss Wright at Lodore, near Keswick, and by Dr. Kinahan, near Dublin.

The Male Fern is one of our commonest species, its typical form abounding everywhere, in wooded and shaded situations, and occurring commonly in hedge banks. The species is also common all over Europe, as no doubt are the Incised and Golden-sealed varieties. It is found in North Africa, and the Golden-sealed variety abounds in Madeira. In Asia, the common form occurs at Erzeroum, along the Altai Mountains, and in India, from Kumaon to Assam; the Incised variety in the region of the Caucasus, and in Georgia; and the Golden-sealed, in various parts of India, and probably in Java. It does not appear to grow in North America, but forms resembling both the common and Golden-sealed, are found in various parts of South America, Mexico, Guatemala, New Granada, Peru, and Brazil.

The Male Fern, as well as the Braeken, is applied to various economic uses. Its ashes are used in the dressing of leather, manufacture of glass, bleaching of linen, &c. The inhabitants of Siberia boil it in their ale to improve its flavour. In Norway the dried fronds are infused in hot water, and form food for cattle, sheep, and goats, which eagerly eat and are said to fatten upon it. In the dried state it forms a warm litter for cattle, or a good light protective covering for plants. Medicinally it has some repute as an anthelmintic, but was formerly employed more frequently than now, not, however, it appears so much on account of its inefficiency as from the greater facility with which other and perhaps better understood agents are procured. The remedy of Madame Nouffer, of Switzerland, for expelling tape worms, had this plant for its basis. In the form of ethereal extract, 12-24 grains are a dose (night and morning), or 1-3 drachms of the powder. The inner parts of the fresh caudex, and of the portions of leaf-stalk at-

taehed to it, which are fleshy and of a light greenish colour, should only be employed. This should be renewed annually, and kept close from the air. This species is supposed to have been the *pteris* of Dioscorides according to Dr. Royle, who states that several ferns were no doubt employed medicinally by the ancients.

This very common Fern is ornamental when in vigorous health. It may be planted about shady walks, in woods and wilderness scenery, and on the shady sides of rockwork. As a pot plant it requires abundance of space for its roots, a sandy loamy soil, and the ordinary attention of supplying it with water in summer. The pots may be plunged in a sheltered situation out-doors for the winter.

(4.) **Lastrea rigida**, Presl.—Rigid Buekler Fern.—Fronds elongate-triangular or lanceolate, bipinnate, glandular; pinnules oblong, blunt, pinnatifid, the segments broad rounded two to five toothed, the teeth not spinulose; indusium convex, persistent, fringed with glands.

LASTREA RIGIDA, Presl. Deak. Flor. Brit. iv. 99. Bab. Man. 411. Newm. Hist. 2. ed. 191. Sowerby, Ferns, 22, t. 11. Moore, Nat. Print. Ferns, t. 18.—POLYPODIUM RIGIDUM, Hoffmann.—P. FRAGRANS, Villars; not of Linnæus or Hudson.—P. VILLARSII, Bellardi.—P. HELEOPTERIS, Borkhausen (Weber and Mohr.)—ASPIDIUM RIGIDUM, Swartz. Schkuhr, Crypt. 49, t. 33. Hook, Supp. Eng. Bot. t. 2724. Hk. and Arn. Brit. Fl. 569.—A. FRAGRANS, Gray.—A. PALLIDUM, Link.—NEPHRODIUM PALLIDUM, Bory.—POLYSTICHUM RIGIDUM, De Candolle.—POLYSTICHUM STRIGOSUM, Roth.—LOPHODIUM RIGIDUM, Newman, App. xxi; Id. Hist. 175.

Caudex perennial thick, tufted, usually decumbent, having a scaly crown, and long wiry dark-coloured roots. *Vernation* circinate. *Stipes* short, one-third or more the length of the frond, glandular, densely clothed with long subulate reddish-brown scales intermixed with broader ones below; terminal and adherent to the caudex; *Rachis* with scattered hair-scales, both primary and secondary rachides having numerous short-stalked trans-

lucent glands. *Fronde*s 1-2 feet high, firm, dull green,



[*Lastrea rigida*.]

paler beneath, the surface, sprinkled while young with numerous minute spherical sessile glands, which impart a glaucous hue, most conspicuous in fresh plants, and give them a slight but peculiar balsamic fragrance; spreading or erectish; usually elongately-triangular, the lower pinna being longest, but sometimes lanceolate; bipinnate. *Pinna* alternate; the lower ones subopposite, more or less elongately-triangular; above more or less oblong with a taper point; the uppermost narrow-triangular. *Pinnules* oblong or ovate-oblong, truncate

at the base, obtuse at the apex, the lower shortly stalked, the upper adnate, deeply pinnatifid; lobes oblong, notched, the upper with about two, the lower with about five acute not spinulose teeth. *Venation* (pinnules) consisting of a sinuous midvein, branching alternately, producing a vein to each lobe; the veins branch so as to project a venule towards each marginal tooth, the lower anterior venules being fertile. *Fructification* dorsal, occupying the upper half of the frond. *Sori* rather large, round, numerous, occupying the whole length of the pinnules; indusiate, medial on the basal anterior venules, forming a line on each side near the midvein, crowded, often becoming confluent. *Indusium* lead-coloured, firm, membranaceous, persistent, convex, reniform affixed by the sinus, bearing both on the surface and at the margin stalked glands. *Spore-cases* numerous, brown, obovate. *Spores* oblong, muriculate. The fronds are annual.

This is a local species, confined to limestone tracts, within a small area in the approximating portions of Westmoreland, Lancashire, and Yorkshire, where, however, it is often found in great profusion, growing in the deep fissures of the natural platform, and occasionally high in the clefts of the rocks. It has also been reported from the west of England, and from Louth, Ireland. It is found in the middle and south of Europe, and in Asia Minor. The Californian and N. American *Aspidium argutum* is probably only a larger state of this species.

This is an elegant plant under cultivation, flourishing in well-drained porous loamy soil, or in a shady peat border. The soil may be intermixed with small lumps of broken limestone. It should not be kept too moist, and the crown should be well raised above the surface.

(5.) **Lastrea cristata**, Presl.—Crested or Narrow Prickly-toothed Buckler Fern.—Fronds erect, narrow linear-oblong or lanceolate, sub-bipinnate or bipinnate, serratures spinose-mucronate; scales of stipes ovate,

scattered, pallid; indusium without marginal glands:—(*type*): fronds narrow linear-oblong; pinnæ short triangular; pinnules or segments oblong, mostly connected at the base, crenato-serrate or obscurely lobed, the anterior and posterior ones of the lower pinnæ nearly equal.

LASTREA CRISTATA, Presl. Deak. Flor. Brit. iv, 107. Bab. Man. 410. Newm. Hist. 2 ed. 204. Sowerby, Ferns 21, t. 10. Moore, Nat. Print. Ferns, t. 19.—L. CALLIPTERIS, Newm. Hist. 2 ed. 12.—POLYPODIUM CRISTATUM, LINNÆUS.—P. CALLIPTERIS, Ehrhart.—ASPIDIUM CRISTATUM, Swartz. Schkuhr, Crypt. 39, t. 37. Sm. Eng. Bot. t. 2125 (not t. 1949); Eng. Fl. iv, 276. Hk. and Arn. Br. Fl. 569.—NEPHRODIUM CRISTATUM, Michaux.—POLYSTICHUM CRISTATUM, Roth.—POLYSTICHUM CALLIPTERIS, De Candolle.—DRYOPTERIS CRISTATA, A. Gray.—LOPHODIUM CALLIPTERIS, Newm. Phytol. iv. 371; App. xix; Id. Hist. 3 ed. 170.

Var. uliginosa: fronds various; earlier fertile ones tall, erect, narrow linear-lanceolate, bipinnate below, the pinnules oblong-acute, mostly adnate, inciso-serrate or lobed, with aristate teeth; barren ones shorter, late fertile ones broader, both with oblong bluntish adnate crenato-serrate pinnules; anterior and posterior basal pinnules nearly equal in size.

LASTREA CRISTATA, *v.* ULIGINOSA, Moore, Trans. Bot. Soc. Edin. iv. 109; Phytol. iv. 149; Id. Nat. Print. Ferns t. 20. Bab. Man. 410.—LASTREA ULIGINOSA, Newm. Phytol. iii., 679.—ASPIDIUM SPINULOSUM, Hk. & Arn. Br. Fl. 571 (in part).—ASPIDIUM SPINULOSUM, *v.* ULIGINOSUM, A. Braun.—LOPHODIUM ULIGINOSUM, Newm. Phytol. iv. 371; App. xix.; Hist. 3 ed. 163.

Var. spinulosa: fronds narrow oblong-lanceolate, bipinnate; pinnules oblong-acute, inciso-serrate or pinatifid, with aristately-toothed lobes; posterior basal pinnules much larger than the anterior ones.

LASTREA CRISTATA, *v.* SPINULOSA, Moore, Handbk. ed. 2. 115; Id. Nat. Print. Ferns, t. 21.—L. SPINULOSA, Presl. Bab. Man. 410. Sowerby, Ferns 24, t. 12.—L. DILATATA, *v.* LINEARIS, Bab. Man. 1 ed. 336 (excl. syn).—L. SPINOSA, Newm. Nat. Alm. 1814, 21. Deak. Flor. Brit. iv. 108.—POLYPODIUM SPINULOSUM, Muller, Flor. Frid. 193, t. 2, f. 2; Fl. Dan. t. 707.—P. FILIX-FEMINA, *v.* SPINOSA, Weis.—ASPIDIUM SPINULOSUM, Swartz, Syn. 420. Schkuhr. Crypt. 43,

t. 48 (excl. fig. *d, e*).—POLYSTICHUM SPINOSUM, Roth.—LOPHODIUM SPINOSUM, Newm. Phytol. iv., 371; App. xviii.; Hist. 3 ed. 157.



[*Lastrea cristata*.]

Caudex perennial, stoutish, decumbent or slowly creeping, *i. e.* extending in a horizontal direction, the fronds of each season being in advance of those of the preceding one; branched, scarcely tufted, somewhat scaly above, and having coarse dark brown roots. *Vernation* circinate, the pinnae lying flat against the incurved rachis. *Stipes* stout, terminal, and adherent to the caudex, about one-third the entire length of the frond, dark brown below, green upwards, sparsely scaly, with broad ovate membranaceous pale brown scales which are mostly

appressed, and more numerous near the base; the *rachis* almost free from scales. *Fronde*s 1-3 feet high, herbaceous, dull green, erect, narrow linear-oblong tapering at the apex, scarcely narrowed at the base, sub-bipinnate. *Pinnæ* numerous, the lower ones distant, sub-opposite, short triangular; the upper alternate, elongate triangular; all shortly stalked, the stalk twisted so that they stand nearly horizontal. *Pinnules* oblong, bluntish, all except the lowest in highly developed fronds more or less adnate, and connected by the wing of the rachis. pinnatifid with the lobes serrated, or inciso-crenate with the crenatures serrated, the serratures tipped by a spinulose point. The posterior basal pinnules are scarcely longer than the anterior ones of the same pinnæ; those of the late summer and autumnal fronds are broader, and larger. *Venation* (pinnules) depressed on the upper surface, consisting of a flexuous midvein, from which a vein passes into each lobe, and bears several venules, which are either simple or forked, one being directed towards each tooth, and terminating within the margin in a somewhat thickened point. *Fructification* dorsal, usually confined to the upper half of the frond. *Sori* numerous, round, indusiate, medial on the anterior basal venules, forming a row on each side nearer the midrib than the margin; in the most luxuriant pinnules sori are borne on the posterior venules, producing a more irregular arrangement. *Indusium* membranaceous, reniform, flat, somewhat irregular, but without glands at the margin, with a deep basal sinus. *Spore-cases* numerous, dark brown, roundish-obovate. *Spores* oblong muriculate.

The *var. ULIGINOSA* is intermediate between *L. cristata* and *spinulosa*, differing from the former, most obviously, in having the pinnules of its early fertile fronds rather more acute and more conspicuously-toothed, the discrepancy in size between the anterior and posterior basal pinnules being also somewhat more manifest; and from the latter, in having some of its fronds like those of

cristata. *Caudex* stout decumbent, sparingly branched. *Stipes* sparingly furnished with blunt ovate pallid scales. *Fronde*s erect linear-lanceolate 2-4 feet high, bipinnate at the base of the pinnæ; they are of three kinds, but not all simultaneously produced:—(1) Early fertile or spring fronds, like *spinulosa*, erect linear-lanceolate tri-



[*Lastrea cristata uliginosa*—: *a* early fertile, *b* barren, *c* later fertile pinnæ.]

pinnate, the basal pinnules distinct; pinnæ stalked, twisted horizontally, so that the upper surface is turned towards the zenith, elongate triangular; the lower ones shorter, broader, and more oblique, the first posterior pinnule being larger than the anterior one; the basal pinnules generally distinct oblong, acute, pinnatifid, the

lobes sharply serrate with spinulose teeth; the upper pinnules adnate, and sharply and deeply serrate: (2) early barren fronds generally accompany the early fertile ones; they are smaller, spreading, pinnate, with decurrent oblong-obtuse pinnules, resembling the infertile fronds of *L. cristata*: (3) later or summer fronds, also *cristata*-like, large, frequently fertile, with decurrent oblong-obtuse pinnules of the same form as in the earlier barren fronds. The pinnæ, especially in the earlier fertile fronds, are twisted so that their upper face instead of lying in the plane of the frond is directed towards the zenith, the *fructification* produced over the whole frond, most copious towards the top. The vernation is circinate, with the pinnæ flat and rolled inwards from the point as in *L. cristata*. The fronds are said to appear always several days earlier than those of *cristata*, but our cultivated plants prove irregular in this respect. It occurs along with *L. cristata* in Norfolk, Nottinghamshire, and Cheshire; and we believe also at Tunbridge Wells. It has been found in Germany.

The *var. SPINULOSA* has a stout perennial *caudex*, decumbent or slowly creeping, the fronds growing erect from its apex, branched, sometimes tufted, slightly scaly, furnished with numerous coarse dark brown roots. *Vernation* circinate, the rachis sometimes simply circinate, but occasionally also having a lateral curvature, the pinnæ and pinnules separately involute. *Stipes* terminal and adherent to the caudex, nearly as long as the leafy part, stoutish, dark brown-purple below, sparsely scaly, with broad ovate pallid scales, more or less appressed; the *rachis* scarcely at all scaly. *Fronde*s 2-5 feet high, erect, yellowish-green, narrow oblong-lanceolate, tapering at the apex, bipinnate. *Pinnæ* numerous; the lower ones sub-opposite, distant, obliquely triangular, the posterior basal pinnules being largest; the upper ones closer, narrower, stalked, frequently more or less drooping, often set on at an acute angle, and twisted so as to turn their upper surface towards the zenith. *Pin-*

[*Lastrea cristata spinulosa.*]

nules oblong acute, broadest at the base, the lower ones with a short stalk-like attachment, the upper more or less adnate; pinnatifid almost to the midrib, with oblong acute lobes, the lobes strongly serrated with spinulose teeth, the points of the teeth directed towards the apex of the lobe, and often curved upwards above the plane of its surface; upper pinnules inciso-lobate with spinulose serrate lobes, or coarsely serrate with spinulose teeth. The barren fronds are usually broader, and more lax; and sometimes entire plants assume this character. *Venation* (pinnules) consisting of a stout midvein, from which a primary vein enters each lobe where it forms a flexuous secondary midvein, bearing alternate forked venules; the sori are placed on the short anterior venules, and form two rows along the lobes of the pinnules. In the less divided pinnules the primary midvein produces branched veins, and the anterior basal venule also in this case bears the sorus near to its termination, so that the sori then form two lines along the pinnule; the venules are directed one towards each serrature, but terminate before reaching it in a thickened point. *Fructification* dorsal; usually occurring on the upper half, but sometimes extending over the whole surface of the frond. *Sori* numerous, round, indusiate, medial or sub-terminal on the venules. *Inclusium* flat, reniform, membranaceous, persistent, with an entire wavy margin without glands. *Spore-cases* brown, numerous, rotundate. *Spores* oblong, muriculate. The plant is common in damp shady places, and no doubt generally distributed, though from being confounded with *L. dilatata*, the records of its occurrence are unsatisfactory. It has certainly been found here and there all over England, and in Wales; but is rarer both in Scotland and Ireland, though undoubtedly growing in both. It is also found in the northern and central parts of Europe, and, as we think, occasionally in North America.

The normal form of the species is a very local plant, found only in boggy places, chiefly in the counties of

Suffolk, Norfolk, Nottingham, and Chester. It is dispersed over Europe, and occurs also in North and North-west America.

The species, together with the varieties, are free growing and easily cultivated plants; and being of erect habit, and bearing exposure well, they are both suitable for damp rock-work, and of distinct character, especially adapted for planting on the margins of an artificial bog. They grow well in any other situation suitable for ferns.

(6.) **Lastrea dilatata**, Presl. — Broad Prickly-toothed Buckler Fern.—Fronds ovate subtriangular or oblong-lanceolate, bipinnate, with the pinnules pinnate or pinatifid, serrated, the serratures spinose-mucronate; scales of the stipes lanceolate, entire or fimbriate, usually dark-centred; indusium fringed with stalked glands: —(type): fronds ample, ovate, somewhat drooping, bi-tripinnate; scales of the stipes entire, strongly two-coloured, *i. e.* dark in the centre, pale at the margins; indusia prominent, gland-fringed.

LASTREA DILATATA, Presl. Bab. Man. 411. Sowerby, Ferns 25, t. 13. Moore, Nat. Print. Ferns, t. 22.—L. MULTIFLORA, Newman, Hist. 2 ed. 216. Deak. Flor. Brit. iv. 113.—ASPIDIUM DILATATUM, Smith, Fl. Brit. 1125; Eng. Bot. t. 1461; Eng. Fl. iv. 280, Swartz, Synops. 420.—A. SPINULOSUM, Swartz, Schrad. Jour. 1800, ii. 38, in part; Id. Synops. 4, in part, (not 420). Sm. Eng. Bot. t. 1460; Eng. Fl. iv., 279, in part. Hk. & Arn. Brit. Fl. 571, in part.—ASPIDIUM CRISTATUM δ Ruprecht.—NEPHRODIUM CRISTATUM, Michaux.—N. DILATATUM, Desvauz.—POLYPODIUM DILATATUM, Hoffmann.—P. CRISTATUM, Hudson, Fl. Ang. 457. Bolt. Fil. 42, t. 23.—P. MULTIFLORUM, Roth.—POLYSTICHUM MULTIFLORUM, Roth.—POLYST. SPINULOSUM, De Candolle.—POLYST. DILATATUM, De Candolle.—DRYOPTERIS DILATATA, A. Gray.—LOPHODIUM MULTIFLORUM, Newm. Phytol. iv. 371; App. xvii.; Id. Hist. 3 ed. 148.

Var. tanacetifolia: fronds ample triangular or subtriangular, tri-quadrifid; scales dark-centred: indusia small, the margin irregular, slightly glandular.

LASTREA DILATATA β Moore, Handbk. ed 1, 59.—L. MULTIFLORA β Deakin, Flor. Brit. iv. 113, 116.—ASPIDIUM DILATATUM, Willdenow.—A. SPINULOSUM, Schkuhr, Crypt. 4^a, t. 47. (excl. c.)—A. EROSUM, Schkuhr, Crypt. 46, t. 45 (monstrous).—POLYPODIUM TANACETIFOLIUM, Hoffmann.—P. ARISTATUM, Villars.—POLYSTICHUM TANACETIFOLIUM, De Candolle.

Var. nana: fronds dwarf, ovate, bipinnate, somewhat glandular; pinnules decurrent convex; scales dark-centred; indusia small evanescent, the margin slightly glandular.

LASTREA DILATATA, *v. nana*, Moore, Handbk. ed. 2, 127; Id. Nat. Print. Ferns t. 26 c. d.—L. MULTIFLORA, *v. nana*, Newm. Hist. ed. 2, 222. Deak. Flor. Brit. iv. 114.—LOPHODIUM MULTIFLORUM, *v. NANUM*, Newm. Hist. ed. 3, 153.

Var. dumetorum: fronds dwarf or dwarfish, oblong-ovate or triangular ovate, bipinnate; stipes rachides, and veins beneath clothed with glands; pinnules convex, oblong; scales broad lanceolate, usually pale, indistinctly two-coloured, fimbriate; sori large, with gland-fringed indusia.

LASTREA DILATATA, *v. DUMETORUM*, Moore, Nat. Print. Ferns t. 25: not Handbk. 124.—L. D. MACULATA, Moore, Handbk. ed. 2, 124.—L. D. COLLINA, Moore, Handbk. ed. 2, 123, in part.—L. DUMETORUM, Moore MS. (Nat. Pr. F.).—L. MULTIFLORA, *v. COLLINA*, Newm. Hist. ed. 2, 222, in part.—L. COLLINA, Newm. Hist. ed. 2, 224, in part.—L. MACULATA, Deak. Flor. Brit. iv., 110.—ASPIDIUM DUMETORUM, Smith, Eng. Fl. iv. 281.—LOPHODIUM COLLINUM, Newm. App. xviii. in part; Id. Hist. ed. 3, 144, in part.

Var. collina: fronds narrow elongate ovate, or ovate-lanceolate, bipinnate; pinnæ distant; pinnules convex oblong obtuse, the basal ones pinnatifid, the lobes obtuse serrated towards the end with coarse acuminate teeth; scales dark centred, at the base numerous and subulately tipped, the upper ones few broader.

LASTREA DILATATA, *v. COLLINA*, Moore, Handbk. ed. 1, 59; Id. Nat. Print. Ferns t. 26 A. B. Bab. Man. 411.—L. MULTIFLORA, *v. COLLINA*, Newm. Hist. ed. 2, 222, in part. Deak. Flor. Brit. iv., 114, in part.—LASTREA COLLINA, Newm. Hist. ed. 2, 224, in part.

—*LOPHODIUM COLLINUM*, Newm. App. xviii. in part; Hist, ed. 3, 141, in part.

Var. Smithii: fronds narrowly subtriangular-elongate-ovate, bipinnate; pinnae opposite horizontal distant: pinnules narrowly decurrent with the slender wing of rachis, oblong obtuse, serrated, the serratures incurved; scales dark two-coloured, and except at the base, small narrow and scattered.

LASTREA DILATATA, v. *SMITHII*, Moore, Handbk. ed. 2. 123.—*ASPIDIUM SPINULOSUM*, Smith, Eng. Fl. iv., 279, according to specimen communicated as authentic, by Mr. Shepherd of Liverpool.

Var. Chanterlæ: fronds lanceolate narrowed and truncate below, caudately elongated above, the stipes rachis and under surface glandular; pinnae distant, lower ones unequally deltoid, the rest nearly equal; pinnules oblong obtuse distant pinnatifid, the lobes with coarse aristate teeth; scales dark-centred, entire, aristate; indusia gland-fringed.

LASTREA DILATATA, v. *CHANTERLÆ*, Moore, Nat. Print. Ferns t. 24.—*L. CHANTERLÆ*, Moore MS. (Nat. Pr. F.)

Var. angusta: fronds linear-lanceolate bipinnate; pinnae short deltoid, the posterior and anterior pinnules of the lowest pinnae very unequal; scales two-coloured. pallid; indusia indistinctly glandular.

LASTREA DILATATA, v. *ANGUSTA*, Moore, Handbk. ed. 2, 124; Id. Nat. Print Ferns, under t. 22.

Var. alpina; fronds narrow linear-lanceolate, membranaceous, bi-subtripinnate; pinnae unequally deltoid; scales broad lanceolate, pale brown, variously two-coloured; sori large, with small evanescent ragged glandular indusia.

LASTREA DILATATA, v. *ALPINA*, Moore, Nat. Print. Ferns, under t. 22.

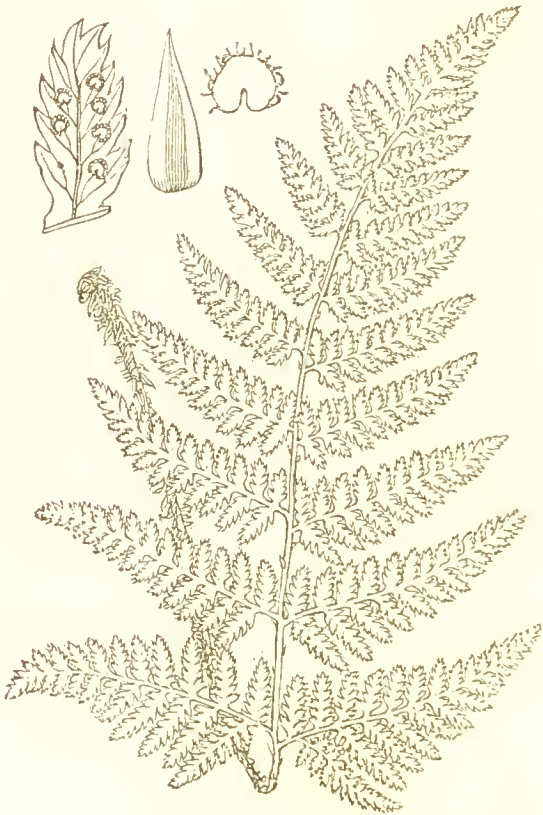
Var. glandulosa: fronds ample, lanceolate-ovate, or oblong-lanceolate, tripinnate below, densely covered

with stalked glands beneath, as well as on the stipes and rachis; scales pallid, whole-coloured, or faintly two-coloured, broadly lanceolate-ovate, semi-appressed.

LASTREA DILATATA, v. GLANDULOSA, Moore, Handbk. ed. 2, 124; Id. Nat. Print F. t. 23.—L. GLANDULOSA, Newm. Phytol. iv. 258.—LOPHODIUM GLANDULOSUM, Newm. App. xviii.; Id. Hist. ed. 3, 154.—LOPHODIUM GLANDULIFERUM, Newm. Phyt. iv. 371.

Caudex perennial, stout, usually erect, rarely decumbent, not creeping, often becoming elongated and trunk-like, sometimes tufted; the crown densely sealy; the fronds arranged in a eirclet around the crown when the caudex is erect. *Vernation* eircinate, the rachis often folded laterally as well as involutely fore and aft; the apex simply eircinate. *Stipes* terminal and adherent to the caudex, from one-third to one-half the length of the frond, stout below, densely sealy; the scales spreading, most numerous below, but usually abundant along the stipes, in the normal plant lanceolate-attenuate, dark centred; the *rachis* smooth or glandular, somewhat sealy, with small subulate more or less distinctly two-coloured scales. *Fronds* averaging 2-3 feet, but (exclusive of varieties) varying from 1-6 feet in height herbaceous, dark green above, paler beneath, smooth or glandular, spreading and more or less arched or drooping, ovate or ovate-lanceolate, bi or tri-pinnate. *Pinnæ* numerous sub-opposite, more distant below, the lower ones, especially the lowest, obliquely triangular-elongate, the posterior pinnules being much larger than, often twice as large as, the anterior ones; upper ones nearly equal-sided. *Pinnules* ovate-oblong, acutish, often convex, the basal ones stalked, the upper sessile and decurrent; the lower ones (especially of the lowest pinnæ) very deeply pinnatifid, sometimes pinnate, the lobes or pinnulets oblong, bluntish, the divisions all sharply-toothed with subovate teeth, terminating in a bristle-like point, which is in general curved laterally towards the apex of the pinnule or lobe. *Venation* (pinnulets of the

lower pinnae) consisting of a stout flexuous vein, from the rachis-like vein of the primary pinnule, forming a



[*Lastrea dilatata*.]

secondary midvein, from which a venule proceeds into each marginal lobe; the venules forked where the lobe is toothed, giving off a branch towards each tooth, the anterior branch fertile at some distance below its apex; the larger of the less divided primary pinnules have the same arrangement of the veins on a reduced scale, and the same, still more simplified, occurs in the smaller primary pinnules; the venules all terminate in a small club-shaped apex, below the tooth towards which they are directed. *Fructification* dorsal, occupying the whole under surface. *Sori* numerous, distinct, round, indusiate, medial subterminal or terminal, seated on the anterior basal venules in the less divided, and on the lowest anterior branch of the venules in the more compound pinnules; in the former ranging in a line on each side the midvein, much nearer to it than the margin; in the latter, forming two lines in a similar way along the lobes. *Indusium* reniform, usually rather large, convex, membranous, fringed with stalked glands, sometimes small flat and indistinctly glandular. *Spore-cases* numerous, brown, rotundly obovate. *Spores* roundish or oblong, angular, muriculate.

This is a very variable species, intimately related to *L. amula* on the one hand, and to *L. spinulosa* (our *cristata* v. *spinulosa*) on the other. The latter is always distinguishable by its *creeping* caudex, its sparse broad pallid scales, and its entire indusium; the former by its more strictly evergreen habit, its lacerated or contorted pallid scales, its anthoxanthoid fragrance, the absence of stalked glands on its indusium, the concavity of its pinnules, and even by the decay of its fronds, which do not usually perish at the base of the stipes and fall while the upper part remains fresh, but decay from the point downwards.

The *var.* TANACETIFOLIA is a tripinnate or quadripinnate state of the species, with broad fronds having a strongly-marked tendency towards triangular development. *Fronds* usually large, though there occur plants

of but moderate size, in which the peculiarities of the variety are developed. *Stipes* furnished with the usual entire, lanceolate, dark-brown, abundant scales, marked with a still darker bar down their centre. It is one of the commoner forms, and variable, merging gradually into that which we consider the type of the species.

The *var. NANA* differs in its constantly smaller size, the extreme length of the fronds, including the stipes, being 2-4 inches in the smallest, and 8-10 inches in the largest specimens referred to this variety. This diminutive size appears a permanent characteristic, the variety having been observed by Mr. Tatham to grow near Settle in Yorkshire, for the last twenty years, without change, and in company with the typical form three feet high; even when freely manured, the plants, though growing about fifteen inches high, do not lose the dwarfish aspect of the natural specimens. The same fact of constancy for a series of years has been observed by the Rev. J. M. Chanter, in plants which occur near Ilfracombe in Devonshire. *Stipes* (Settle plants) nearly half the entire height, with lanceolate scales having the usual dark central mark; stipes, rachis, and under side of the veins sparingly clothed with short stalked glands. *Fronde* ovate, broadest at the base, bipinnate. *Pinnæ* nearly equal above, the lowest unequal-sided. *Pinnules* decurrent, more or less convex; the larger ones somewhat lobed, the lobes serrated; the rest merely serrate, with spinulose teeth. *Sori* most copious in the upper part of the frond, rather small, the spore-cases almost black while fresh, covered by small delicate somewhat glandular-margined indusia, which soon shrivel and become concealed among the spore-cases. It is probably not uncommon in elevated rocky localities.

The *var. DUMETORUM* is a dwarfish form, remarkable for its sub-triangular or ovate fronds, its glandular surface, its pale coloured broad lanceolate sparingly fimbriated scales, and its large abundant sori, produced freely on plants of very immature age. This form, which almost appears entitled to specific distinction, occurs under seven-

ral modifications, some of which have been referred to the var. *collina*, with which, however, they do not agree. One of them, discovered in the Lake district by Miss

M. Beever, is the most marked, and sufficiently accords with the imperfect specimens of *Aspidium dumetorum* to be found in Smith's herbarium.

*Fronde*s about one foot high, elongate triangular ovate, very glandular, especially on the stipes, rachis, and lower surface of the veins; bipinnate. *Pinnae* concave, bluntish. *Pinnales* broad, oblong, or oblong-ovate, convex, crispy, lobed; the lobes coarsely toothed, the teeth broad and acuminate tipped by a small bristle.

Stipes sparingly clothed with lanceolate pale brown scales, of variable width, often scarcely at all darker in the centre, and having their margin fimbriate. *Sori* large, distinct, produced over the whole under surface; covered by indusia which are prominently fringed with stalked glands. Young



[*Lastrea dilatata dumetorum*.]

plants of this form, but a few months old, and 3-4 inches high, are abundantly fertile. Other plants, agreeing in the essential features of pale fimbriated scales, dwarf habit, subtriangular or ovate fronds, glandulose surface, and large distinct sori, have been found on hills near Rhayader, Mount Glyder, and Phainon Vellon in Wales; Glen Croe, Rivelston near Edinburgh, Tarbet, and Arran in Scotland; in Derbyshire, the vicinity of Ilfracombe in Devonshire, and in the Isle of Man.



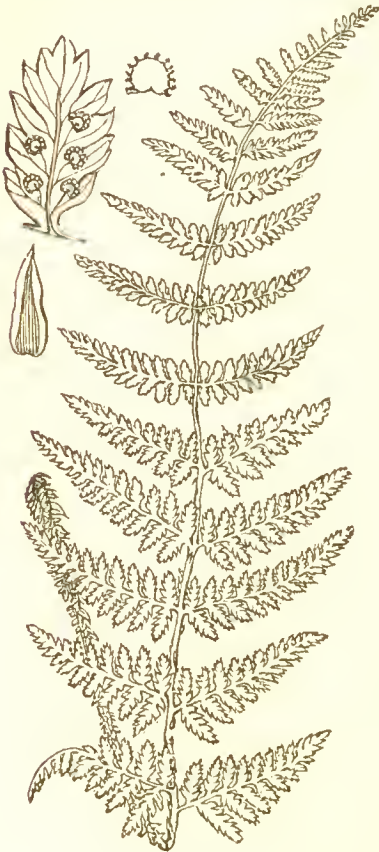
[*Lastrea dilatata collina.*]

The *var. COLLINA* is remarkable for its obtuse coarsely-toothed pinnules. *Fronde* 1-2 feet high, ovate, attenuately elongated at the apex, or more elongated *i. e.* oblong-lanceolate or ovate-lanceolate, dark green, smooth or sparingly glandular, bipinnate. *Stipes* variable, averaging about one-third the length of the fronds, scaly, with entire lanceolate brown dark-centred scales, the lower and most numerous ones narrow with a long subulate point, above which are others, broader, scattered, and shorter; *rachis* almost devoid of scales. *Pinnæ*, especially the lower ones, distant and

spreading, the lowest unequally deltoid, the next less unequal, the upper parallel-sided, rounding slightly near the end to an acutish not at all acuminate point. *Pinnules* convex, obtusely oblong-ovate, the basal ones narrowed to a broadish stalk-like attachment, the rest sessile and more or less decurrent; the larger ones deeply pinnatifid, with blunt oblong lobes, sparingly toothed, mostly at the apex, the teeth coarse acuminately-aristate. *Sori* scattered over the whole frond, covered by gland-fringed indusia. This variety was first found by the Rev. G. Pinder on the hills of Westmoreland, Lancashire, and Yorkshire, where it has since been met with. It is also reported from Ireland, about Powerscourt Waterfall, Wicklow, and the Dublin mountains.

The *var.* CHANTERLE is remarkably distinct, differing in the narrowed form and attenuated apex of its fronds, its distant pinnae, and its distinct blunt pinnules. *Caudex* erect. *Stipes* clothed plentifully with lanceolate and ovate-lanceolate entire scales, brown with a dark central streak, and tipped by a longish weak bristle point; stipes, rachis, and under surface clothed with sessile or very shortly stalked glands. *Fronde* 1½ to 2 feet high, nearly erect, lanceolate or oblong-lanceolate, the base somewhat narrowed truncate, the apex attenuated, bipinnate. *Pinnae* distinct, somewhat spreading, twisted so that the upper surface is turned towards the zenith, the lowermost very unequally deltoid, their posterior basal pinnules being more than twice the length of the anterior ones, these posterior pinnules being themselves almost pinnate; the next are unequally deltoid, but the inequality is less marked, and is nearly lost in the upper pinnae. *Pinnules* (basal of upper pinnae) nearly oblong, their base having a narrow stalk-like attachment, little broader at the base than their apex, which is very blunt; upper ones more or less decurrent; all more or less deeply pinnatifid, according to position, the lobes bluntly oblong, toothed, the teeth few, coarse, distinct, terminated by a bristle-like point. *Sori* covered by reniform indusia, fringed with small stalked

glands. This variety was discovered, in 1854, by the Rev. J. M. and Mrs. Chanter, at Hartland on the north



[*Lastrea dilatata* Chanteriae.]

coast of Devon, where it was found growing in moderate quantity within a limited area, surrounded by other common forms of the species.

The *var. AN-GUSTA* has the outline and general features of the erect typical form of *L. spinulosa*, but possessing also the particular characteristics of *L. dilatata*. *Stipes* furnished with large attenuately lance-shaped, pale-brown, dark-centred scales. *Fronds* two feet high, narrow-linear-lanceolate, bipinnate. *Pinnae* shortly deltoid, the lower two or three pairs very unequally so, the

posterior pinnules being much the largest. *Pinnules* narrow, oblong-obtuse, deeply pinnatifid, with ovate or oblong lobes, the lobes having aristate teeth. *Sori* small, abundant, occurring from the base to the apex of the frond, covered by small indistinctly glandular convex indusia. This was found near Tunbridge Wells by the late Miss Bower.

The *var.* ALPINA has fronds of the outline of ordinary states of *L. spinulosa*, that is, straight-sided, broadly linear, scarcely lanceolate; almost tripinnate below, bipinnate upwards. *Pinnæ* ovate-lanceolate or ovate, ascending, delicate in texture, and bearing two rows of large prominent sori, the covers very evanescent, small and somewhat glandular on the margin; teeth of the pinnules mucronately tipped. *Scales* broad lance-shaped, palish-brown with a dark central mark. This form occurs plentifully among rocks on the higher parts of Ben Lawers, Perthshire, and no doubt in other places.

The *var.* GLANDULOSA is a large and somewhat erect-growing plant, with much the aspect of *L. spinulosa* when large and broad, but differing from that, in the intermediate form of the scales of the stipes, in their frequently being two-coloured, in the glandular-fringed indusia, and in the sub-erect, not creeping, caudex. *Stipes* from about one-third to one-half the entire length of the frond, clothed near the base, sparingly upwards, with ovate bluntish and ovate-lanceolate pointed scales, the scales generally pale brown, scarcely tawny, some having, others wanting, a dark central streak, many becoming a good deal appressed; the stipes, rachides, and under surface of the fronds densely covered with stalked glands. *Fronds* 1½-4 feet high, oblong-lanceolate in large plants, ovate-lanceolate in smaller ones, nearly erect around the stout pale-coloured crown, which terminates the thick ascending tufted caudex; bipinnate above, tripinnate below. *Pinnæ* ascending, twisted so as to lie in nearly a horizontal plane, lanceolate, ovate. *Pinnules* large, lanceolate-ovate or pyramidately-ovate, acute,

the posterior ones on the lower pinnules longest, the lower ones stalked, the rest successively decurrent, then adnate, then confluent; all pinnatifid almost down to the midvein; lobes oblong, adnate, incised or toothed, the serratures tipped by a bristle-like point. *Sori* copious over the whole frond; *indusia* fringed with stalked marginal glands. This variety was first noticed near Lydbrook, in the Forest of Dean, Gloucestershire, by Mr. Bennett, of Brockham; since in Epping Forest, by Mr. H. Doubleday; at Hastings, by Mr. J. Stidolph; at Windermere, by Mr. F. Clowes (?); at Broseley, by Mr. G. Maw; and, we believe, a glandular variety obtained at Festiniog, by Dr. Allechin, will prove the same. Some other glandular forms, from Croydon and Barnes in Surrey, Hampstead in Middlesex, Pembrokeshire, Windermere, and other localities, supply connecting links between *L. glandulosa* and the typical *L. dilatata*, the most ordinary-looking forms of the latter being, moreover, sometimes quite glandular.

There are a few other known varieties, which we here briefly notice:—

lepidota (M): this remarkable variety is reported to have been found in Yorkshire. We first saw it, two or three years since, in the collection of Mr. A. Tait, who obtained it from Mr. Stark, of Edinburgh. *Fronde* about 1½ feet high, broadly ovate, indeed, almost as broad as long, quadripinnate; the ultimate pinnules small, pinnatifid, and spiny-toothed; *stipes* and *rachides* everywhere densely clothed with lanceolate contorted whole-coloured scales, which are smaller upwards. We notice the plant in this subordinate position, solely because the exact evidence of its being a native plant is wanting, although there seems little doubt that it is of British origin. It is so different from all other ferns known to us, that, believing it entitled to specific rank, we have given it the MS. name *L. lepidota*. Though a comparatively dwarf plant, it is stout and vigorous, and is manifestly more divided

than any other British *Lastrea*. In our cultivated plants (under glass) we notice a peculiar habit,—the fronds develop so slowly, that the basal pinnules become fully grown with mature, ripe, or scattered sori, before the point of the pinnæ bearing them is unrolled; so that, while the central portion of the frond has shed its spores, the apices of the frond and pinnæ are still growing. Its chief characteristics consist in its being quadripinnae, the pinnules being small and distant; and in its stipes and rachides, throughout, being remarkably scaly.

Smithii: fronds bipinnate, about a foot high; stipes three inches long, clothed at the base with long dark-coloured scales, and furnished above with a few small narrow ones; pinnæ opposite, distant, nearly horizontal, but slightly unequal in the size of their anterior and posterior pinnules; pinnules ovate-oblong, obtuse, the basal ones pinnatifid, the lobes blunt, mucronately-serrated at the end; these basal pinnules have a narrow stalk-like attachment, the rest are more or less decurrent; sori forming a line on each side of the midrib of the pinnules. This plant has some resemblance to the var. *collina*, and is perhaps only a modified form of it. It is known to us from a specimen sent by Mr. Shepherd of Liverpool, as being taken from part of the very plant sent by Dr. Mackay to Sir J. E. Smith and described by him as *Aspidium spinulosum*; it quite agrees with that description, and would appear to be the Spike Island plant there mentioned.

pumila: fronds small, deltoid or ovate-deltoid, bipinnate, scales pallid. It is the *dumetorum* of our previous edition (p. 124). Found in England, Wales, Scotland, and Ireland, and perhaps only a young state of some of the larger common forms.

deltoides: fronds deltoid, tripinnate, the segments small, fine-looking; stipes slender; scales dark. Devonshire, Rev. J. M. Chanter.

fuscipes: fronds glandular, deltoid, tripinnate, the points

of frond and pinnæ caudate; stipes slender, pale-brown behind; scales dark. Guernsey, Mr. G. Wolsey.

micromera: fronds normal, *i. e.* ovate-lanceolate in outline, two feet high, more finely divided than usual, though small almost quadripinnate, the pinnules and lobes with sharp narrow teeth; stipes stout, with large dark scales. Devonshire, Rev. J. M. Chanter.

distans: fronds large lax ovate; pinnæ distant, not very unequal-sided except the lowest; pinnules distant, ovate-oblong, obtuse, with narrowed stalk-like somewhat decurrent base; teeth acuminately aristate. Surrey, Mr. S. F. Gray.

obtusa: fronds narrow ovate; pinnules oblong, obtuse, shallowly-lobed. Found in several localities.

valida: fronds ovate, broad, erect, rigid and fleshy or leathery-looking; pinnules mostly divided nearly to the midrib; venules terminating in a hair-like white line near the margin, giving the upper surface a falsely strigose appearance. Devonshire, Rev. J. M. Chanter: Guernsey, Mr. C. Jackson.

interrupta: fronds lanceolate-ovate, of the *collina* type; a portion of the pinnæ and pinnules unequally depauperated, irregular in shape, size, and toothing. Yorkshire, Mr. A. Clapham.

Schofieldii: a curious permanent diminutive variety: fronds 2-4 inches high, often ramose or multifid; when single they are pinnate, the pinnæ oblong, notched. It is analogous to the dwarf crisped variety of the Lady Fern. Caudex decumbent, scales pallid concolorous; so that it perhaps belongs to *spinulosa* rather than *dilatata*. Found near Buxton, Derbyshire.

This common, yet withal really handsome species, has the fronds semi-persistent, the old ones scarcely perishing before new ones are produced in spring. It is found commonly in sheltered hedge-banks, thickets, glens, or moist woods. It is equally common and widely dispersed over Europe; and occurs in Asia, *e. g.* Mingrelia,

Kamtschatka; in Africa, *e. g.* Azores; as well as in several places in North and North-West America.

The species, as well as its varieties, is of free growth and easy culture, and is suitable either for rock work, shady borders, or wilderness scenery. It is one of the most compound and elegant of our native species, and though it may be grown exposed, yet it succeeds better in the shade.

(7.) **Lastrea æmula**, *Brackenridge*.—Hay-scented, or Triangular prickly-toothed Buckler Fern.—Fronde triangular or triangular-ovate, spreading, tripinnate, pinnules concave; pinnalets pinnatifid, the numerately serrate lobes curved upwards; scales of the stipes concolorous, narrow-lanceolate, lacinate or fimbriate, contorted; indusium margined with minute sessile glands.

LASTREA ÆMULA, Brackenridge, Unit. St. Expl. Exped. xvi. 200 (excl. syn. Pr.). J. Smith, Cat. Kew Ferns, 1856—L. FENISECII, Watson, Phytol. ii. 568. Deak. Flor. Brit. iv. 117. Bab. Man. 411. Sowerby, Ferns, 27, t. 14. Moore, Handbk. ed. 2, 132; Id. Nat. Print. Ferns, t. 27.—L. RECURVA, Newm. Nat. Alm. 1844, 23; Id. Hist. ed. 2, 225.—L. CONCAVA, Newm. MS. (Hist. ed. 2, 235.)—NEPHRODIUM FENISECII, R. T. Lowe.—ASPIDIUM ÆMULUM, Swartz.—A. RECURVUM, Bree, Phytol. i. 773.—A. FENISECII, Kunze.—A. DILATATUM *var.* RECURVUM, Bree, Mag. Nat. Hist. iv. 162.—A. DILATATUM, γ Hk. and Arn. Br. Fl. 571.—A. DILATATUM *v.* CONCAVUM, Babington.—POLYPODIUM ÆMULUM, Aiton, Hort. Kew, iii. 466; according to authentic specimen, with Solander's autograph, in Hb. Banks.—LOPHODIUM FENISECII, Newm. App. xvi.; Id. Hist. ed. 3, 136 (excl. syn. Sm.)—L. RECURVUM, Newm. Phytol. iv. 371.

Caudex perennial, stout, tufted, erect, or sometimes decumbent, densely scaly, and having long stout wiry dark-brown roots. *Vernation* circinate. *Stipes* usually about half the length of the frond, rigid, moderately stout, brownish purple from the base upwards, furnished plentifully with subulately lanceolate, entire fimbriate or lacerate, contorted scales, of a pale rusty brown colour; terminal and adherent to the caudex; the *rachis* greenish,

and furnished with fewer smaller scales; and, as well as the stipes and secondary rachides, bearing numerous small



[*Lastrea æmula*.]

sessile spherical glands. *Fronde* 1-2 feet high, including the stipes, rich bright green somewhat paler beneath, and there sprinkled with small sessile glands; drooping, triangular elongate-triangular or ovate, tripinnate. *Pinnae*

sub-opposite, more or less deltoid, the lowest broadly and unequally so, the pinnules on the posterior being larger than those on the anterior side, the lower pinnae also usually but not always the longest. *Pinnules* pyramidately-triangular or obliquely oblong, the basal posterior ones of the lowest pinnae much larger than the rest, and divided into ovate-oblong or oblong pinnulets, the largest of which are deeply pinnatifid, the lobes oblong serrated; the basal pinnae pinnules and pinnulets are all stalked, the upper ones becoming gradually sessile, and then decurrent. The margins of the pinnules and lobes are mucronately toothed, and turned upwards from the plane of the spreading or drooping fronds, so that all the ultimate divisions are concave, and the entire frond has a beautiful erispy appearance. *Venation* (pinnulets) consisting of a dark-coloured flexuous secondary midvein, formed of a branch from the midvein of the primary pin-



[*L. æmula.*]

nule, and producing short lateral forked venules, the anterior veinlet bearing a sorus below its apex, all terminating within the margin. *Fructification* dorsal, occupying the whole under surface. *Sori* round, numerous, indusiate, forming two rows along the pinnules and pinnulets, placed near to the midvein, often becoming confluent. *Indusium* reniform, its margin jagged and uneven, and sparingly furnished with sessile glands. *Spore-cases* numerous, brown, obovate. *Spores* oblong, often angular, muriculate. The fronds when dried have a fragrance like that of new hay.

We have received from Mr. Moore of Glasnevin, a lax variety of this fern, in which the secondary pinnules are more confluent, and the teeth longer and more spiny-looking than usual; it was found near Cushendall in Antrim.

This fern, which has evergreen or persistent fronds, and prefers rocky, shady habitats, is very plentiful in Ireland, and occurs abundantly in the peninsula formed by the counties of Cornwall, Devon, and Somerset; more sparingly in Sussex, in Wales, in the Isle of Man, and North Lancashire, in Cumberland and Northumberland, and on both the eastern and western sides of Yorkshire. It is also found in the East and West Highlands, and in the Northern and Western Isles. A small form of this plant, found near Festiniog, in N. Wales, by Dr. Allchin, has the parts considerably narrowed, and seems to connect the ordinary form with a narrowed form of the species found in Madeira—the var. *productum* of Mr. Lowe. The same species is plentiful in the Atlantic islands, off the African coast, *i. e.*, the Azores, Madeira, and the Cape de Verd Isles.

This is one of the most beautiful of all the British Ferns, being of moderate size, gracefully pendulous in habit, and perfectly evergreen. When protected its fronds remain quite fresh until after young ones are produced the following year. This feature renders it a charming fern for the greenhouse or Wardiau case. It will grow freely in light porous loamy soil, and should be put in well-drained pots.

Genus 6. **ATHYRIUM.** Roth.

Sori indusiate, short, oblong, lunate, or unequally or sometimes equally hippocrepiform; the *receptacles* medial on the anterior (sometimes also crossing and returning along the posterior) side of the vein. *Indusium* of the same form, often lacerate-fimbriate. *Veins* simple or forked, from a central costa; *venules* free, sometimes pinnate.

Fronds herbaceous, bi-tri-pinnate. *Sori* more or less generally, the basal ones usually, rarely nearly all, arcuate. Rhizome short, erect or creeping.—Name from the Greek *athyros*, opened.

This genus is closely related to *Asplenium*, from which neither its short sori, nor fringed indusia are sufficient to distinguish it, but the occurrence of hippocrepiform sori, more or less numerous, is abundantly distinctive, and indicates a tendency towards the structure of *Lastrea*. There are several exotic species in which the same structure occurs. The genus may be regarded as the connecting link between the *Asplenium*, and the *Aspidium*.

(1.) **Athyrium Filix-fœmina**, Roth. Lady Fern.
—Fronds lanceolate, herbaceous, sub-bipinnate or bi-tri-pinnate; pinnules oblong ovate or lanceolate, sessile and distinct, or more or less decurrent and united, toothed,

or ineiso-pinnatifid with the lobes toothed, the teeth acute not spinulose.

— (*type*): fronds broad-lanceolate, lax or drooping; pinnæ approximate or distinct, the lower pair sometimes smaller deflexed; pinnules flat, oblong, connected by a winged rachis, toothed, or linear-lanceolate or ovate-lanceolate distinct pinnatifid, the lobes toothed.



[*Athyrium Filix-femina.*]

Larger Forms (more divided, not winged) — *ATHYRIUM FILIX-FÆMINA*, Roth. Presl. Bab. Man. 413 β. Newm. Hist. 208. Sowerby, Ferns, 43, t. 25. Moore, Nat. Print. Ferns, t. 30.—*A. F-F. INCISUM*, Newm. Hist. 214.—*A. INCISUM*, Newm. App. xiii.; Id. Hist. 214.—*A. OVATUM*, Roth, not Newm.—*A. LAXUM*, Schumacher.—*A. LÆTUM*, Gray.—*A. CYCLOSORUM*, Ruprecht.—*ASPENIUM FILIX-FÆMINA*, Bernhardt. Hk. and Arn. Br. Fl. 574. Deak. Flor. Brit. iv. 57 (incl. *v. ovatum, incisum*).—

ASPIDIUM FILIX-FÆMINA, Swartz. Schkuhr, Crypt, 56, t. 58, 59. Sm. Eng. Bot. t. 1459 (not good); Eng. Fl. iv. 282.—*NEPHRODIUM FILIX-FÆMINA*, Stempel.—*CYSTOPTERIS FILIX-FÆMINA*, Cosson and Germ.—*POLYPODIUM FILIX FÆMINA*, Linnæus. Bolt. Fil. 46. t. 25 (bad).—*P. F-F. DENTATA*, Weis. *P. DENTATUM*, Hoffmann.—*P. INCISUM*, Hoffmann.—*P. OBLONGO-DENTATUM*, Hoffmann.—*P. LÆTUM*, Salisbury.

Smaller Forms (less divided, winged)—*ATHYRIUM MOLLE*, Roth. Newm. Nat. Alm. 1844, 26; Id. App. xii; Id. Hist. 215 (excl. Aberdcen hab.)—*A. F-F. MOLLE*, Newm. Hist. ed. 2, 242; ed. 3, 215. Bab. Man. 413 γ.—*A. DEPAUPERATUM*, Schumacher.—*A. TRIFIDUM*, Roth.—*ASPENIUM FILIX-FÆMINA, MOLLE, et TRIFIDUM*, Deak. Flor. Brit. iv. 59.—*POLYPODIUM MOLLE*, Schreber.—*P. F-F. CRENATA*, Weis.—*P. OVATO-CRENATUM, BIFIDUM, et TRIFIDUM*, Hoffmann.

Var. rhaeticum: fronds narrow-lanceolate, erect, bipinnate, pinnæ distant; pinnules distinct, deeply pinnatifid, lanceolate acute, becoming linear from the incurvation of the lobes; lower anterior lobe longer auriculate; sori short numerous, near the midrib, becoming confluent.

ATHYRIUM FILIX-FEMINA *v.* RHÆTICUM, Moore, Nat. Print. Ferns, t. 31 A.—A. F-F. CONVEXUM, Newm. Hist. ed. 2, 245. Bab. Man. 413.—A. RHÆTICUM, Roth, Newm. Nat. Alm. 1844, 26; Id. Hist. 212. Moore, Handbk. ed. 2, 136.—A. CONVEXUM, Newm. App. xiii; Id. Hist. 212.—A. IRRICUUM, Gray.—ASPLENIUM FILIX-FEMINA RHÆTICUM, Deak. Flor. Brit. iv. 60.—POLYPODIUM BILETICUM Linnæus; according to the Linnæan Herb.—ASPIDIUM RHÆTICUM, Sprengel.—A. IRRIGUUM, Sm. Herb; Eng. Fl. iv. 283 (the fig. Eng. Bot. t. 2199, rather resembles *molle*).

Var. latifolium.—Fronds oblong lanceolate semi-drooping; pinnæ approximate; pinnules short-stalked, flat, imbricate, ovate, unequally-lobed at the base, toothed above; sori small, uniserial on each side of and distant from the midrib.

ATHYRIUM FILIX-FEMINA, *v.* LATIFOLIUM, Babington, Man. 413 (δ). Moore, Nat. Print. Ferns, t. 31 B.—A. LATIFOLIUM, Bab. MS.; not Presl.—A. OVATUM, Newm. Phytol. iv. 368 (excl. syn. Roth, Newm. Presl.); App. xii (excl. syn. Hoffmann, Roth, Newm.)—ASPLENIUM FILIX-FEMINA, *v.* LATIFOLIUM, Hk. and Arn. Brit. Fl. 574. Moore and Houltst. Gard. Mag. Bot. iii. 262.

Var. marinum.—Fronds spreading, elliptic-lanceolate; pinnæ approximate; pinnules crowded oblong, obtuse, connected at the base by the wing of the rachis, notched with shallow lobes, which are bifid or toothed below, short, simple, and tooth-like above; sori short, numerous, often much curved, or becoming confluent.

ATHYRIUM FILIX-FEMINA *v.* MARINUM, Moore, Pop. Hist. ed. 1, 91; Id. Nat. Print. Ferns, t. 31 C.

Var. polydactylon.—Monstrous; fronds lanceolate; several times forked at the apex; pinnæ flat, their apices symmetrically bi-tri-furcate, with flat not crispy divisions (*incisum* type).

ATHYRIUM FILIX-FEMINA *v.* POLYDACTYLON, Moore, Nat. Printed Ferns, under t. 30.

Var. corymbiferum.—Monstrous; fronds suberect, and as well as the pinnæ corymbosely subsymmetrically multifid-cripsed at the apex, the tassels large crispy; pinnules flat incised (*incisum* type).

Var. multifidum.—Monstrous; fronds lanceolate, their apex and the apices of the convex pinnæ symmetrically multifid-erisped in a corymbose manner; sori crowded, confluent; pinnules narrow (rhaeticum type).

ATHYRIUM FILIX-FÆMINA, v. MULTIFIDUM, Moore, Handbk. ed. I, 94; Id. Nat. Print. Ferns, t. 33.—A. F.-F. VIVIPARA, Steele, Handbk. of Field Bot. 215.—A. F.-F. FURCATUM, of gardens.—A. F.-F. CRISTATUM, Wollaston MS.

Var. depauperatum.—Monstrous; fronds suberect, fureately divided at the apex into numerous narrow rachiform segments; pinnæ small irregularly depauperated, unsymmetrically lacerated at their apices; sori small, chiefly confined to the pinnæ.

ATHYRIUM FILIX-FÆMINA, v. DEPAUPERATUM, Wollaston; Moore, Nat. Print. Ferns, t. 34 B.—A. F.-F. RAMOSUM, Moore and Houlston, Gard. Mag. Bot. iii. 262. Moore, Handbk. ed. 2, 141.

Var. crispum.—Monstrous, dwarf; primary rachis irregularly branched, the apices of the branches and pinnæ dilated and multifid-erisped; sori small, scattered, often wanting.

ATHYRIUM FILIX-FÆMINA, v. CRISPUM, Moore, Handbk. ed. I, 94; Id. Nat. Print. Ferns, t. 34 A.—A. F.-F. SMITHII, of gardens.

Caudex perennial, stout, erect or decumbent, sometimes elongated and trunk-like, often tufted, scaly at the crown, and having strong wiry dark-coloured roots. *Vernation* circinate, the apex becoming liberated in the partially developed fronds and bent down in a curve like a shepherd's crook. *Stipes* terminal and adherent to the caudex; from one-third to one-fourth the entire length of the frond, green or purplish red, stoutish, much thickened just above the base, scaly, the scales numerous on the lower part, lanceolate or linear, varying from dark reddish brown to almost black; fewer and narrower upwards, often contorted; the *rachis* furnished sparingly with smaller narrow deciduous scales. *Fronds*



[*Athyrium Filix-femina*.]

variable in size, outline and division; soft herbaceous, erect spreading or drooping, bright tender green; 1-5 feet high, lanceolate, sometimes very broad, sometimes narrow; the less developed forms scarcely bipinnate, the pinnules being connected by the winged rachis; the more highly developed almost tripinnate, the pinnules being distinct, and divided almost to the midvein. *Pinnæ* numerous, distant, often deflexed below, approximate or distinct above. *Pinnules* oblong ovate-lanceolate or lanceolate, obtuse or acute, sessile decurrent or confluent at the base, or with a narrowed stalk-like attachment; pinnatifid with shallow 2-3 toothed lobes at the base, simply toothed towards the apex; or deeply pinnatifid throughout, the lobes variously toothed, the teeth confined to the apices of the lobes or extending along their sides, usually short and blunt-pointed, sometimes narrowed and lengthened, never bristle-pointed, the anterior basal lobe larger. *Venation* (pinnules of the less divided forms) consisting of a flexuous midvein producing alternate veins; lower veins forked, a venule being directed into each tooth, the upper simple, directed into the simple apical teeth, the anterior of the venules bearing a sorus along its anterior side. In more divided pinnules the veins branch pinnately, and the alternate venules correspond with the number of teeth, the anterior basal one here also bearing a sorus, but other venules of the lower lobes are also fertile, and in the most deeply divided pinnules each vein produces several fertile venules; they all terminate in a slightly attenuated point, just within the apex of the tooth. *Fructification* dorsal, dispersed over the whole surface. *Sori* numerous, often confluent in age, short oblong, or curved; indusiate, medial, usually occupying the anterior side of the anterior venules in the less divided forms, and then straight short oblong; the receptacle of the lower one, sometimes of more than one, crossing the venule and forming a curved sorus, or also returning along the posterior side of the venule, and forming an arcuate or horse-shoe shaped sorus. In the much di-

vided varieties these enurved sori are more numerous, and sometimes they are even more abundant than the simple ones, and then the fructification may readily be mistaken for that of *Lastrea*. *Indusium* membranaceous, the free margin cut into capillary segments. *Spore-cases* numerous, dark brown, obovate. *Spores* oblong, granulate or muriculate.

This species is extremely variable. The smaller forms, in which the pinnules, not very deeply divided, are more or less united at the base, are called *MOLLE*. These, though fertile, are, certainly, sometimes, juvenile plants of the larger forms, and we are uncertain whether there are any permanently smaller less divided forms to which this name is applicable. The larger more incised forms, often known as *INCISUM*, seem to be the more mature normal development, and we, therefore, regard them as typical of the species. Between the *molle*-like and *incisum*-like forms, there is an unbroken series of variations, independent of those having other peculiarities, and enumerated hereafter as varieties.

The *var. RHÆTICUM* is generally distinguishable by its narrow erect fronds, and its distinct and apparently linear pinnules, which, however, owe their narrow appearance to the inflection of the points of their lobes over the sori. The anterior basal pinnules are also conspicuously longer than the rest, as are the anterior basal lobes of all the pinnules. *Caudex* short, tufted. *Stipes* shortish, pale green or purplish red, much thickened just above the base; terminal and adherent to the caudex. *Fronds* 2-4 feet high, narrow-lanceolate, erect, more or less rigid-looking, though really herbaecous, which appearance, as well as the convexity of the pinnae is owing to their growing in exposed places; bipinnate. *Pinna* distant, mostly ascending, the lower ones deflexed. *Pinnules* distinct, the anterior basal ones longest, narrow, appearing almost linear, from the incurving of the points of the marginal lobes, whence the pinnules become convex; the enlarged basal lobe quite evident; lobes toothed. *Sori* at the base of the lobes on the an-

terior sides of the venules, forming two lines up the larger lobes, but the lobes being narrow, they are



[A *Filix-fœmina rhaeticum*.]

near together from the first, and soon become confluent. This form, or variety, is no doubt generally distributed, being known to occur here and there over England, in North Wales, in Scotland, both in the Highlands and Lowlands, and in the four provinces of Ireland. It prefers open boggy habitats. To this variety probably, certainly to the species *Filix-fœmina*, belongs the *Asplenium Adiantum-nigrum* β of Smith, from the "mountains of Mourne, in ye county of Down," Ireland.

The var. *latifolium* has a peculiarly distinct aspect; its principal differences consisting in the densely-crowded condition and unequal size, as well as uneven toothing or laciniation of the pinnales, and in the situation of the sori. *Caudex* stout, erect. *Stipes* shortish, and, as well as the *rachis*, stout. *Fronde*s 3-4 feet high, elongate, ob-



[*Athyrium Filix-femina*; *a*, latifolium; *b*, ovatum (too narrow);
c, obtusum; *d*, incisum (type); *e*, laxum; *f*, dissectum.]

long-lanceolate, semi-drooping, dark green, bipinnate. *Pinnæ* short and distant below, approximate or crowded upwards, irregularly linear-oblong, with a tendency to become cuspidate. *Pinnules* ovate or oblong-ovate, blunt or sometimes acute, unequal, the anterior side being largest, flat, overlapping, stalked or having a narrow stalk-like attachment; laciniate at the base with oblong irregularly-toothed lobes; the lobes smaller upwards eventually towards the apex merging into teeth, the teeth usually but unequally taper-pointed. *Sori* produced on the anterior side of the lowest anterior venule as usual, but as the vein becomes branched at a greater distance than usual from the midvein, the sori, which are small, often curved, range in two distant lines about halfway between the midvein and margin. This variety was found by Miss Wright near Keswick, in Cumberland, a plant or two only having been discovered. It does not appear to have occurred elsewhere, but, like many other varieties, is reproduced from the spores.

The *var. MARINUM* is a small growing plant, peculiar in having exactly elliptic-lanceolate fronds, and in the crowded oblong pinnules being connected at the base, and notched on the margin with blunt shallow even teeth, which, in many fronds are mostly simple. *Fronds* 1-1½ foot high, spreading or sub-decumbent, elliptic-lanceolate, scarcely bipinnate. *Pinnæ* spreading, the lower ones deflexed. *Pinnules* largest next the rachis, oblong, very obtuse, crowded or slightly overlapping, connected by the narrow wing of the rachis, the margin toothed rather than lobed, the indentations being shallow and even, and the projecting points on the upper half seldom more than blunt simple or somewhat retuse teeth, though below they are 2-3 toothed, and are sometimes nearly all bifid. *Sori* lunate, with a strong tendency to assume the arcuate or horse-shoe form, ranged in a double line along the pinnules, distinct or sometimes becoming confluent. It is a very constant and neat-growing va-

riety. It was originally found by Dr. Diekie, in a eave by the sea near Aberdeen, and a very similar plant has since been found by Dr. Allehin in the Isle of Man.

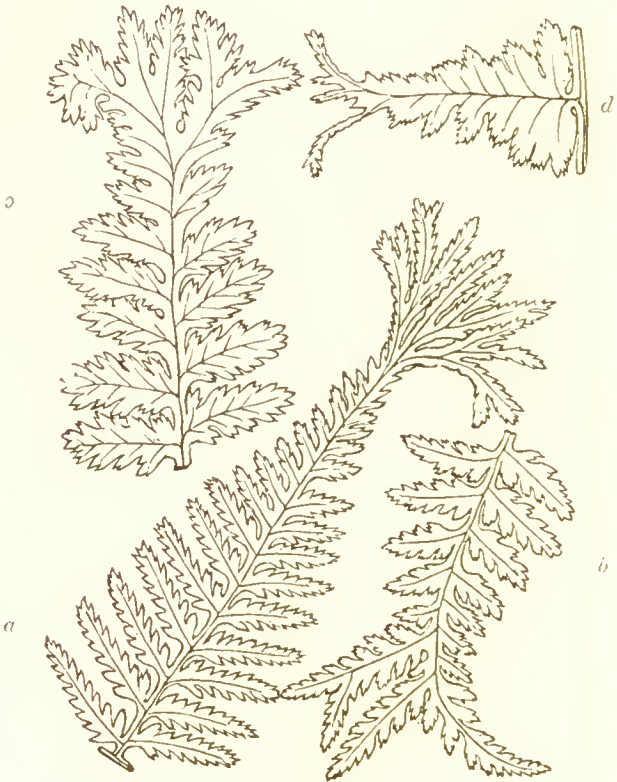
The *var.* MULTIFIDUM is chiefly remarkable for the elegant and symmetrical way in which the apices of all the pinnae, and of the frond itself, become developed in a corymbose or multifid manner into a crispy tassel-like tuft. *Fronde* 1-2 feet high, resembling the *var.* *rhæticum* in general aspect, the pinnules being narrow and elongate, distinct, and deeply cut into narrow lobes. The pinnules themselves as well as the fronds and pinnae become tasselled in vigorous plants. The sori are subrotund, placed very near the midrib, and finally confluent. It was found in Ireland by Mr. D. Moore, and similar forms have subsequently been met with by others.

The *var.* POLYDACTYLON is also a tasselled variety, but its pinnules are flat and incised in the way of some of the commoner forms, not convex as in *rhæticum*. Its fronds are several times forked at the apex, and the pinnae



[A. F-f. marinum.]

all once or twice forked, the divisions forming a flat spreading bunch or tassel, not at all crispy; it is



[*Athyrium Filix-fœmina*: *a*, *multifidum*; *b*, *polydactylon*; *c*, *corymbiferum*; *d*, *depauperatum*.]

pale green. It was found in Somersetshire by Mr. Elworthy; and a similar form, near Tunbridge Wells, by Mrs. Delves.

The *var.* CORYMBIFERUM is another quite distinct tasselled variety, red-tinged, flat-pinnuled, and of moderate size, the apex of the frond developed into a large corymbosely tasselled tuft, and the pinnæ all symmetrically or subsymmetrically tasselled, the tufts large and well developed. It is larger pinnuled and broader tasselled than the other tasselled forms. This was found in Guernsey by Mr. J. James.

The *var.* DEPAUPERATUM grows about a foot high; the apex of the frond is compoundly and dichotomously divided into numerous branches, which are corymbosely arranged; the pinnæ greatly and unequally reduced in size, the consequence of which is a total loss of symmetry in the frond; both frond and pinnæ being divided at the apex into numerous narrow branching rachiform lacerated or depauperated segments, differing in size; the pinnules irregular, bluntly-toothed, or sometimes wanting. The sori are small, frequently abortive. It was found in Ireland by Mr. J. Gunning. Two forms occur.

The *var.* CRISPUM is a dwarf and very distinct-looking plant, having the appearance of a dense tuft of curled parsley. Fronds slender, from six inches to a foot long, having no definite form, the rachis being irregularly and unequally branched, the apex of the divisions especially, as well as of the pinnæ, more or less densely tasselled or tufted, the pinnæ and pinnules unsymmetrically lacinated, and frequently wanting. The sori are frequently but not always abortive. This was first met with by Mr. A. Smith "on the hill Orah," Antrim, Ireland, and has since been found in Bræmar in Scotland, by Sir W. C. Trevelyan, and at Todmorden by Mr. Hudhart.

In addition to the foregoing, which are the most distinct (normal and abnormal) variations, there are many others deserving of record, most or all of which appear to

have permanent characteristics. Of these, the following are more or less normal in development :—

confluens : small and very remarkable, rigid in the wild state ; pinnae short, the basal pinnule distinct, obtuse, and shallow-toothed like *marinum*, the others crowded



[A. F-f. crispum]

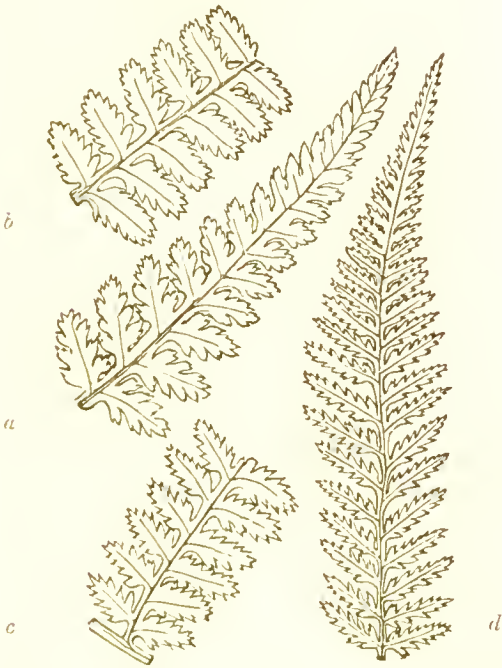
and confluent, forming lobes with distinct blunt teeth ; this confluent portion in the wild plant reduced considerably in size. Dunkeld, Mr. A. Tait.

stenodon : small, pinnules united by a wing, approximate, linear-oblong, pinnatifid with toothed lobes below, simply toothed above, the teeth conspicuously narrow and elongated ; rachis pale dull red. Surrey, Mr. E. Morse ; Devonshire, Rev. J. M. Chanter.

acuminatum : dwarf and slender ; pinnae crowded, ending in a longish acuminate serrated point ; pinnules distinct but decurrent, oblong, often narrowed below, crowded, pinnatifid at the base, the apex cut into longish acute teeth ; the small narrow pinnules and acuminate pinnae are its characteristics.

This was found on Snowdon, by Mr. W. Pamplin.

ecurrens: dwarfish; this and the next have the general appearance of the forms called *molle*, *i. e.*, smallish



[*Athyrium Filix-fœmina*:—*a*, *molle*; *b*, *marinum*; *c*, *stenodon*; *d*, *acuminatum*.]

oblong blunt pinnules, connected by a wing; this has the veins run out beyond the point of the teeth into diaphanous hair-like points. Tunbridge Wells, Mr. Wollaston; Devonshire, Rev. J. M. Chanter.

- odontomanes*: dwarfish, *molle*-like, the teeth of the lobes elongated or linear, acute, somewhat irregular. Coniston, Miss Beever; Tunbridge Wells, Mrs. Delves; and elsewhere.
- gracile*: slender, dwarfish, and pendent; fronds lanceolate. 12-18 inches high; pinnæ distant; pinnules distinct. narrow linear-oblong, decurrent, with longish narrow teeth, mostly simple. In the collection of Mr. Parker, nurseryman, Holloway.
- pruinatum*: somewhat like a large growth of *molle*, the stipes and rachides hoary with small glands; occurs with the stipes both red (Tarbet) and green, (Virginia Water, Surrey, Dr. Allchin).
- ovatum*: large growing, with broad lanceolate fronds; pinnules flat, ovate-oblong with a narrowed blunt apex, flat, largest on the anterior side, deeply pinnatifid: known by the shortish subovate pinnules. The figure of this (p. 151) is too narrow.
- obtusum*: fronds broad; pinnules flat distinct, obliquely and very obtusely ovate-oblong, pinnatifid; somewhat resembling blunt-pinnuled forms of *Lastrea dilatata*. Virginia Water, Dr. Allchin.
- frondosum*: large compound, *incisum*-like, with broad fronds, broad approximate pinnæ, and broad pyramidal deeply pinnatifid pinnules, from which results an unusually leafy appearance. Mayford, and elsewhere.
- davallioides*: large compound and *incisum*-like, with the sori placed at the sinuses formed by the lobes of the pinnules, and so near the edge that, with a coincident bulging of the upper surface, a resemblance is produced to the fructification of a *Davallia*. Dublin, Dr. Kinahan.
- undulatum*: a large form of the *incisum* type; the pinnules deeply-inciso-pinnatifid, and toothed in the usual manner, but more crowded, and the edges wavy, giving a minutely crispy appearance to the frond. Guernsey, Mr. J. James.

laxum: large loose *incisum*-like; the fronds broad but lax, the pinnules deeply pinnatifid, and the anterior basal lobe very manifestly larger and more elongated than the rest. Frequent.

The following forms are more or less abnormal:—

dissectum: abnormal; fronds short broad; pinnæ unequal; pinnules distant, decurrent, unequal in size, irregular in form, generally ovate oblong, blunt, and cut into distant unequally spread-toothed lobes. Ireland, Dr. Young; similar forms, not identical, have been found elsewhere.

diffissum: this has the pinnules cut very much as in *dissectum*, but the frond, instead of being remarkably short and broad, is of the normal outline, and of moderate size. Guernsey, Mr. J. James

præmorsum: dwarf and barren so far as yet known; fronds irregular ovate-lanceolate; pinnæ unequal; pinnules oblong decurrent, lacerate, and irregular as if bitten. Aberdeen mountains, Dr. Dickie. We suspect it may belong to *Polypodium alpestre*.

irregulare: full-sized; the pinnules of the lower pinnæ, except that next the rachis, very much and irregularly shortened, frequently roundish or fan-shaped, with serrated lobes; upper pinnæ less affected. Belvoir, Mrs. Rogers; and several other places.

laciniatum: small, irregular, some pinnæ caudate, others præmorse, some quite short; pinnules decurrent, variable in size and form, and very irregularly lacinated. Nettlecombe, Mr. Elworthy. A larger form of similar character, *laciniatum majus*, has been found at Tunbridge Wells by Mrs. Delves.

erosum: full-sized, the fronds and pinnæ normal in outline; pinnules very irregularly lacinated and toothed, frequently bifid or multifid, or more or less depauperated. Tunbridge Wells, Mr. Wollaston; and elsewhere.

interruptum: fronds small, the pinnæ mostly shortened, often much so, their apices truncate, or with a ten-

dency to become bifid; the pinnules variously shaped, irregularly and deeply incised.

ramosum: glandular, branched, with unequal branches; pinnæ normal, long, short, interrupted, depauperated, or abortive; pinnules similarly irregular, and unsymmetrical in development. Tunbridge Wells, Mr. W. W. Reeves.

caudiculatum: very odd-looking; some of the pinnæ are wanting, and the rest are dissimilar, forming a narrow interrupted frond; the apices both of the frond and pinnæ are dilated and crowdedly multifid-cripsed, several of the divisions being extended into short tail-like points; the pinnules, which are very irregular in size and form, have an uneven or ridgy surface. Devonshire, Rev. J. M. Chanter.

polyclados: large ramose forms, unequally branched, the pinnæ unequal, sometimes bifid, the pinnules irregular in shape, size, and division. Devonshire, Rev. J. M. Chanter; Guernsey, Mr. C. Jackson; and a smaller form of the same, Scarborough, Mr. A. Clapham.

furcatum: furcate and subtasselled, of the *molle* type, the ends of the pinnæ forked once or oftener, with a tendency to dilatation in the tips; the apex of the fronds divided into a short tassel. Devonshire, Rev. J. M. Chanter.

thyssanotum: fronds and pinnæ symmetrically tasselled or multifid-cripsed at the apex, as in *multifidum*; the pinnules flat, broader, resembling *trifidum* or *incisum*. Guernsey, Mr. J. James.

inexpletum: a remarkably depauperated form raised by Mr. R. Sim, from spores of *multifidum*. The apices of the fronds and pinnæ are depauperately caudate, and sub-tasselled, and the pinnules are decurrent and unequally depauperated, sometimes reduced to a mere rib.

The species, whose fronds are annual, fragile, and perishing early in autumn, is abundant in most parts of Great Britain and Ireland, its favourite

localities being sheltered moist woods and hedge-row banks. It grows all over Europe, and is widely dispersed in Asia—from the Ural mountains, to Siberia, and North-west India. It is found also in Algiers, and the Canary and adjacent islands; and appears widely dispersed in North and Central America. The foreign varieties are numerous, but quite analogous to what occur in this country. An allied species, *A. asplenioides*, with a creeping caudex, is common in North America; and another similar creeping-stemmed species comes from Asia.

This fern does not appear to be applied to any special use, except that, in Ireland, where it abounds, it is employed as a packing material, as the common bracken is in this country.

This very beautiful plant is of all wild ferns one of the easiest to cultivate. It prefers a light, free, loamy soil, both sandy and turfy, and should be planted in moist sheltered places, being far less beautiful in dry exposed situations. It may be introduced among rock-work, or just within the mouth of a cavernous recess, with fine effect. In woodland walks, or on the shady margin of ornamental water, no fern can be more appropriately introduced. When grown in a pot, it requires one of large size. To attain anything like a fair degree of its lady-like gracefulness, the Lady fern must, under all circumstances, be well supplied with water.

Genus 7. **ASPLENIUM**, *Linnæus*.

SPLEENWORT.

Sori indusiate, linear short or elongated, oblique; the *receptacles* lateral on the anterior side of the veins. *Indusium* linear membranaceous, plane or fornicate. *Veins* simple or forked, from a central costa (sometimes, in exotic species, single and costæform in the ultimate narrowly-cut segments); or forked from the base of the segments, the costa being evanescent or wanting; *venules* parallel, direct, free.

Fronde coriaceous, herbaceous or membranaceous; rarely rachiform; simple lobed pinnate or variously decomposed; the rachis or veins not rarely proliferous. *Sori* usually on the anterior side of the venules, but often inverse in the basal auricles, sometimes diplazioid. *Caudex* short, erect, or decumbent, or sometimes stoloniferous. Name from the Greek *asplenon*, derived from *a*, privative, and *splen*, the spleen.

The British species of this genus belong to two groups, in one of which the pinnules or ultimate divisions have a distinct mid-vein, while in the other there is no mid-vein, but the veins which enter at the base of the divisions become more or less flabellately furcate. These distinctions, which are tolerably obvious in the few British species, become lost among exotics.

(1.) **Asplenium fontanum** *Bernhardi*.—Smooth Rock Spleenwort.—Fronde, small, rigid, linear-lanceolate,

broadest upwards, glabrous, bipinnate; pinnae oblong-ovate; pinules small, obovate-cuneate with a few large angular mucronate teeth; rachis narrowly winged throughout; sori short, oblong.

ASPLENIUM FONTANUM, Bernhardi. Sm. Eng. Fl. iv. 269. Hk and Arn. Br. Fl. 574. Deak. Flor. Brit. iv. 62. Sowerby, Ferns 45, t. 26. Moore, Nat. Print. Ferns t. 35 A.—A. HALLERI, "R. Br." Sprengel.—POLYPODIUM FONTANUM, Linnæus. Bolt, Fil. 38, t. 21.—P. ALPINUM, Lamarck.—ASPIDIUM FONTANUM, Swartz. Schkuhr, Crypt. 52, t. 53. Sm. Eng. Bot. t. 2024.—A. HALLERI, Willdenow.—ATHYRIUM FONTANUM, Roth. Bab. Man. 413.—A. HALLERI, Roth.



[Asplenium fontanum.]

lower ones smaller, palmately three lobed and more distant, the upper ones smaller oblong, and more crowded.

Caudex perennial, short, erect, tufted, with a few subulate, dark-brown scales, which are striate with elongate parallel cells; and having slender fibrous roots. *Vernation* circinate. *Stipes* short, slender, dark purplish-brown, and furnished with a few small deciduous scales below, green upwards; terminal, and adherent to the caudex; *rachis* green, with a narrow elevated margin or wing throughout, the margin extending nearly to the base of the stipes. *Fronde* averaging 4-5 inches, varying from $2\frac{1}{2}$ -12 inches long, rigid, dark-green, smooth, erect or spreading, narrow, lanceolate, broadest above the middle, bipinnate. *Pinnae*

Pinnules roundish-obovate, tapering to the base, the lower ones distinctly stalked on the narrowly-winged secondary rachis, the upper decurrent; their margins deeply notched, with from 2-3 to 5-7 coarse, angular, spinosely-mucronate teeth. *Venation* (pinnules) consisting of a flexuous midvein, sending off alternate simple veins, one of which is directed towards each tooth, and extends almost to its apex. *Fructification* dorsal, most copious upwards, but extending nearly to the base. *Sori* small, short oblong, from two to four on each pinnule, attached near the base of the veins on their anterior side; at first distinct, but often becoming confluent, forming large shapeless masses over the centre of the pinnules; indusiate. *Indusium* short oblong, white, usually straight behind, sometimes curved, rounded entire and sometimes slightly waved on the free margin. *Spore-cases* small, roundish. *Spores* angular, rough.

The claims of this mural species to be regarded as a native plant have been much questioned; but there are authoritative records which we cannot reject. Hudson records Hamersham church, and Wybourn, Westmoreland. Lightfoot states that he gathered it on Amersham church, Bucks. Bolton figures a specimen gathered in Buckinghamshire. It has been more recently reported from the neighbourhood of Alnwick Castle, Northumberland; from Cavehill, Belfast; from rocks in Wharfedale Wood, Yorkshire, in 1838; from an old high wall, at Tooting, Surrey, in 1845. Mr. Shepherd, of Liverpool, who has been for many years a cultivator of ferns, has sent specimens, which he states to have been gathered at Matlock, in Derbyshire. Mr. Hutcheson, formerly gardener at Boxley Abbey, Kent, states that he gathered it, in 1842, near Stonehaven, Kincardineshire, on rocks since destroyed by the construction of a railway. The Rev. A. Bloxam records a Welch habitat between Tany-bwlch and Tremadoc, and another, Swanage Cave, in the Isle of Purbeck. More recently, it has been found by the Rev. W. Hawker, on a wall near Peters-

field, Hampshire, where it is said to be growing in several large patches. In most of these stations, except the last, the plant seems to have become destroyed by repairs; and, as far as we know, the few rupestral habitats have not recently afforded specimens. It is indeed probable that the plant has been overlooked in its native haunts, and, undoubtedly, many localities where it may exist, have never been sufficiently examined. We are not, therefore, justified in rejecting the testimony of our older botanists, and excluding this interesting plant from our flora.

The species is found in Alpine localities, chiefly in the central parts of Europe: in Spain, France, Switzerland, Hungary, Germany, and Italy. Sadler reports it from Scandinavia. It is found on the Ural mountains.

There is in cultivation a singular proliferous plant, which has been regarded as a variety of *A. fontanum*, and suspected to be a native of Scotland. We have named it *A. refractum* (Nat. Print. Ferns, under t. 35 A), believing it to be perfectly distinct from this or any other known species. Its Scottish origin is supported only by the fact of its having been sent, received, and grown as "*A. viride* from Scotland," its difference being for some time undetected. It was made public by Mr. Parker, nurseryman, of Holloway, but we first saw it from the gardens at Peper-Harrow Park, Surrey. Though most like (in size and division) to *A. fontanum* of our British species, it is really quite different from that plant, somewhat approaching *A. ebeneum*; the fronds longer and narrower in proportion, with a dark-brown rachis throughout, and this not distinctly winged, though furnished with a slight green decurrent line at the upper angle uniting the pinnæ; the outline different—equal and almost linear, not broader upwards; the lower pinnæ scarcely more distant than the rest; the pinnæ all refracted in a remarkable manner, as well as less divided; the habit spreading; and the fronds proliferous. It is a remarkable plant, and the obscurity in which its history is involved, is a matter of regret.

A very pretty and easily grown evergreen plant. It

should be potted in very porous soil, so that superfluous moisture may drain away from its roots, and is best elevated slightly above the level of the soil between two or three pieces of soft sandstone. It never attains a great size, and therefore does not require a large pot, and should be kept in a moist shady frame. It may be propagated by division of the plant. This species grows admirably in a damp shady hothouse.

(2.) **Asplenium lanceolatum**, *Hudson*.—Lanceolate Spleenwort.—Fronds lanceolate, rigid, glabrous, bipinnate; pinnae ovate-lanceolate; pinnules obovate or obliquely ovate, blunt, lobed or toothed; the teeth coarse, angular, mucronate; rachis with slightly elevated margins in front, not winged, minutely sealy; sori short oblong, borne near the margin.

ASPLENIUM LANCEOLATUM, *Hudson*. *Sm. Eng. Fl.* iv. 298; *Eng. Bot.* t. 240. *Hk. and Arn. Br. Fl.* 573. *Bab. Man.* 414. *Newm. Hist.* 219 (excl. syn. *Viviani* and *Sadler*). *Deakin, Florigraphia Britannica*, iv. 67. *Sowerby, Ferns* 47, t. 27 (bad). *Moore, Nat. Print. Ferns.* t. 35 B.—*A. ROTUNDATUM*, *Kaulfuss*.—*A. BILLOTH*, *F. Schultz*.—*A. CUNEATUM*, *F. Schultz*.—*TARACHIA LANCEOLATA*, *Presl*.—*POLYPODIUM ADIANTOIDES*, *Poiret*.

Var. microdon: fronds pinnate; lower pinnae distinct, obtuse, obliquely-triangular or cordately sub-hastate, undulate and lobate below, upper ones narrower, confluent; margin apiculato-dentate; sori small.

ASPLENIUM MICRODON, *Moore Hb.*—*A. MARINUM* v. *MICRODON*, *Moore, Nat. Print. Ferns*, under t. 38.

Caudex perennial, short, stoutish, erect, or decumbent, tufted, densely sealy, with elongately subulate shining brown cellulose-striate scales, and having stout branched roots. *Vernation* circinate. *Stipes* one-third or more of the length of the frond, dark chestnut-coloured below, this colour extending along the back of the rachis, sparingly sealy; terminal and adherent to the caudex; *rachis* with a slightly elevated margin in front, and having few slender jointed hairs; the partial rachides winged, and fur-



[*a* *Asplenium lanceolatum* ; *b*. var. *microdon*.]

nished with similar hairs. *Fronde* 3-12, occasionally 18 inches high, rigid, bright green, smooth, erect or spreading, lanceolate, bipinnate. *Pinnæ* narrowing from

the base to the point, sometimes deflexed, scarcely stalked, sub-opposite or alternate; lower ones more distant and shorter. *Pinnules* obovate, obliquely ovate, or dimidiately sub-quadrata, the anterior side most developed, more or less euneate at the base; in large fronds pinnatifid below, with obovate sharply-toothed lobes, coarsely toothed above, the teeth mucronate; in smaller fronds coarsely mucronately-toothed. Occasionally the lower pinnæ are longer; sometimes the fronds are narrow and only pinnate, with lobed pinnæ; and occasionally they are membranaceous. *Venation* (pinnules) consisting of a flexuous midvein; veins alternate, the lowest anterior one directed to the principal lobe, the venules which proceed from it extending one into each tooth, but not quite reaching the margin; the other veins are forked or simple, and correspond in number with the marginal teeth; their termination is marked by a depression of the upper surface. *Fructification* dorsal, scattered over the whole surface. *Sori* indusiate, oblong, borne on the anterior side of the venules; that is, above the fork of the veins, occupying rather the centre of the lobes than the centre of the pinnules; at first distinct, but becoming confluent in irregular masses on the lobes, which gives them a sub-marginal appearance; occasionally they are set back to back on the venules. *Indusium* white, oblong, slightly irregular, and wavy on the free margin. *Spore-cases* globose. *Spores* ovate, angular, roughish.

The *var.* MICRODON is a remarkable form, so little divided, that in the smaller state in which we first received it, it was referred to *A. marinum*; though now, that more vigorous fronds have been obtained, it proves to be an undivided form of *A. lanceolatum*. *Fronde* irregularly linear, scarcely linear-lanceolate, with a tapered point, 6-8 inches or more high, pinnate. *Pinnæ* distinct below, with a short stalk, shortly and broadly triangular or cordately sub-hastate, bluntish; the upper ones narrower, becoming adnate, those of the upper half confluent; undulate, with one or two shallow roundish lobes

at the base; the margins furnished with smallish apiculate teeth. *Sori* oblong, smallish, placed towards the margin. This was found in Guernsey in 1855, by Miss Wilkinson, and subsequently by Mr. C. Jackson and others; a similar plant, smaller, has been gathered in Devonshire by the Rev. J. M. Chanter; and another, slightly more divided, and confirming its relationship with *A. lanceolatum*, near Penzance, by Mr. G. Wager. It appears to grow on rough masonry in company with *A. lanceolatum*.

There are few other varieties known. Occasionally the fronds are forked or proliferous. There have also been noticed:—

laciniatum: fronds depauperated, the leafy part more or less wanting, the pinnæ and pinnules frequently reduced to mere ribs; the sori copious; subpermanent. Channel Isles.

crispatum: pinnules very distinct; the teeth exaggerated sub-spinous and slightly undulated, giving a somewhat crispy appearance to the frond. Guernsey, Mr. C. Jackson.

This species, which is of elegant appearance and ever-green habit, is a maritime or sub-maritime species. Its its head-quarters appear to be the shores of the Bristol channel, in the counties of Cornwall, Devon, Somerset, and Gloucester, and those of Glamorgan and Pembroke. It occurs again in Merioneth and Carnarvon or Denbigh, in Wales, and has been reported (by Link) from Gilphead in Scotland. It has been found at Tunbridge Wells, Kent; and recently near Cork, in Ireland. In the Channel Islands it is abundant. It is known to occur in the north-west of France, in Switzerland, and in Spain and Portugal in Europe, and on the African coast at Tangiers, and in the islands of Madeira and the Azores.

The plant is not suited for rock-work or exposed situations, as it requires a mild sheltered climate. In a frame or shady greenhouse, where it may have a moist and calm atmosphere, and a moderately elevated temperature, it

will grow freely. The soil should be well intermixed with porous material to secure perfect drainage. It may be propagated by division.

(3.) **Asplenium Adiantum-nigrum**, *Linnæus*.—Black Maidenhair Spleenwort.—Fronds ovate or deltoid, acute or acuminate, glabrous, subcoriaceous, bi-tri-pinnate; pinnæ triangular, obliquely acute or acuminate; pinnules ovate or ovate-elongate attenuate, pinnate or pinnatifid, the ultimate divisions oblong or subtrapezoid, cuneate at the base, shallowly-lobed with the lobes toothed, or simply toothed; teeth acute; sori linear-elongate, contiguous to the midvein.

ASPLENIUM ADIANTUM-NIGRUM, Linnæus, Bolton. Fil 30, t. 17, fig. 1-3. Schkuhr, Crypt. 74, t. 80 a. Sm. Eng. Bot. t. 1950; Eng. Fl. iv. 297 (excl. β). Deak. Florig. Brit. iv. 64. Hk. and Arn. Br. Fl. 573. Bab. Man. 414. Newm. Hist. 225. Sowerby, Ferns 49, t. 28. Moore, Nat. Print. Ferns, t. 36.—A. ONOPTERIS, Lindæus.—A. NIGRUM, Bernhardt.—A. TRICHOMANOIDES, Lumnitz.—A. LUCIDUM, Salisbury.—A. CENEIFOLIUM, Viviani.—A. PATENS, Gaudichaud.—A. ARGUTUM, Kaulfuss.—A. TABULARE, Schrader.—A. CAPENSE, Lin. MS. Hb.—TARACHIA ARGUTA, Presl.—T. ADIANTUM-NIGRUM, Presl.—PHYLITIS LANCI-FOLIA, Mœnch.

Var. obtusatum: fronds ovate, smaller and less divided; pinnæ blunt or bluntish, not acuminate; pinnules ovate, their rounded apices toothed; rachis winged.

ASPLENIUM ADIANTUM-NIGRUM *v.* OBTUSUM, Newm. Hist. ed. 2, 258. Moore, Handbk. ed. pr. 155 (excl. syn. Kit. Willd); Id. Nat. Print. Ferns, t. 36, C. D. (excl. var. syn.)—A. ADIANTUM-LANCEOLATUM, Hoffmann (excl. syn.)

Var. acutum: fronds deltoid, tripinnate throughout, and as well as the pinnæ (the lower pair especially) caudate; ultimate pinnules narrow-lanceolate, ineiso-pinnatifid; lobes linear, very acute, entire.

ASPLENIUM ADIANTUM-NIGRUM *v.* ACUTUM, Newm. Hist. 2 ed. 259. Moore, Nat. Print. Ferns, t. 37.—A. ADIANTUM-NIGRUM, Bory (Isles Fort.)—A. ADIANTUM-NIGRUM *v.* ANGUSTATUM, Desvaux.—A. ACUTUM, Bory MS., Willdenow (side spec. Bory. in Hb. Hew.).

Newm. Hist. ed. 3, 230 (excl. syn. Sm.)—A. VIRGILII, Bory.—A. PRODUCTUM, Lowe.—TABACHIA ACUTA, Presl.



[Asplenium Adiantum-nigrum.]

Caudex perennial, short, stoutish, tufted, often decumbent, with lanceolate hair-pointed, cellulose-striate scales, and having numerous branched roots. *Vernation* circinate. *Stipes* elongate, usually as long as, sometimes longer than, the leafy portion, dark purplish-brown, and having a few cellulose-striate lanceolate hair-pointed scales below, smooth upwards; terminal and adherent to the caudex; the *rachis* with the brown colour of the base extending upwards behind. *Fronde*s, including the stipes, 3-4 to 18-20 inches high, usually coriaceous or rigid, shining dark-green above, paler beneath, deltoid or ovate, or sometimes with the sides nearly parallel below, always with a tapered or acuminate apex; bi-tri-pinnate or occasionally almost quadripinnate in the larger fronds. *Pinnæ* obliquely triangular-elongate, attenuated at the apex, the lower nearly opposite, as long as, usually longer than, the rest; the upper becoming alternate; all usually pointing upwards. *Pinnules* alternate, the lowest on the



[A. *Adiantum-nigrum*.]

anterior side of the rachis, and considerably larger than the rest, obliquely and broadly ovate with an attenuated apex, pinnate at its base; its lowest (secondary) pinnules ovate, obtuse, pinnatifid, with sharply serrated lobes below, and sharply serrated at the apex; upper pinnules oblong and decurrent at the base. In the smaller forms the pinnæ are less attenuated, the pinnules shorter, blunter, and either barely divided to the midvein, or merely lobed. The ultimate divisions are all notched with distinct acute prominent serratures. *Venation* (secondary basal pinnules in the tripinnate, and primary basal pinnules in the bipinnate fronds) consisting of a flexuous midvein, which sends out a vein towards each marginal tooth; these, if the pinnule is not deeply lobed, and the teeth are simple, are also simple, and bear the sorus on their lower half, commencing just above their base, and extending half way to the margin; but if

the pinnule is lobed below, one vein goes off to each lobe, and divides into venules corresponding to the number of teeth, one or two of these venules in the principal lobes bearing a sorus; the smaller lobes are occupied by one furcation of the vein. The veins bear the sori on their anterior side, commencing near the midvein of the pinnule and extending beyond the point of furcation. *Fructification* throughout the back of the frond. *Sori* linear elongate, indusiate near the base of the veins, therefore central with respect to the pinnules, crowded and often becoming confluent. *Indusium* linear, entire, pallid, semi-transparent, and apparently violaceous from the dark colour of the spore-cases showing through it. *Spore-cases* globose, shining brown. *Spores* ovate, angular, roughish.

The *var.* OBTUSATUM is, perhaps, rather a less developed condition than a variety, as various gradations occur; nevertheless its extreme states appear distinct. *Fronde*s comparatively small, rather ovate than triangular, 2 to 6-8 inches high; the smaller ones barely bipinnate, with short bluntly triangular pinnae, and roundish obovate very indistinctly-toothed pinnules; the larger tripinnate, their primary and secondary pinnules corresponding with the pinnae and pinnules of the smaller specimens. It is probably not uncommon, and occurs in the three kingdoms. We believe it is not the *Asplenium obtusum* of Willdenow, as we formerly supposed, that being a more slender plant, with deeply incised pinnules.

The *var.* ACUTUM, in its typical state, is a distinct plant, but there are connecting links uniting it with compound states of the more common form. The texture of the plants is firmer, and less coriaceous than in the usual states. *Caules* short, thick, tufted, furnished at the crown and on the base of the stipes with cellulose-reticulated scales, lanceolate below, and ending in a hair-like point. *Stipes* elongated, dark purplish-brown. *Fronde*s 6-18 inches in length, including the stipes, quite smooth, deltoid or more correctly pentagonal, the apices of the lowest posterior pinnules forming additional angles,

sometimes ovate with the point much attenuated, almost quadripinnate in the larger fronds. *Pinnæ*, especially



[*Asplenium Adiantum-nigrum*, var. *acutum*.]

the lowest, which are also the largest, of the same sub-deltoid outline as the fronds, excepting that the pinnules, being alternate instead of opposite, as are the lower pair of pinnæ, they are oblique, and approach a trapeziform outline; their apices, as well as those of the frond and generally of the pinnules also, are caudate with a few sharp deep distant teeth. *Pinnules* (larger ones of the lowest pinnæ) somewhat obliquely ovate attenuate, their divisions (secondary pinnules) lanceolate, deeply pinnatifid at a very acute angle into linear lobes, the lower

of which are about three-toothed, the upper bifid at their points, these teeth as well as the simple ones at the apex of the pinnae being narrow and very acute; upper pinnae and pinnules narrower and at length reduced to linear lanceolate sharply-toothed lobes, which again gradually merge into the simple linear teeth of the caudate extremities. A similar mode of division on a smaller scale obtains in the smaller forms; the fronds being only tripinnate, and the secondary pinnules narrower, and less deeply lobed. The *veins*, though slender, are very distinct and consist of a series of furcations without any distinct midvein. *Sori* very narrow linear, contiguous to each other near the centre of the pinnules. *Indusium* white, semi-transparent, entire. The true variety has been found in two or three localities in Ireland—Killarney, Cahir Conree, and the Dublin mountains. It is also found in Spain, Portugal, Italy, Corsica, and Cyprus; in Teneriffe, Madeira, and the Azores; whilst transition forms have been gathered in Sicily, Algiers, Abyssinia, and the Cape of Good Hope.

In addition to these, there are some other variations to be recorded:—

oblongum: remarkable for its oblong parallel-sided fronds, the pinnae shortly triangular, the two or three lower pairs nearly uniform in size. It is occasionally met with.

variegatum: sub-permanent, the fronds unsymmetrically striped with white. Guernsey, Mr. C. Jackson; also in Yorkshire.

fissum: curious and abnormal-looking; the fronds caudately lengthened, the pinnules irregularly cut into long linear acute entire segments or lobes, answering to the acute teeth of the usual states of the plant; some of the pinnules become palmately-laciniated. Devonshire, Miss Hoseason.

intermedium: lax ample elongated forms, often mistaken for *acutum*; they differ from the latter in their longer

less compound fronds, and in the greater breadth of the ultimate divisions. It is the extreme development of the typical form of the species. West of England, and the Channel Isles principally.

oxyphyllum: fronds small narrow elongated, the teeth of the pinnules deep, narrow, and conspicuously acute, simulating *acutum* in this respect, but the fronds are narrow. Dunoon, Argyleshire, Mrs. East.

decompositum: almost or quite quadripinnate, resembling *acutum* in the form of its fronds and pinnæ, and even the pinnules, but the ultimate parts, though narrow, are bluntly rounded off, not acute, and the texture is less rigid and more leathery; the segments, though small and comparatively narrow, are not so much narrowed as in *acutum*. Devonshire, Rev. J. M. Chanter.

This pretty evergreen species is very common, occurring throughout England, Wales, and Scotland, and extending to the Northern and Western Isles, Ireland, and the Channel Islands. It grows in sandy hedge-row banks, in the crevices of rocks, and on old decaying walls. It is also widely dispersed over Europe, varying considerably, the South European forms often approaching *acutum*. It again occurs in Teneriffe, Madeira, and the Azores, at the Cape of Good Hope and Natal, and at St. Helena. In Asia, it has been found both in the Caucasian and Siberian provinces of Russia, in Syria, Arabia, and Armenia, in several parts of India from Affghanistan to Simla, and probably in Java. It also occurs in the Sandwich Isles.

The Black Spleenwort was once reputed to be efficacious in the treatment of coughs, asthmas, and similar affections of the chest; but it has not maintained its reputation.

This is a very ornamental species both for pot-culture and artificial rock-work. In the latter situation, its neat habit and glossy evergreen fronds render it very desirable; and it will, moreover, grow either in exposed or

shaded situations, the chief difference being that, in the latter, it attains a greater degree of luxuriance. It is readily propagated by separating the crowns.

(4.) **Asplenium marinum**, *Linnæus*.—Sea Spleenwort.—Fronds linear or linear-lanceolate, tapered above, pinnate; pinnæ ovate oblong or linear, oblique, shortly stalked, the margin serrate unequally crenate or lobate, rarely pinnatifid; anterior base truncate and sub-auriculate, posterior cuneate; upper pinnæ confluent; sori large, linear, elongate near the midrib; rachis and petiole winged.

ASPLENIUM MARINUM, *Linnæus*. Bolt. Fil. 26, t. 15. Sm. Eng. Bot. t. 392; Id. Eng. Fl. iv, 294. Schkuhr, Crypt. 64, t. 68. Hook. Fl. Lond. iv. 57, t. 60. Deak. Flor. Brit. iv. 69. Hk. and Arn. Brit. Fl. 573. Bab. Man. 414. Newm. Hist. 235. Sowerby, Ferns, 50, t. 29. Moore, Nat. Print. Ferns, t. 38.—ADIANTUM TRAPEZIFORME, *Huuson*; according to Smith and authors.

Var. sub-bipinnatum: fronds pinnate, the pinnæ almost pinnate at their base, deeply pinnatifid throughout; anterior basal lobes oval, acute, serrate.

ASPLENIUM MARINUM *o.* SUB-BIPINNATUM, *Moore*, Nat. Print. Ferns, under t. 38.

Caudex perennial, tufted, erect or decumbent, densely scaly with dark-brown shining cellulose-striate lanceolate scales, which extend into a long hair-like point; roots branching numerous. *Vernation* circinate. *Stipes* shorter than the frond, smooth, chestnut-coloured or purplish-brown; terminal and adherent to the caudex; the *rachis* margined and more or less coloured brown below, winged and green above. *Fronds* 6-12 inches long, sometimes much longer, smooth, coriaceous, broadly linear tapering to the apex, pinnate. *Pinnæ* oblique, the anterior basal angle being most produced, oblong-oblong-

ovate or linear, obtuse, often of nearly equal width throughout, the anterior base truncate rounded and produced into a blunt more or less apparent auricle, the



[*a* *Asplenium marinum*; *b*. narrow form; *c*. *incisum*; *d*. *sub-bipinnatum*.]

inferior base cut away obliquely; lower ones stalked, the stalks winged; upper decurrent, the uppermost becoming confluent into a tapering pinnatifid apex; margins usually doubly crenato-serrate, the serratures unequal, sometimes deeper, forming evident lobes, sometimes form-

ing very even crenatures. *Venation* consisting of a prominent flexuous midvein, from which proceed forked veins; the lowest anterior vein is two or three times forked, the rest usually only once forked, the venules terminating within the margin. *Fructification* spread over the back of the frond. *Sori* linear, oblique, indusiate, borne on the anterior side of the venules (except sometimes on the veins of the auricle when two or more sori are borne on the same fascicle of venules), commencing near the midvein, and forming two series of oblique lines along each pinnæ. *Indusium* persistent, entire. *Spore-cases* numerous, globose, brown. *Spores* ovate, angular.

The *var. SUB-BIPINNATUM*, is remarkable in having all the pinnæ deeply pinnatifid; the basal anterior lobes largest, nearly separated from the rest, acute and serrate, the lobes generally acutish and spreading. It was found in Guernsey by Mrs. Dobree; and a similar form from Cornwall has been sent to us by Mrs. Delves.

There are some other varieties to be briefly noticed:—*acutum*: has the pinnæ elongated, and gradually narrowed to a point. It occurs chiefly in the West of England and in the Channel Isles.

crenatum: has short obtuse oblique trapeziform pinnæ, with very even small deep roundish crenatures. It is an inland plant, found in a stone-quarry near Warrington.

trapeziforme: has robust leathery fronds, and trapeziform imbricated crenulated pinnæ. Scarborough, Mr. Clapham.

cuneatum: has no auriculiform projection at the anterior base of the pinnæ, which have a wedge-shaped base, and are oblong, with deep sharp uneven serratures. Clare, Dr. Allchin.

ramosum: fronds branched, or frequently united by the stipes in pairs; pinnæ sub-undulate, crenato-lobate, the lobes with blunt teeth. Dorsetshire, Mr. Wollaston.

assimile: pinnae elongated, more or less acute, lobate or pinnatifid, resembling *Aspl. caudatum*, or auriculate resembling *Aspl. auritum*. Channel Isles; Ireland.

incisum: fronds small; pinnae somewhat irregular, obliquely semi-ovate, with a few deeply incised lobes, the lobes notched or erenate. Great Orme's Head, Mr. C. Griffith. A similar form, from Llangollen, has been sent to us by the Rev. T. Rooper.

This distinct and handsome evergreen species, though found in a few inland situations, must be regarded as a maritime plant, the fissures of sea-cliffs and the roofs of sea-caves being its favourite haunts. It occurs, often abundantly, on all our coasts, excepting those of the eastern side of England; being most profuse in the south-west of England and in Wales; thence extending eastwards to Sussex, and northwards to Orkney, returning along the eastern side of Scotland to Yorkshire. It is also found in the Hebrides, and is abundant on the Irish coast, and in the Channel Islands, where it is sometimes remarkably fine; M. Boistel has forwarded thence fronds nearly three feet in length. In Europe, it seems limited to the western part, whence it crosses from Spain to Tangiers on the African coast, and is again met with in Madeira, the Azores, and the Canary Isles. It is also found in St. Helena.

This plant is easily cultivated in a frame or greenhouse, where it has shelter afforded it, but does not succeed if exposed, at least to a London atmosphere. It is probably constitutionally tender, since it attains great luxuriance when cultivated in the warm moist atmosphere of a shady stove. The plants are rather difficult to establish when newly removed from the rocks, their roots being of necessity much injured in the process of removal; but once established, and placed in a sheltered position, they grow freely, and may be increased by division in spring. It should be protected against frost in winter. The soil for ferns of this character should be light turfy peat with a liberal intermixture of silver sand.

and a little friable loam, the whole blended with small nodules or fragments of sandstone or brick. Its ever-green habit renders it at all times ornamental.

(5.) **Asplenium Trichomanes**, *Linnaeus*.—Common Maidenhair Spleenwort.—Fronde linear pinnate; pinnae roundish-oblong roundish-ovate or obovate, scarcely stalked, obliquely cuneate at the base, crenated; rachis chestnut-brown throughout, margined in front with a dark coloured erect membranaceous border, not a herbaceous wing; sori distant from the midrib.

ASPLENIUM TRICHOMANES, *Linnaeus*. Bolt. Fil. 22, t. 13. Sm. Eng. Bot. t. 576; Id. Eng. Fl. iv. 202. Schkuhr. Crypt. 69, t. 74. Hook. Fl. Lond. v. 150, t. 156. Bab. Man. 414. Hk. and Arn. Brit. Fl. 573. Deak. Flor. Briv. iv. 73. Newm. Hist. 249. Sowerby, Ferns, 52, t. 30. Moore, Nat. Print. Ferns, t. 39.—A. TRICHOMANOIDES, *Weber et Mohr*. Withering.—A. MELANOCAULON, *Willdenow*.—A. SAXATILE, *Salisbury*. *Gray*.—TRICHOMANES CRENATA, *Gilibert*.—PHYLLITIS ROTUNDIFOLIA, *Moench*.

Var. incisum: pinnae deeply pinnatifid; segments narrow inciso-serrate; barren.

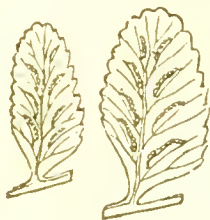
ASPLENIUM TRICHOMANES v. INCISUM, *Moore*, Nat. Print. Ferns, t. 39, D. E.—A. TRICHOMANES v. PINNATIFIDUM, *Opiz*.—A. SAXATILE β INCISUM, *Gr. y.*—[Schkuhr, Crypt. t. 74, fig. f.]

Caudex perennial, short, tufted, scaly, erect or decumbent; the scales lanceolate brown cellular, often with a dark central stripe, the roots wiry branching. *Vernation* circinate. *Stipes* short, smooth, chestnut-coloured or dark-brown, rounded behind, flat in front with a raised line on the face of each angle; terminal and adherent to the caudex; the *rachis* chestnut-coloured throughout. *Fronde* 2-3 to 12-14 inches long, linear, pinnate. *Pinnae* thick, herbaceous, deep green, numerous, mostly roundish-oblong, obtuse at the apex, obliquely cuneate at the base, scarcely stalked, but attached to the rachis by the lower angle, usually crenated, but sometimes nearly en-

tire on the margin, and always entire at the cuneate base; sometimes most of the pinnae, and usually the lower ones are more ovate in outline, and less unequal-sided; more rarely the reduction of the upper basal angle gives the pinnae an obovate outline. The pinnae are readily detached from the mature fronds, and eventually fall away, leaving the rachis bare. *Venation* consisting of a midvein, from which issue forked veins, terminating within the margin; the anterior of the venules or branches bears the sorus above the point of furcation. *Fructification* dorsal, distributed over the frond. *Sori* linear, oblique, numerous, often becoming confluent, indusiate. *Indusium* entire, or slightly crenated on the free margin. *Spore-cases* numerous, globose. *Spores* angular, rough.

[*Asplenium Trichomanes.*]

The *var. INCISUM* is the most marked of several varieties which are known. It is always barren, and has the



[A. Trichomanes.]

pinnae deeply divided into narrow incised segments, thus being exactly analogous to the *var. cambricum* of the common Polypody. It is very rare, but has been found at Burnley, Lancashire; in Devonshire, and in Clare; and more recently near Settle in Yorkshire, by Mr. Clapham; and in Borrowdale, Cumberland, by Miss Wright.

The following forms are deserving of record; the dichotomous forking

of the frond is not uncommon but inconstant:—

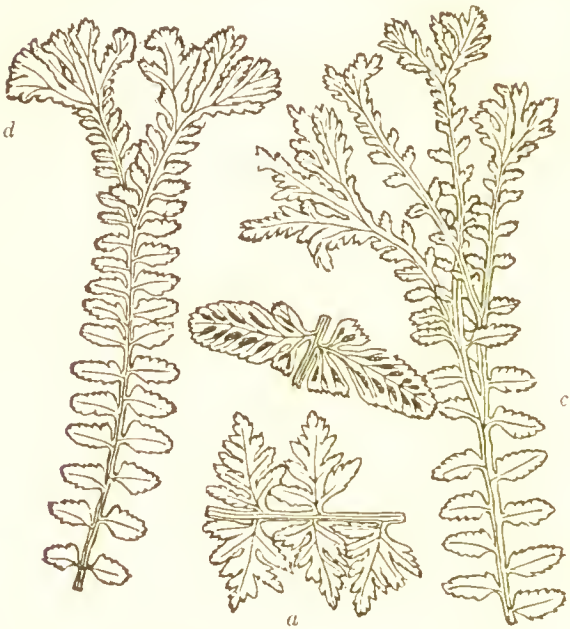
bifurcum: has the apical lobe frequently enlarged, and is always doubly or trebly furcate; constant. Kent, Mr. Wollaston; Hoddam Kirk Yard, Dumfriesshire, Mr. W. G. Johnston.

ramosum: a very much ramified variety, and more or less permanent; the apical lobes are frequently enlarged, and the rachis several times divided. Found in several places, *e. g.*, Devonshire, Rev. J. M. Chanter; Windermere, Mr. Clowes; Keswick, Miss Wright; Quin Abbey, Ireland, Mr. Kinahan. (Nat. Print. Ferns, t. 39, F.)

multifidum: fronds ramosely bi- or tri-dichotomous in the rachis in the upper part of the frond, the ultimate divisions multifid-cripsed. This was found at St. Mary's Isle, Kircudbright, by Mr. Dick, and was communicated by Mr. McNab of the Edinburgh Botanic Garden. (Nat. Print. Ferns, t. 39, G.)

crisatum: fronds beautifully tufted or tasselled at the apex, not ramified below as in *multifidum*. It is one of the most beautiful varieties of this species. It appears to have been raised accidentally from spores adhering to some *Hymenophyllum* received by Mrs.

Delves from the Glasgow Botanic Gardens. (Nat. Print. Ferns, t. 39, H.)



[*Asplenium Trichomanes* vars: *a. incisum*; *b. lobatum* (centre figure); *c. multifidum* *d. cristatum*.]

depauperatum: pinnae depauperately narrowed, serrate or lacinate, sometimes reduced to a mere winged rib. Clare, Dr. Allehin; Rydal, Mr. Wollaston. (Nat. Print. Ferns, t. 39, C.)

subaequale: pinnae nearly equal-sided, attached at or near the centre of their base, oblong, erenated. It is, perhaps, the more perfect state of the form of which *de-*

pauperatum is a depauperated monster. Monmouth, Mr. Enys; Windermere, Mr. Clowes.

lobatum: large and robust; the pinnae frequently lobed at the base, and having one or two broad obovate lobes separated nearly down to the midrib. Devonshire, Rev. J. M. Chanter. Another lobed form has been found, at Ottery St. Mary, by Mr. Wollaston.

A commonly distributed species throughout the United Kingdom and Ireland, growing on rocks and old walls or ruins, more rarely in hedge-row banks, where, however, it is more luxuriant. Irish specimens (Mr. W. Andrews and Mr. R. Barrington) are sometimes more than a foot in length, and are probably mistaken for *A. anceps*. It is found throughout Europe, extending eastward to Greece, and westward to the Spanish Peninsula, thence to Madeira and the neighbouring Atlantic Islands, and the Cape of Good Hope. In Asia, it is found in the Caucasus, in Persia, in various parts of India, and in Siberia. It is found in Tasmania and New Holland; in various parts of the United States of America, in British North America; in Cuba, Mexico, Peru, and Venezuela; and in the Sandwich Isles.

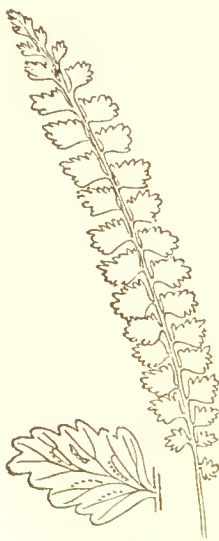
It would appear that this fern once had a medicinal reputation which it does not now possess. Ray speaks of it as useful in affections of the chest and lungs; and Lightfoot records that the Scotch country people made from it a tea and a syrup, which were taken as remedies for coughs and colds. Some old medical books refer to this plant as the source from which the syrup called *Capillaire* is prepared.

This elegant evergreen fern may be grown either on rock-work or in pots, but its roots, being wiry and insinuated into the crevices of walls and rocks, it is often found difficult to transplant it successfully. The smaller and younger plants should be chosen, and carefully taken up and planted with as little injury to the roots as possible. It forms a very elegant little evergreen plant on rock-work, and grows freely, in a pure atmosphere, when

established, if care be taken not to allow stagnant water to remain about its roots. Its small size, of course, adapts it only for the more prominent situations in the rockery. It is propagated by dividing the crowns.

(6.) **Asplenium viride**, *Hudson*.—Green Spleenwort.—Fronds linear pinnate; pinnae sub-rotund roundish-ovate or rhomboidal, erenated, distinctly stalked; rachis green with an obtuse elevated green border in front, not winged; sori approximate to the midrib.

ASPLENIUM VIRIDE, *Hudson*. *Bolt. Fil.* 29, t. 14. *Sm. Eng. Bot.* t. 2257; *Eng. Fl.* iv. 293. *Sebkuhr, Crypt.* 68, t. 73. *Hk. and Arn. Brit. Fl.* 573. *Bab. Man.* 414. *Deak. Flor. Brit.* iv. 71. *Newm. Hist.* 243. *Sowerby, Ferns.* 54, t. 31. *Moore, Nat. Print. Ferns.* t. 40.—A. TRICHOMANES RAMOSUM, *Linnaeus*.



[*Asplenium viride*.]

Caudex perennial, tufted, somewhat creeping, sparingly scaly at the crown, the scales lanceolate dark-brown, cellulose; the roots slender, branched. *Vernation* eireinate. *Stipes* sometimes short, usually about a-third of the length of the frond, smooth, dark-brown at the base, green upwards, semiterete: terminal and adherent to the caudex; *rachis* green, slender. *Fronds* 2-5 to 8-10 inches long, delicately herbaecous, pale green, linear, pinnate. *Pinnae* usually roundish ovate, and somewhat emeate at the base, or more obliquely emeate there thus becoming subtrapeziform or rhomboidal. distant and usually opposite below, more crowded and alternate above, attached by a distinct slender stalk: the margin erenated or in-

cis-erenate, except at the euneate base which is entire; occasionally the pinnæ are equal-sided and broadest at the base, much shortened and rounded at the apex; and sometimes they are more elongated and acute. *Venation* consisting of a midvein, producing forked veins at the base of the pinnæ, and simple ones above; these veins and venules terminate abruptly within the margin, the point of termination being marked by an elevation on the upper surface. *Sori* borne on the anterior side of the vein, opposite the furcation and extending below it, when they are forked, and near to the midrib when they are simple. *Fructification* dorsal, more copious on the upper part of the frond. *Sori* linear, oblique, contiguous to the midvein and soon becoming confluent, indusiate. *Indusium* narrow, crenated on the free margin. *Spore-cases* globose. *Spores* angular, rough.

A few slight varieties have been noticed:—

multifidum: has the rachis bifidly or multifidly divided towards the apex, and is not unfrequent; subpermanent.

bipinnatum: has the pinnæ deeply incised very much as in the incised variety of *A. Trichomanes*, but fertile. Whitbarrow, Mr. Hudhart.

acutum: with pinnæ lanceolate and acute, is mentioned by Mr. Newman as having been found by the late Mr. S. Gibson.

This neat evergreen species is found principally in mountainous rocky districts in the North of England and Scotland, widely dispersed and frequent in equigial localities, but is not at all a common fern. It is not unfrequent in Wales, and is found in Shetland, as well as in a few localities in the South of England. It is rare in Ireland. The same fern occurs throughout the alpine and subalpine districts of northern and central Europe, extending to Italy and Spain. In Asia it is found in India, in Tauria, in Siberia, and Sitka; and is again met with in North-west America, and the Rocky Mountains.

This is a free-growing plant, under careful cultivation, not, however, often attaining the size which it acquires in sheltered places amongst the moistened rocks, in the interstices of which its roots delight to insinuate themselves. It requires well drained pots, and soil intermixed plentifully with small lumps of broken free-stone, and delights in a damp shady situation, provided the moisture is not stagnant. In the rockery it needs shade and the shelter of a bell-glass. On a pile of damp stones, under a bell-glass kept from the sun, it forms a lovely little window or parlour ornament. The proper bell-glasses for these half-hardy ferns, are those having a small opening in the crown, which may be closed or not at pleasure, but is in general best left open in favourable weather. The plants may be propagated by dividing the caudex.

(7.) **Asplenium Ruta-muraria**, *Linnaeus*.—Rue-leaved Spleenwort, or Wall Rue.—Fronds deltoid bi-tripinnate; pinnules obovate or rhomboid, wedge-shaped and entire at the base, the anterior margins acute, rounded or truncate, toothed; sori linear, crowded, central; indusium crenulate on the free margin.

ASPLENIUM RUTA-MURARIA, *Linnaeus*. Bolt. Fil. 28, t. 16. Sm. Eng. Bot. t. 150; Eng. Fl. iv, 296. Schkuhr. Crypt. 75, t. 80 b. Hook. Gen. Fl. t. 30. Hk. and Arn. Br. Fl. 573. Bah. Man. 414. Deak, Flor. Brit. iv. 75. Newm. Hist. 261. Sowerby, Ferns 55, t. 32 Moore, Nat. Print. Ferns, t. 41 A.—A. MURORUM, Lamarck.—A. MURALE, Bernhardi. Salisbury. Gray.—SCOLOPENDIUM RUTA-MURARIA, Roth.—ADIANTUM PYGMÆUM, Lin. MS. in Hb.—AMESIUM RUTA-MURARIA, Newm. Hist. ed. 2, 10; ed. 3, 254; Append. viii.—TARACHIA RUTA-MURARIA, Presl.—PHYLLITIS RUTA-MURARIA, Mœneh.

Caudex perennial, short, tufted, scaly, the scales small, very dark brown, narrow-lanceolate striato-reticulate; fibres numerous branched. *Vernation* circinate.

Stipes as long as or longer than the frond, smooth dark-purple at the base, green above; terminal and adherent to the caudex; the *rachis* smooth, green. *Fronde*s 1-6 inches long, numerous, deep green, subcoriaceous, often



[*Asplenium Ruta-muraria*.]

coriaceous, deltoid. bi tri-pinnate; when young simple and reniform or trifoliately pinnate, with roundish or subreniform leaflets, the trifoliate state fertile. *Pinnæ* alternate. *Pinnules* obovate or rhomboidal, the base wedge-shaped, entire and tapering into a more or less distinct petiole, the apex rounded or acutely prolonged or truncate, always toothed, the teeth small and nearly equal. *Venation* consisting of a series of veins, repeatedly forked from the base, so that there is no distinct midvein, the number of branches or venules correspond-

ing with the number of marginal teeth. *Fructification* dorsal, borne on the inner sides of the venule about the centre of the pinnae or pinnules. *Sori* linear, few; sometimes simulating those of *Scolopendrium*, being nearly opposite, contiguous, and opening inwardly from each margin; often becoming confluent. Starved plants produce small pinnules and abundant sori, which is confluent over the whole under surface. *Indusium* narrow linear,



[*A. Ruta-muraria*.]

the free margin wavy or crenulate. *Spore-cases* dark-brown, numerous, roundish-obovate, coarsely reticulate. *Spores* roundish, strongly muriculate.

Some slight varieties have been observed:—

cristatum: has the fronds crowded and tasselled at their apices, or the apical lobes folded, the rachis not unfrequently divided. It is variable, and less marked than the varieties of many other ferns. Guildford, Dr. Allchin; Tunbridge Wells, Mr. Wollaston. (Nat. Print. Ferns, t. 41 A, 7). A prolific form of this has been called *proliferum*.

dissectum: pinnules deeply incised and elongated. Devonshire, Mr. Wollaston; Ireland, Dr. Kinahan.

cuneatum: is the form often mistaken for *A. germanicum*; it is scarcely more than pinnate, the narrow pinnae cuneate below, truncate above, with small equal apical teeth. Stenton Rock, Dunkeld. Analogous forms, more distinctly bipinnate, have been found at Town Malling, Dovedale, Keswick, and Ennis.

pinnatum: pinnate, the pinnae rhomboidal, stalked, crenato-dentate in the upper larger half. Mucross, Dr. Allchin.

unilaterale: one-sided, developing a normal pinnae on one side, the rest of the frond confused, the rachis often excurrent, and hooked at the point; sometimes

the pinnæ becomes an enlarged branch; irregular and monstrous. Mucruſs, Dr. Allechin. (Nat. Print. Ferns, t. 41 A, 8). A ſimilar plant has been found at Black Head, Clare, by Mr. Barrington.

A very common ſpecies, found in the fiſſures of rocks, and more abundantly on old walls, generally diſtributed throughout Great Britain and Ireland; leſs frequent on the eaſtern ſide, and rare in the Highlands. It occurs throughout Europe from Finmark to Greece; and is found in Kaſhmir and Thibet, in the Caucasus, on the Ural and Altaï mountains; in Algeria; and in North America.

The Wall Rue grows beſt in fragments of old brick and mortar or in ſoil (ſandy loam), with which theſe are largely intermixed. It requires leſs moiſture and confinement than is generally congenial to this race of plants.

(8.) **Asplenium germanicum**, Weis. — Alternate-leaved Spleenwort.—Fronds linear oblong, broadest at the baſe, pinnate or ſub-bipinnate; pinnæ alternate, aſcending, narrow wedge-shaped, toothed at the apex, entire below, the lower ones three-cleft; ſori elongated central; induſium entire.

ASPLENIUM GERMANICUM, Weis. Newm. Hiſt. ed. 2, 265. Derk. Flor. Brit. iv. 77. Bab. Man. 414. Moore, Nat. Print. Ferns, t. 41 B.—A. ALTERNIFOLIUM, Wulfen, Jacq. Miſc. ii. 51, t. 5, f. 2. Sm. Eng. Bot. t. 2258; Eng. Fl. iv, 296. Hk. and Arn. Br. Fl. 573. Sowerby, Ferns, 56, t. 33.—A. BREYERII, Retzius. Schkuhr Crypt. 77, t. 81.—AMESIUM GERMANICUM, Newm. Hiſt. ed. 2, 10; ed. 3, 258; Append. vii.—SCOLOPENDRIUM ALTERNIFOLIUM, Roth.—PHYLLITIS HETEROPHYLLA, Mœnch.—TARACHIA GERMANICA, Presl.

Caudex perennial, tufted, ſhort, thickiſh, ſcaly, the ſcales ſmall narrow lanceolate dark-brown. ſtriato-reticulate. *Vernation* circinate. *Stipes* terminal and adherent to the caudex, ſlender, nearly often quite as long

as the frond, dark purplish-brown below, green above; and as well as the *rachis* smooth. *Fronde*s 2-6 inches high, narrow linear-oblong, somewhat broadest at the base, pinnate, sub-bipinnate, or, when very luxuriant,



[*Asplenium germanicum*.]

so that the pinnule is occupied by from two to five or six flabellately-forked nearly parallel venules. *Fructification* dorsal, occupying all the pinnæ. *Sori* linear-elongate, on two or three of the central venules, opening inwardly from each margin, at length confluent. *Indusium* narrow linear, the margin entire or somewhat wavy. *Spore-cases* obliquely obovate, brown. *Spores* roundish-oblong, roughish or muriculate.

bipinnate below, palish green, scarcely sub-coriaceous. *Pinnæ* alternate, ascending, remote; the lower ones largest and most developed: in small plants narrow-obovate or euneate, cut into two or three narrow lobes, the lobes simple or toothed, the apex unequally toothed, the base tapering into a kind of petiole: in larger specimens more distinctly stalked and sometimes decidedly bipinnate, with one distinct cuneate pinnule; upper pinnæ less lobed but unequally toothed at the blunt apex, falcately curved inwards; apex of frond formed of several coalescent narrow lobes. *Venation* consisting of from two to four series of furcate divisions of the vein which constitutes the vascular bundle of the footstalk. without a midvein, a venule extending to each of the teeth.

This is one of the rarest of our native ferns. It has been found recently near Culbone, Somersetshire, by Miss Payne; and was subsequently recorded from stations near Llanrwst and Llanberis, in North Wales; Borrowdale, and the mountains of Cumberland and Westmoreland; Kyoee Crags, Northumberlandshire: near Kelso, and Minto Crags, in the Lowlands: Dunfermline, Fifeshire, and Dnukeld, Perthshire. In Mr. Gray's herbarium there is a specimen of this fern, labelled as *A. septentrionale*, from Arthur's Seat. Mr. Hutchison states that it is abundant on rocks almost inaccessible near Airlie Castle, Forfarshire. The species is found sparingly in most of the countries of Europe.

A small evergreen fern, requiring careful management. If potted in porous soil, with the crown well elevated, and covered by a bell-glass in a shaded frame, or put in a moist shaded house or pit without a bell-glass, it will generally grow freely; but the plants are very liable to perish in winter. The safeguard is, not to allow water to reach their crowns, to keep their roots just moderately moist, and not to suffer the bell-glasses employed to protect them from the risk of being wetted, to injure them by retaining, at that season, a constantly damp atmosphere, which they will do, if they are kept permanently closed.

(9.) *Asplenium septentrionale*, Hoffmann. — Forked Spleenwort.—Fronds linear, simple or two-three-cleft, with linear cleft divisions; segments alternate, ascending, elongate and rachiform, with a few deep narrow distant teeth; sori few, elongate, often parallel; indusium entire.

ASPLENIUM SEPTENTRIONALE, Hoffmann. Hull. Sm. Eng. Bot. t. 1017; Id. Eng. Fl. iv, 295. Schkuhr, Crypt. 62, t. 65. Presl. Tent. 106, t. 3, f. 8. Hook. and Arn. Br. Fl. 572. Bab. Man. 415. Deak. Flor. Brit. iv, 74. Newm. Hist. 2 ed. 269. Sowerby. Ferns, 58, t. 34. Moore. Nat. Print. Ferns, t. 41 C — ACROSTICHUM SEPTENTRIONALE, Linnæus. Bolt. Fil. 12, t. 8 — A. LACINIATUM,

Gilib.—*PTERIS SEPTENTRIONALIS*, Smith.—*SCOLOPENDEIUM SEPTENTRIONALE*, Roth.—*BLECHNUM SEPTENTRIONALE*, Wallroth.—*ACROPTERIS SEPTENTRIONALIS*, Link. Fee, Gen. Fil. 77, t. 6 A, f. 1.—*AMESIUM SEPTENTRIONALE*, Newm. Hist. 2 ed. 10; 3 ed. 265; Id. App. vii.

Caudex: perennial, short, thick, tufted, often forming large dense masses, the scales small narrow-lanceolate dark-brown striato-reticulate; the fibres numerous, wiry branched. *Vernation* circinate. *Stipes* terminal and adherent to the caudex; dark brown-purple at the base, green above, as long as or longer than the fronds. *Fronds* 2 - 6 inches high; sometimes simple, and then either entire, or with a few distant marginal sub-



[*Asplenium septentrionale*.]

ulate teeth appearing as if split away from the main portion, or divided into two or three narrow-linear alternate ascending lobes; sometimes forked, with the two divisions either simply toothed or lobed on the same plan as the simple fronds; numerous, deep green, the simple ones narrow-linear-lanceolate, that is, narrow and tapering towards both ends, the forked ones indefinite in form, and apparently one sided, one of the divisions being smaller than the other, and looking like a lateral branch without a balancing branch on the opposite side; lobes sometimes so much separated as to look like distinct pinnae. *Venation* consisting of two or three series of fureate divisions of the vein which enters from the

base, one of the venues extending to each of the teeth, there being no midvein. *Fructification* dorsal. *Sori* linear elongate on the inner side of two or three of the few venules, and opening towards the centre. They are often opposite above, and contiguous almost as in *Scolopendrium*, in consequence of the narrowness of the parts; and being crowded with spore-cases, they become confluent, and appear to be universal as in *Acrostichum*, but these are mere similarities. *Indusium* linear entire. *Spore-cases* roundish-obovate, dark-brown. *Spores* roundish-oblong, slightly muriculate.

This rare evergreen species is found in the counties of Somerset, Devon, Carnarvon, Denbigh, York, Northumberland, Cumberland, Westmoreland, Roxburgh, Edinburgh, Perth and Aberdeen, which is the most northern certified habitat. It is not found at all in Ireland. It is plentiful in some of the mountainous tracts of central Europe, and extends from the north into Italy and Spain. In Asia it is found in Northern India, and in the regions of the Caucasus, the Ural and the Altai mountains. It is also found in New Mexico.

This and the preceding minute species require shelter, and constant moderate but not stagnant moisture. They grow well in pots, placed in cold close frames, but do not bear exposure.

Genus 8. **SCOLOPENDRIUM**, *Smith.*

HART'S TONGUE FERN.

Sori indusiate, linear, often elongated, approximate in parallel and opposite pairs; the *receptacles* on the anterior and posterior sides of venules belonging to adjacent fascicles of veins. *Indusium* linear, plane, membranaceous, each opening on its exterior side, (with reference to the fascicle on which it is placed), so that the twin sori open face to face. *Veins* forked from a central costa; *venules* direct, parallel, free, terminating in club-shaped apices.

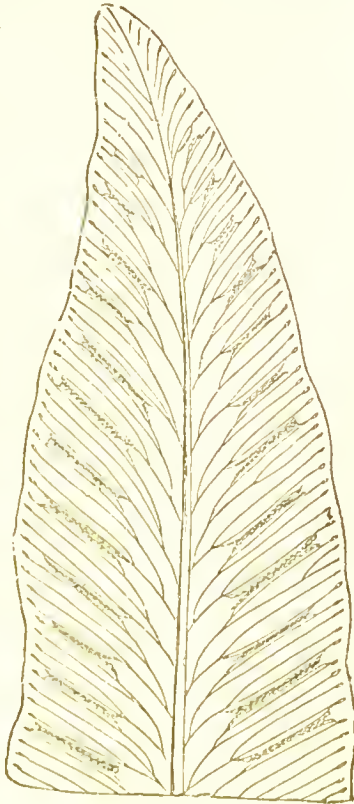
Fronds thick herbaceous, simple or pinnate, frequently undulate lobate or multifid. Caudex short, stoutish. erect or decumbent.—Name from *Scolopendra*, the name given to a genus of myriapods.

This beautiful fern is one of the most prolific of varieties of all our native species. It has been proposed to substitute the name *Phyllitis* for that of *Scolopendrium*. on the ground that the latter was originally applied as a specific appellation, and ought not to be used as a generic name; but such changes are quite unnecessary, and if followed out, must tend to bring the so-called law of priority in botanical nomenclature, into merited contempt. The normal condition of the veins in *Scolopendrium*, is, to lie in parallel-forked lines, quite free; but this arrangement is sometimes disturbed in varieties of abnormal character, in which the tissues become irregularly contracted, and the veins so far deranged that

here and there they unite, forming a kind of reticulate venation.

(1.) **Scolopendrium vulgare**, *Smith.*—Common Hart's Tongue Fern.—Fronds (normal) broadly linear or oblong strap-shaped, entire, the apex attenuate, the base cordate, smooth or slightly hair-scaly on the midrib beneath; stipes shaggy, with narrow membranous scales.

SCOLOPENDRIUM VULGARE, *Smith*, Mem. Acad. Turin v. 421, t. 9, f. 2; Eng. Bot. t. 1150; Eng. Fl. iv. 301. *Symons Syn.* 193. *Hk. and Arn. Br. Fl.* 574. *Deak. Flor. Brit.* iv. 78. *Bab. Man.* 415. *Newm. Hist.* 2. ed. 289. *Sowerby, Ferns* 50, t. 35. *Moore, Nat. Pr. Ferns* t. 42, f. 1. (small).—*S. OFFICINARUM*, *Swartz. Schkr. Crypt.* 78, t. 83. *Hook Gen. Fil.* t. 57 B.—*S. PHYLLITIS*, *Roth.*—*S. OFFICINALE*, *De Candolle.*—*S. LINGUA*, *Cavanilles.*—*ASPLENium SCOLOPENDRIUM*, *Linnaeus. Bolt. Fil.* 18, t. 11.—*A. ELONGATUM*, *Salisbury.*—*BLECHNUM LINGUIFOLIUM*, *Stokes.*—*PHYLLITIS SCOLOPENDRIUM*, *Newm. Hist.* 2 ed. 10; 3 ed. 271; App. vi.



[*Scolopendrium vulgare.*]

Var. polyschides: fronds linear strap-shaped, subtruncate at the base, the margin distinctly lobed and irregularly crenate; fertile.

SCOLOPENDRIUM VULGARE, *v.* POLYSCHIDES, Gray. Deak. Flor. Brit. iv. 79, fig. *a.* Sowerby, Ferns 60. Moore, Nat. Print. Ferns, t. 42, fig. 2.—S. *v.* ANGUSTIFOLIUM, of gardens.—PHYLLITIS POLYSCHIDES, Ray.

Var. cornutum: fronds strap-shaped, crenate or lobate, usually obtuse, the midrib excurrent below the apex, forming a horn projecting from the surface.

SCOLOPENDRIUM VULGARE, *v.* CORNUTUM, Moore, Nat. Print. Ferns, under t. 42.

Var. marginatum: fronds linear strap-shaped, truncate at the base, the margin inciso-lobate; epidermis of the under surface near the margins developed into a lobed excurrent or free membrane, which, as well as the frond itself, bears sori.

SCOLOPENDRIUM VULGARE, *v.* MARGINATUM, Moore, Handbk. 2 ed., 174; Id. Nat. Print. Ferns, t. 42, fig. 3.

Var. crispum: fronds strap-shaped, the margin undulated, the base strongly auriculato-cordate; usually barren.

SCOLOPENDRIUM VULGARE, *v.* CRISPUM, Gray. Deak. Flor. Brit. iv. 78. Sowerby, Ferns, 60. Moore, Nat. Print. Ferns, t. 42, fig. 4.—S. OFFICINARUM, *v.* CRISPUM, Willdenow.—PHYLLITIS CRISPA, J. Bauhin.

Var. multifidum: fronds irregular; sometimes lobate and plane at the apex; or more usually many times furcately divided, the divisions crisped; usually fertile, and often forming dense curly tufts.

SCOLOPENDRIUM VULGARE, *v.* MULTIFIDUM, Gray. Sowerby, Ferns, 61. Moore, Nat. Print. Ferns, under t. 42, in part. *s.* *v.* LOBATUM, Deak. Flor. Brit. iv. 79, fig. *b.* (plane lobate form). Sowerby, Ferns, 61.—S. *v.* DÆDALEUM, Deak. Flor. Brit. iv. 79,

fig. c. (multifid-crisped form.)—*S. OFFICINARUM*, v. *MULTIFIDUM*, Schkr. Crypt. 79. t. 83, fig. b.—*S. OFF. DÆDALEUM*, Willdenow.
—*PHYLLITIS MULTIFIDA*, Gerard. Ray.



[a. *Scolopendrium vulgare*;
b. var. *marginatum*.]

Var. ramosum :
fronds irregular, the apex densely multifid-crisped ; stipes ramose.

SCOLOPENDRIUM VULGARE, v. *RAMOSUM*, Gray. Moore, Handbk. ed. 2, 175, 178, fig. e.—*S. OFF. RAMOSUM*, Willdenow.

Var. laceratum :
fronds (on same plant) strap-shaped or broadly ovate ; the margin more or less undulate, deeply incisoblobate, the lobes unequally prolonged and sometimes crisped ; the apex multifid-crisped ; basal pair of lobes frequently much enlarged and multifid-crisped.

SCOLOPENDRIUM VULGARE, v. *LACERATUM*, Moore Handbk, ed. 2. 175 ; Id.

Nat. Print. Ferns, t. 42, fig. 10. Sowerby, Ferns 61.—S. v. SERRATUM, PALMATUM, and ENDIVLEFOLIUM, of gardens.

Caudex perennial, short, tufted, often decumbent, having lanceolate-acuminate pale-brown finely reticulato-venose scales, and numerous branched roots. *Vernation* circinate. *Stipes*, about one third the length of the frond, usually clothed with subulate contorted pallid scales, sometimes smooth, purplish-brown at the base; terminal and adherent to the caudex. *Fronde* $\frac{1}{2}$ -2 feet high or upwards, narrow elongate-lanceolate, or broadly linear, or oblong strap-shaped, normally entire or slightly sinuous on the margin, the apex more or less attenuated and acute, the base cordate; plane, fleshy or coriaceous, deep green. The varieties deviate in unnumbered forms by the laceration or undulation of the margin, the multifid dilatation of the apex, the branching (often repeated) of the stipes and midrib, the loss of the cordate lobes at the base, and the arrest of longitudinal development. *Venation* parallelo-furcate, *i. e.*, the veins which spring from the midrib are one two or three-times forked near their base, the veinlets extending side by side nearly to the margin, and terminating in club-shaped apices. *Fructification* dispersed over the back of the frond,* most abundantly upwards. *Sori* linear oblique, un-

* "The fructification of *Scolopendrium* is normally dorsal, as in the rest of the Polypodiaceæ." A very curious deviation from this law, however, occurs in some of the varieties, the sori being produced, often abundantly, on the upper as well as the lower surface. This sometimes happens from the elongation, as it were, of the sori of the underside, which extend to the margin, and return on the upper side, the sori in these cases being generally opposite the sinus of one of the marginal crenatures. But it frequently happens that a sori is produced on the upper side, distinctly within the margin, and where there is no corresponding sori beneath. Those varieties which have the margin crenated or lobed, are most liable to assume this abnormal suprasoriferous condition. The same deviation from the normal structure is known to occur in a few other ferns."—*Nat. Pr. Ferns*.

equal in length; twin, *i. e.*, growing in pairs, the two contiguous parallel sori borne on the posterior and anterior veinlets of adjacent fascicles of veins, and becoming confluent into one broad linear mass. *Indusium* also double, narrow, entire, at first conniving, the two at length opening face to face, by separating down the centre of the twin sorus, finally pushed back by the spore-cases. *Spore-cases* numerous, obovate, reddish-brown. *Spores* roundish or oblong, muriculate.

The *var.* POLYSCHIDES, has the fronds six inches to a foot long, narrower than the common form, somewhat pinnatifid, or deeply and irregularly crenately-lobed on the margin, the lobes crenately toothed; erect, more or less fertile. Veins here and there united. Sori short, oblong or linear, very irregular. Found near Bristol, and more recently also in Devonshire by the Rev. J. M. Chanter. There are several subvarieties.

The *var.* CORNUTUM is dwarfish, with coriaceous somewhat undulated fronds, which are crenate or deeply-lobed, the lobes scarcely-toothed; they usually terminate abruptly, the rachis not reaching the apex, but becoming excurrent on the upper surface in the form of a hook or horn; fertile and quite constant. Yorkshire, Mr. Thorn. A subvariety, SUBCORNUTUM, has stiff, erect, narrower, occasionally furcate fronds, with the excurrent horn from the under surface. This was noticed by Mr. Tait, in the nursery of Mr. Sang, of Kirkaldy.

The *var.* MARGINATUM, is the most remarkable and beautiful form yet known. Fronds erect, a foot or more in height, simple strap-shaped, the margin irregularly lobed, the under surface producing within the margin a disrupted or excurrent membrane, which is also lobed, so that the fronds have, as it were, a double margin. Both surfaces of this membrane and the under surface of the frond itself exterior to it, are soriferous. When less perfectly developed, the membrane is reduced to a longitudinal vein-like ridge. Found near Nettlecombe, in Somersetshire, by Mr. Elworthy, gardener to Sir W.

C. Treveylan. Other good forms have subsequently been found near Selworthy, by Mrs. Archer Thompson; in Devonshire, by the Rev. J. M. Chanter; and at Enys, Penryn, by Mr. G. Dawson. Besides these, numerous modified varieties have been discovered. A frond from the younger Linnæus, is in Sir J. E. Smith's herbarium.

The *var.* CRISPUM, is a very handsome frilled form, and quite constant. It is of the normal outline, but the margin is very much



[*S. vulgare* vars:—*a*, lobatum; *b*, polyschides; *c*, crispum.]

curled or undulated, and the base is auriculately-cordate. It is usually barren, but sometimes fertile. This very old variety is well-known as a garden plant. Recently it has been found in Yorkshire by Mr. Clapham; in Hants, by the Rev. W. H. Hawker; in

Denbigh, by Mr. Pritelhard, and in Guernsey and Devon, by Mr. Jackson. There are several subvarieties. A finely frilled one, sometimes fertile, *CRISPATUM*, was found by Mr. James, in Guernsey. Another less frilled, narrower, and constantly fertile, is *UNDULATUM*; and a lobed variation of this, well known in gardens, and quite constant, *UNDULATO-LOBATUM*, has been recently found in Sussex by Mr. Wollaston.

The *var.* *MULTIFIDUM* includes a host of minor varieties, agreeing, in being more or less multifidly divided at or



[*S. vulgare* vars.—*a*, *polyschides*;
b, *crispum*; *c*, *multifidum*;
d, *ramosum*.]

towards the apex; the divisions being sometimes plane as in the *lobatum* forms, and, in other cases occurring multifid-erisped, which is its more usual state, but of which every degree and gradation occurs. The forms are usually more or less fertile. Of the numerous subvarieties, some have been distinguished by name, and will be mentioned hereafter.

The *var.* RAMOSUM is a dwarf crispy *multifidum*, forking below the leafy part of the frond into two or



three branches, each of which resembles ordinary small fronds of that variety. It is constant, and one of the most ramified forms, the stipes, starting single from the caudex becoming divided as the limbs of a tree, the midrib of each branch breaking up into lobes almost innumerable. Recently it has been found by Mr. Jackson, in Guernsey, and by the Rev. J. Chanter, in Devonshire, but it is an old well-known form.

The *var.* LACERATUM is a curious variable and very handsome form. The fronds are sometimes short, almost as broad

[*S. vulgare laceratum.*]

as long, very blunt at the apex, irregularly and very deeply lobed in a pinnatifid way along the margin, the lobes crowded, imbricating and much undulated, more or less dilated at the apex, and multifidly forked. The lower pair of lobes are sometimes almost distinct, and much enlarged; and sometimes the lobes are so much developed as to produce an approach to the palmate form. Sometimes the fronds are much longer, strap-shaped, the margins inciso-lobate, most of the lobes prolonged into a narrow point. The apex is usually multifid-crested, or submultifid; and the base is sometimes hastate. It was found at Taunton by Mr. Young, and has probably been improved by multiplication from the spores. The same plants produce the various forms indiscriminately, the most usual being the dwarf broad dilated, and the longer inciso-lobate fronds.

Besides the foregoing, which are the most distinct deviations from the typical form, there are numberless and daily increasing varieties, of which the greater part are found to be permanent in their peculiarities. These, on account of the obvious differences presented to the eye, and their evergreen character, are deservedly great favourites among cultivators. We can only notice briefly the more remarkable as varieties of secondary rank:—

macrosorum: broader than *polyschides*, the margin more frilled, with an undulated series of bluntish teeth, and deeper occasional incisions; base truncate; sori short, broad; constant. Guernsey, Mr. James: two forms.

fissum: larger and broader than *polyschides*, usually blunt-ended, the margin deeply incised and undulate, as well as crenately toothed; veins slightly netted; sori oval-oblong; constant and handsome. Nettlecombe, Sir W. C. Trevelyan; Guernsey, Mr. Jackson; Denbigh, Mr. Pritchard.

obtusidentatum: dwarfish, narrow, the margin shallowly or sometimes deeply lobed, the lobes frequently separated by broad sinuses, and notched with uniform blunt

evident teeth; usually blunt-ended. Ilfracombe, Rev. J. M. Chanter.

crenato-lobatum: normal in size and outline, but the margin, especially in the upper half, is strongly crenato-lobate; sometimes subundulated; abundantly soriferous beneath, with elongate normal sori, and distinctly suprasoriferous, the upper sori often large and distinct; sometimes slightly marginate. Dorsetshire, Mr. Wollaston; Kent, Mr. Brent; Devonshire, Rev. J. M. Chanter; Guernsey, Mr. C. Jackson; and other places.

resectum: margin sinuate, the lobes irregular, entirely or obscurely crenate; rounded wedged-shaped at the base, the usual auriculate lobes altogether wanting. Sussex, Mr. Wollaston.

sinuatum: margin here and there contracted, or sinuate, the sinuosities irregular, entire or obscurely-crenate: venation confused in the contracted parts (as is usual in other varieties); sori normal. Sussex, Mr. Wollaston; several other places—Guernsey, Devon, Lancashire, and Yorkshire. Subforms of this, rather more crenately-toothed or incised have been called *salcbrosum* and *laciniatum*.

inaequale: fronds narrow, inciso-lobate and toothed, resembling *obtusidentatum*, but with here and there a broader lobe or branch; the apex often multifid. Ireland, Dr. Allchin.

rimosum: full-sized, the apex lobed, the margins subundulately crenate, or towards the apex finely crenate-lobate or dentate. Guernsey, Mr. James.

inops: narrowish, and dichotomously divided, the margins being irregularly lobed and crenate. Guernsey, Mr. James.

irregulare: some fronds normal, others irregularly lobate, with crenate or incised lobes, somewhat undulate, often forked, altogether irregular, and in the abnormal state sparingly fertile; sub-permanent. Guernsey. Mr. Jackson.

- spirale*: fronds dwarf, small, undulate, and twisted in a kind of cork-screw fashion. Guernsey, Mr. James.
- compositum*: a very elegant form, combining three distinct characters; the frond at the base is sagittate as well as undulately-cripsed, above this, it is marginate and toothed, and the apex again is distinctly and finely undulate-cripsed. Communicated by Mr. Parker, of Holloway.
- nudicaule*: fronds variable, short or elongate, marginate, corrugate, or undulate, the stipes and crown free from the usual hair-scales, and quite smooth. Ireland, Dr. Allehin. Another Irish form, *rugosum*, also found by Dr. Allehin, is similar in character, and almost without scales on the elongated stipes.
- abruptum*: midvein rarely reaching to the apex of the fronds, which are consequently blunt and rounded, otherwise normal; subpermanent. Sussex, Mr. Wollaston.
- variabile*: fronds of various shapes and sizes; sometimes consisting of two distinct kidney-shaped stalked lobes or branches; sometimes of one kidney-shaped distinct lobe, and a longer branch, or sometimes having only the latter, which is generally divided into one or two round blunt lobes (again indicating unequal bifurcation), and is occasionally lobed or multifid at the apex. Found in several places. A sub-variety, *bireniforme*, more constantly bears the kidney-shaped double fronds.
- striatum*: fronds obliquely streaked with yellowish green on a dark green ground, producing distinct variegation. Guernsey, Mr. James.
- subvariegatum*: fronds faintly transverse-streaked with white; various in shape, multifid or ramose, undulate, irregular, crenate or laciniate, generally slightly auricled, sometimes subsagittate. Dorsetshire, Mr. Wollaston.
- apicilobum*: dwarf, broad, the fronds broadest upwards, and deeply blunt-lobed at the apex. Guernsey, Mr. James.

lanceolum: small, the margins crenately-wavy, the frond, though cordately auricled at the base, narrowing downwards from about the centre. Guernsey, Mr. James.

sagittifolium: has the usual auricled part of the base elongated with a distinct midrib, and deflexed, resembling the barbs of an arrow. Two or three forms have been found. Sussex, Mr. Wollaston. Ireland, Dr. Allehin.

sagittato-cristatum: a handsome form of about the average size, the fronds sagittate at the base; somewhat undulated and dichotomously divided and somewhat crisped at the apex. Yorkshire, Mr. Clapham.

retinervium: fronds unevenly strap-shaped, or irregularly lobed, often submultifid, veins frequently reticulated. Ireland, Dr. Allehin.

pachyphyllum: large and stout, crenato-lobate, the apex somewhat multifid, and slightly marginate and contracted. Guernsey, Mr. James.

coriaceum: dwarf and remarkably thick, irregularly ineiso-dentate, generally abrupt, slightly marginate; sparingly and irregularly fertile, the sori produced on both upper or under surface or edge of the frond. Guernsey, Mr. James.

pocilliferum: large, irregularly-lobed, often forked, slightly supra-marginate, bearing on the under surface irregularly-placed cup-shaped or trumpet-shaped excrescences. Guernsey, Mr. James.

periferum: large and subnormal below, more or less crenately-lobed above, and there submarginate on the lower and corrugated on the upper surface; the apex blunt, and puckerred into a pouch or pocket. Ireland, Dr. Allehin.

muricatum: fronds normal in outline, coriaceous, the margin here and there lobed or slightly sinuous, the tissue of the upper surface sunk between the veins, so as to produce a more or less regular ridge and furrow surface, the ridges here and there bearing raised points. Guernsey, Mr. James.

- jugosum*: soriferous veins thickened so as to produce a series of ridges or leafy sorus-like excrescences on the upper surface. Two or three forms have been found. Guernsey, Mr. James and Mr. Jackson.
- papillosum*: upper surface bearing near the margin a series of distinct wart-like excrescences, which form a kind of border to the fronds; not constant. Guernsey, Mr. Jackson.
- sculpturatum*: normal or nearly so in outline, the upper surface about opposite the sori uneven, as if carved or irregularly cut away. Guernsey, Mr. James; Somersetshire, Mr. Elworthy.
- imperfectum*: fronds narrowish, with a somewhat flexuous outline, as though the margin had been irregularly cut away as far in as the sori; the base truncate, not marginate. N. Lancashire, Mr. Wollaston.
- siciforme*: fronds narrowish, with a wavy or flexuous outline, unequally crenulate, and obscurely though continuously marginate beneath; scarcely auricled; suprasoriferous. Guernsey, Mr. Jackson.
- submarginatum*: fronds various, often bifurcate or ramose, partially marginate, the more perfect crenatolobate; the less perfect sometimes lobate on one side the rachis, narrowed and trebly dentate on the other, or truncate and obliquely cornute, or abortively subulate consisting only of a short scaly rib. Found in several places. One or two Guernsey forms, called *constrictum*, are allied to this; they are dilated at the base and apex, and considerably often evenly contracted between.
- proliferum*: a dwarf monstrous variation from *marginatum*; fronds very small, oblong or truncate, often cornute or subulate without any lamina, all, except the latter, irregularly verrucose above, and strongly marginate beneath, the excurrent membrane very large in proportion; it is bulbiferous, but not soriferous.
- fimbriatum*: a narrow strongly marginate form, allied

to *marginatum*, very deeply lobed or toothed at the margin, the larger lobes crenate, forming a frilled edge; fronds sometimes very narrow. Guernsey, Dr. Allehin.

bimarginatum: fronds longish, narrow, with the excurrent membrane beneath, the upper surface gathered up into irregular little nodules, the tissue surrounding some of the lower veinlets forming remarkable distinct calyciform expansions, with trumpet-shaped mouths. Rotherham, Mr. H. Hayling. Similar forms have been sent us by Mr. Cobb, from Breeon, and Mr. Elworthy, from Somersetshire.

supralineatum: has an excurrent membrane or epidermal ridge on the upper instead of the lower surface, affecting the whole or portions of the frond, the margin generally irregular where the disturbance of the tissue occurs. Found in several places, under several modifications of form.

supralineato-resectum: fronds lanceolate, tapered below not at all cordate, like *resectum*, and in addition supralineate. Guernsey, Mr. James.

multiforme: remarkable for its variableness of form; fronds often multifid or ramose, sometimes merely cornute or subulate, marginate, supralineate, corrugate, laciniate, or depauperate; permanent. Guernsey, Dr. Allehin.

chelæfrons: a pigmy variety; fronds bifurcate at the apex, the divisions inflexed, resembling a crab's claw. the exterior margin of the forked portion larger, even, the interior erosely erenate or dentate. Chislehurst, Mr. Wollaston.

crista-galli: fronds multifid-crisped at the apex, the tufts not dilated or spreading, but complicatedly inflexed in a spiral fashion, forming very elegant and often massive crests. Dorsetshire, Mr. Wollaston.

digitatum: one of the more compound of the multifid forms; fronds several times divided below the apices, all densely multifid-crisped; the primary divisions all

lie in one plane, so as to form a flattish frond. A sport from this, raised by Mr. Wollaston, called *depauperatum*, produces usually only subulate ribs instead of fronds, one or two digitate fronds only being produced during the season.

glomeratum: has no plane or flat portion, the short fronds, consisting of a series of repeated furcations, resulting in a semi-globular crispy mass, about three inches high. Jersey, M. Picquet.

flabellatum: a fine variety with short fronds, scarcely crispy, but frequently divided by contiguous furcations, the divisions nearly flat, forming a fan-shaped head, six or eight inches across. Somersetshire, Mr. Elworthy.

cristatum: several sub-forms of this occur; it is nearly allied to *digitatum*, and is one of the more divided of the multifid class, producing larger tasselled heads, with the apical divisions taper-pointed or angular, and with a tendency to elongate.

lacerato-marginatum: a dwarf sport from *laceratum*, raised by Mr. Sim; it resembles the small broad form of *laceratum*, but is smaller, and marginate.

ramo-marginatum: a beautiful ramose multifid-erisped form, with the tassels more or less distinctly marginate; lower part of the frond much narrowed, with a dilated base; apex forming a very large spreading tassel. Raised from spores by Mr. Clapham.

ramosum majus: fronds large, normal or nearly so, sub-undulated, two or three united by their stipes into one compound or ramose frond. An accidental seedling raised by Mr. Clapham.

This fine evergreen species, one of the most beautiful for cultivation, on account of the interesting varieties of form it presents, is one of our commonest ferns, being generally dispersed over the United Kingdom, extending northwards to Orkney and Shetland, but in its northern localities keeping near the coast. It occurs on walls and ruins, on hedge-banks, in thickets, and in the interior of

wells, in the latter situation acquiring extraordinary vigour. Ireland, the Channel Islands, and the western and south western portions of England, are the most prolific of remarkable varieties. The species is found over Europe, from the Baltic to the Mediterranean, being met with in Greece, as well as in Italy and Spain. It is found in Algiers, in Madeira, and the Azores. In Asia, it occurs on the Siberian side of the Ural mountains: in Turcomania; in Asia Minor, at Erzeroum; and in Northern Persia. It is found, though rare, in the northern United States. The Mexican *S. Lindenii*, and the S. European *S. Hemionitis* and *S. sagittatum* can scarcely be considered more than varieties of *S. vulgare*, some of our native varieties of which are still more peculiar.

The species is said to have been formerly used, boiled in red wine, as an astringent in diarrhœa and hæmorrhage; and also as an ointment for healing wounds and ulcers, or, according to Lightfoot, for burns and scalds.

This very distinct-looking fern is highly ornamental on rock-work, from which neither the species, nor its varieties, should be absent. Indeed, the great variety it affords, together with its evergreen habit, render it one of the most valuable of all ferns for the hardy fernery. It is, moreover, a very free growing plant, thriving in almost any situation, though acquiring its greatest perfection in shady, humid places, and beyond the influence of smoke. It is increased by dividing its crowns, or by cuttings from the succulent bases of old or decayed fronds.

Genus 9. **CETERACH**, Willdenow.

SCALE FERN.

Sori linear oblong, obsoletely indusiate; the *receptacles* lateral, usually anterior, *i. e.*, in reference to the segment, (posterior in the basal sori). *Indusium* obsolete: "linear narrow plane, sometimes obsolete," (*Hook.*): "thin, narrow," (*Fée*). *Veins* obscure, forked from a central costa, parallel and soriferous below, anastomosing irregularly near the margin, the basal anterior *venule* (*i. e.*, anterior in reference to the frond), soriferous on its anterior side.

Fronde pinnatifid eoriaceous, densely clothed beneath with membranous imbricated scales. Caudex short erect.—Name modified from *Chetherak*, a name said to be applied to this plant by the Arabian and Persian physicians.

This genus is anomalous. Its affinity is with the *Aspleniceæ* on account of its lateral sori, but the sori in the common species have no evident indusia, and hence might be taken to belong to the *Polypodiaceæ*, but for the position of the spore-cases.

(1.) **Ceterach officinarum**, Willdenow.—Common Scale Fern.—Fronde eoriaceous, narrow-lanceolate, sinuato-pinnatifid, often pinnate below; segments oblong obtuse, entire or sinuately lobed, densely scaly beneath.

CETERACH OFFICINARUM, Willdenow. Hook. Gen. Fil. t. 113, A. Deak. Flor. Brit. iv, 81. Bab. Man. 415. Hook and Arn. Brit. Fl. 566. Newm. Hist. 2 ed. 293. Sowerby, Ferns, C2, t. 36. Moore, Nat. Pr. Ferns t. 43 A. Fée, Gen. Fil. 206. t. 30 A, fig. 2.—ASPENIUM CETERACH, Linnæus. Boh. Fil. 20, t. 12 (bad).—A. SINCATUM, Salisbury.—SCOLOPENDRIUM CETERACH, Symons. Sm. Eng. Bot. t. 1244; Eng. Fl. iv. 302.—VITTARIA CETERACH *a*, Bernhardt.—GYMNOPTERIS CETERACH, Bernhardt.—GRAMMITIS CETERACH, Swartz. Schkubr. Crypt. 186, t. 7 *b*.—GYMNOGRAMMA CETERACH, Sprengel. Presl. Tent. 219. t. 9, fig. 10 (veins ineor).—BLECHNUM SQUAMOSUM, Stokes.—NOTOLEPEUM CETERACH, Newm. Hist. 2 ed. 9; 3 ed. 277; App. v.

Caudex perennial, short, tufted, furnished with ovate-lanceolate finely reticulatovenose dark brown scales, and branched fibrous roots. *Vernation* circinate. *Stipes* short; terminal and adherent to the caudex; dark coloured below, having numerous ovato-lanceolate peltately attached



[*Ceterach officinarum*.]

pale tawny scales, which are beautifully venose, with close black reticulations. *Fronde*s numerous, 1-8 inches long, coriaceous, deep green and smooth above, densely clothed beneath with ovate-acuminate slightly ciliated tawny reticulately-venose closely-imbricated scales; linear-lanceolate, deeply pinnatifid, often pinnate below. *Lobes* oblong obtuse, sessile and adnate by their whole base when distinct, more usually dilated on both sides, and connected at the base, the margins ornamented with projecting scales. *Venation* indistinct, consisting of a sinuous midvein entering the lobe from near the lower angle, and giving off close to the base, on its anterior side, a vein which is several times forked; the rest of the veins are alternate, and two or three times forked. Beyond the second furcations, the branches anastomose, and form two or three series of small areoles near the margin, the ultimate marginal veinlets being sometimes free, sometimes united. *Fructification* produced over the whole under surface. *Sori* linear oblong, borne on the anterior side of the anterior venules above the first fork, except in the case of the lowest anterior vein, which is frequently bisporiferous, one sorus being as usual on the anterior side of its anterior venule, the other on the posterior side of its posterior venule; all at first hidden by the scales. *Indusium* obsolete, described as an "erect white membranous ridge." *Spore-cases* roundish obovate. *Spores* roundish or somewhat oblong, muricate.

One or two slight variations have been noticed:—

crenatum: has the margins of the lobes distinctly crenato-sinuate, and being usually of large size, is perhaps the result of luxuriant growth. Found in many localities.

depauperatum: fronds irregularly sinuate-pinnatifid, some bifurcate, some acuminate, some cornute, the segments much depauperated, occasionally almost wanting. Ireland, Dr. Allchin, and Lieut. Col. Buchanan.

This pretty evergreen plant, found growing on old walls, ruins, rocks, and similar situations, very rarely

epiphytal, is generally distributed over England and Wales, and is abundant in Ireland, somewhat rare in Scotland, apparently absent from the Northern and Western Isles, but found in the Channel Isles. It extends from Scotland, which is apparently its northern limit, through the middle and south of Europe, to Italy, Spain and Greece,

In Asia it is found on the Ural mountains, in the Caucæus and Tauria, in Armenia and North-West India. In Africa it occurs at Algiers; in Madeira, the Azores, and the Cape de Verd Islands; and according to Kunze, it is found in Brazil. We think the much larger Canary Island plant distinct.

This is a free-growing species under cultivation when established. It dislikes close confined, damp, and requires a very porous soil; in



[*C. officinarum*.]

fact, a good proportion of old mortar and broken freestone, should be mixed in the compost in which it is planted. It may be grown either in pots, or planted out on rockwork; and is not very particular as to the situation. It is propagated by dividing the plants.

Genus 10. **BLECHNUM**, *Linnaeus*.

HARD FERN.

Sori indusiate, linear, continuous or rarely interrupted, on a transverse *receptacle*, approximate to the costa; central, or sometimes sub-marginal by the contraction of the fronds. *Inclusium* linear, opening along the inward side. *Veins* (sterile): simple or forked from a central costa; *venules* direct, free, thickened at the apex; in the fertile fronds combined near the base or within the margin by the receptacle.

Fronds simple, pinnatifid or pinnate; the fertile sometimes more or less contracted. Caudex short, erect, or producing elongated creeping stolones.—Name latinized from *blechnon*, a Greek name for a fern.

(1.) **Blechnum Spicant**, *Roth*.—Common Hard Fern.—Fronds dissimilar, linear-lanceolate; the barren prostrate pectinato-pinnatifid, often pinnate below, with oblong linear flat lobes; the fertile contracted erect, taller, pinnate, with linear acute contracted pinnæ, having reflexed margins.

BLECHNUM SPICANT, *Smith*, *Mem. Acad. Turin*, v. 411. *Withering*, *Roth*, *Newm. Hist.* ed 3. 17. *Moore*, *Nat. Print. Ferns*, t. 43 C.—*B. boreale*, *Swartz*, *Sm. Eng. Bot.* t. 1159; *Id. Eng. Fl.* iv. 303. *Schkuhr*, *Crypt.* 102, t. 110. *Hk. and Arn.* *Br. Fl.* 575. *Bab. Man.* 415. *Sowerby*, *Ferbs* 64, t. 37.—OSMUNDA SPICANT *Linnaeus*, *Bolt. Fil.* 8, t. 6.—*O. borealis*, *Salisbury*—ONOCLEA SPICANT, *Hoffmann*.—ASPLENIUM SPICANT, *Bernhardi*—STRUTH-

IOPTERIS SPICANT, Weis.—ACROSTICHUM SPICANT, Villars.—A. NEMORALE, Lamarek.—LOMARIA SPICANT, Desvauz. Deak. Flor. Brit. iv. 51. Newm. Hist. ed. 2, 89—L. BOREALIS, Link.—STEGANIA BOREALIS, R. Brown.—SPICANTA BOREALIS, Presl.

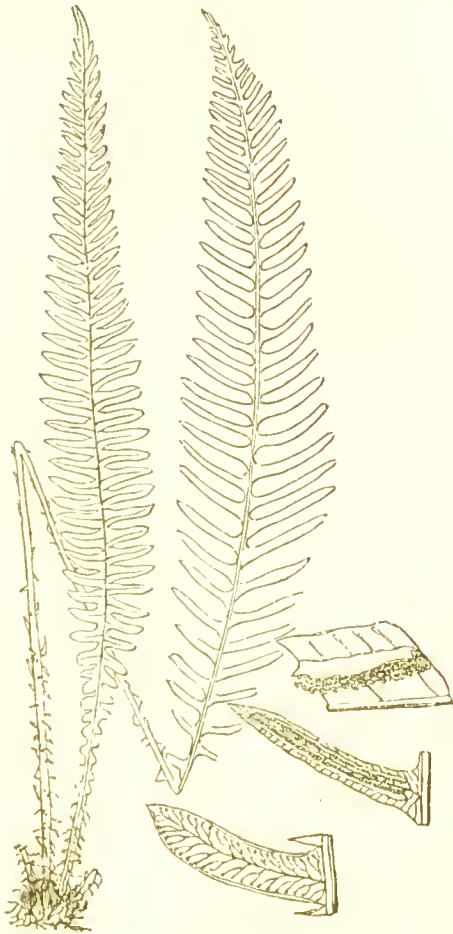
Var. ramosum: fronds divided, the apices of the divisions densely unilobed crisped, forming close convex tufts.

BLECHNUM SPICANT *v.* RAMOSUM, Kinahan in litt. Id.; Phytol. iv. 892. Moore Handbk, ed. 2, 186, 188; Id. Nat. Print. Ferns, under t. 43 C.

Var. multifurcatum: fronds divided, the apices of the divisions repeatedly forked, the ultimate sub-divisions acutely prolonged, forming a flat, spreading tuft.

BLECHNUM SPICANT, *v.* MULTIFURCATUM, Moore, Nat. Print. Ferns, t. 43 C, fig. 3.

Caudex perennial, stontish, erect or decumbent, scaly, with narrow lanceolate acuminate, deep tawny-brown scales, and having stout branched roots. *Vernation* circinate. *Stipes* (barren fronds) usually short, but sometimes 4-5 inches long, densely scaly at the base, and with a few scattered scales which are narrow upwards; dark purplish-brown; terminal and adherent to the caudex; those of the fertile fronds longer, dark coloured; the *rachis* more distinctly purple. *Fronds* of two kinds. *Sterile* fronds 6-8 to 12-18 inches long, dark green, usually spreading or prostrate, linear-lanceolate, pectinately-pinnatifid; *lobes* linear oblong, flat, somewhat falcately curved forwards, dilated and contiguous at their base, bluntish or acute at their apex, the margin entire or rarely, when very vigorous, obscurely lobed; the lower ones small, roundish, the upper confluent into a lanceolate point. *Fertile* fronds of the same form, taller, growing from the centre of the tuft, erect, 1-2 feet high, pinnate below. *Pinnae* and *segments* linear acute, contracted to about half the width of the barren segments, the lower ones distant, the upper more contiguous, and then dilated and confluent at the base. *Fronds* intermediate



[Blechnum Spicant.]

in form, sparingly fertile, and not contracted, are sometimes produced. *Venation* (lobes of barren fronds) consisting of a stout midvein, producing once or twice forked veins, the venules terminating within the margin in a club-shaped head; that of the fertile fronds reduced to a series of veins, seldom having space to become forked, but becoming lost in the continuous longitudinal sporangiferous receptacle, which runs parallel with and very near to the midvein; when less contracted, the venules are seen to be continued towards the margin, exterior to the receptacle. *Fructification* on the back of the fertile fronds, and occupying nearly their whole under surface. *Sori* indusiate, linear, extending on each side the midrib the whole length of the narrow pinnae, over which they soon become confluent; the *receptacle* continuous, longitudinal. *Indusium* a narrow linear scariose membrane attached along the exterior side of the receptacle, within the margin of the frond: but sometimes, from the excessive contraction of the pinnae, appearing almost marginal. *Spore-cases* nearly globose. *Spores* roundish-oblong or ovate, slightly angular and punctate.

The *var.* RAMOSUM has the rachis, rarely the stipes, divided into two or three branches, each branch being normal below, and, at the apex, divided into a large multifidly-crisped, compact, blunt-ended tassel. It is very rare. Ireland: Upper Lough Breagh, Wicklow. Dr. Kinahan; Eriffe, Mayo, Captain Eden; Windermere, Mr. I. Hudhart.

The *var.* MULTIFURCATUM has some fronds branched near the base, others only multifidly divided at the apex; the lateral branches are often smaller than the fronds, but both are many times forked at the apex, the segments irregular in form, spreading, and some of them lengthened out to a point, the whole forming flat spreading, not crispy tufts. Penryn, Mr. F. Symons.

Several other varieties occur, of which the most important are:—

lanceifolium: fronds entire in the upper part nearly or quite half way down, obtusely lobate or distinctly crenate below, narrow, $\frac{1}{4}$ to $\frac{1}{2}$ inch wide; fertile fronds from $\frac{1}{8}$ to $\frac{1}{2}$ inch wide. similar in form, sometimes with only a few small imperfect lobes developed; very rare. Tunbridge Wells, Mr Wollaston.



[B. Spicant vars: a. ramosum; b. multifurcatum; c. heterophyllum.]

heterophyllum: fronds partly normal, but during each season others are produced in which the lobes are either wholly or partially, all or a portion only, reduced in length, often becoming semi-circular, and

inciso-dentate; constant to this irregularity of growth. Tunbridge Wells, Mr. Wollaston.

strictum: lobes of the fronds irregularly shortened, somewhat wavy, bluntly toothed or inciso-dentate; permanent and rare. Westmoreland, Miss Beaver and Mr Clowes. Ireland, Dr. Allchin.

serratum: sterile and broad fertile fronds, crenato-serrate, often deeply so; a luxuriant form. Tunbridge Wells, Mr. Wollaston.

bifidum: lobes of the fronds more or less uniformly bifid, subpermanent. Found in several localities.

fissum: rachis split down at the apex, the lobes on the exterior sides normal, those of the interior sides rudimentary; apices sometimes multifid. Tunbridge Wells; tolerably constant.

multifidum: apices of fronds dichotomously multifid; many forms occur, some of which are constant.

crispum: apex of the fronds dilated, rarely much divided, forming a small wavy tassel. Ireland, Dr. Kinahan; Tunbridge Wells, Mr. Wollaston.

trinervium: fronds trifoliate, as it were, when in its most marked condition; the fronds are, however, sometimes multifid or crisped; the lobes bifurcate. Ireland, Dr. Kinahan.

A common evergreen and very handsome species, occurring in stony and heathy places, preferring moisture, and generally distributed over the United Kingdom. It is also met with throughout Europe, from Sweden to Spain, Sicily and Crete. In Asia it is found in the Russo-Caucasian provinces, in Kamschatka and Sitka. In Africa, it grows in the Canary Islands, Teneriffe, Madeira, and the Azores, and at the Cape of Good Hope; while, probably, the Brazilian *Lomaria Sellowiana* and a Chilian species are not specifically distinct.

This plant is of easy culture, and extremely hardy forming a fine rock plant or pot specimen, and luxuriating in swampy boggy places. It is easily obtained, and propagates readily by division of its crowns.

Genus 11. **PTERIS**, *Linnaeus*.

BRACKEN.

Sori indusiate, marginal, $\frac{1}{2}$ linear, continuous or interrupted; the *receptacles* linear transverse, uniting the apices of the veins. *Indusium* of the same form, membranaceous. *Veins* simple or forked from a central costa; *renules* free.

Fronde varying from pedate to decompose, often large, herbaceous or coriaceous. Rhizome short erect, or creeping, sometimes much elongated.—Name, the Greek *ptēris*, applied to some kind of fern.

(1.) **Pteris aquilina**, *Linnaeus*.—Common Brakes or Bracken.—Fronde bi-tripinnate, pubescent beneath; primary pinnae in pairs; ultimate divisions (pinnulets) sessile, entire or pinnatifid, the terminal one longer; rhizome creeping, subterraneous.

PTERIS AQUILINA, *Linnaeus*. *Bolt. Fil.* 16, t. 10 (bad). *Sm. Eng. Bot.* t. 1679; *Eng. Fl.* iv, 305. *Hook and Arn. Br. Fl.* 575. *Bab. Man.* 415. *Deak. Flor. Brit.* iv, 54. *Newm. Hist.* ed. 2, 93. *Sowerby, Ferns*, 67, t. 38. *Moore, Nat. Prnt. Ferns*, t. 44. *Schkuhr, Crypt.* 87, t. 95-6. *Fée, Gen. Fil.* 126, t. 11 A, fig. 3 (stipes).—*P. BOREALIS*, *Salisbury*.—*P. FEMINA*, *Gray*.—*P. CAUDATA*, *Link*, not *Lin*.—*P. BREVIPE*, *Tausch*.—*P. NUDICAULIS*, *Guldenstadt*.—*P. RECURVATA*, *Wallich*.—*P. FIRMA*, *Wallich*.—*P. TERMINALIS*, *Wallich*.—*P. WIGHTIANA*, *Wallich*.—*P. EXCELSA*, *Blume*.—*P. LANUGINOSA*, *Bory*.—*P. VILLOSA*, *Fée*.—*P. CAPENSIS*, *Thunberg*.—*ALLOSORUS AQUILINUS*, *Presl*.—*A. TAURICUS*, *Presl*.—*A. RECURVATUS*, *Presl*.—*A. LANUGINOSUS*, *Presl*.—*A. VILLOSUS*,

Presl.—*A. HOTTENTOTTUS*, Presl.—*CINCINALIS AQUILINA*. Gle-
ditsch.—*EUPTERIS AQUILINA*, Newm. Phytol. ii 278; App iii;
Hist. e. l. 3, 23.



[*Pteris aquilina* : *a*, vera; *b*, integerrima; *c*, multifida]

Rhizome perennial, as thick as one's little finger, subterraneous, creeping extensively, black and somewhat velvety externally, white succulent and starchy within. *Vernation* circinate; the rachis in an early stage bent down abruptly close against the stipes. *Stipes* lateral, distant and adherent to the rhizome, spindle-shaped, black and velvety at the base; above yellowish-green, pubescent when young, afterwards smooth, sharply angular. The ends of the vascular bundles, as seen in the transverse section, present a fanciful resemblance to the imperial eagle, whence the specific name. *Fronde* variable in size, outline, and composition, deep green; in poor soils $\frac{1}{2}$ -1 $\frac{1}{2}$ foot high, in more favourable localities from 3-4 to 8-10 feet or more in height; the smaller fronds nearly triangular, and the lower pair of branches only being well developed they appear three-branched; the larger fronds are more elongated, and consist of a series of branches in pairs successively developed; the smaller are bipinnate, the larger fronds tripinnate. *Primary pinnæ* ovate or oblong-ovate, opposite, often distant; secondary narrow lanceolate, or narrowing from a broad base, opposite or alternate, contiguous, bluntish, or sometimes caudate. *Pinnulets* sessile, entire or sinuate, oblong and adnate by their whole breadth, or more ovate pinnatifid and then with a narrower attachment, blunt at the apex, smooth above, hairy beneath, the pinnatifid ones with blunt, linear oblong, or shorter triangular lobes. *Venation* (entire pinnulets), consisting of a stoutish mid-vein, producing veins two or three times forked, the venules extending to the margin; in pinnatifid venules, the veins become secondary midveins to the lobes, and give off a series of once or twice forked veins; in these latter, the lowest branches right and left of the secondary midveins frequently meet and unite, forming a series of costal areoles; along the edges of the fertile pinnules extends a longitudinal submarginal vein, which becomes the receptacle. *Fructification* abundant on the back of the fronds, marginal. *Sori* linear, continuous, indusiate, mar-

ginal. *Inclusium* linear, continuous, consisting of a thin whitish fringed membrane, growing from the outer edge of the receptacle, and folded inwards over the spore cases; besides this there is beneath the spore-cases, and growing from the inner edge of the receptacle another similar membrane, also fringed with small jointed hairs. *Spore-cases* roundish obovate. *Spores* round, oblong or angular, muriculate.

Two forms commonly occur; in one, which we call *vera*, the secondary pinnules are more or less deeply pinnatifid; in the other, *integerrima*, they are almost or quite even, or entire on the margin. One or two other varieties have been noticed:—

crispa: margin of the pinnulets entire and undulate or crenate and corrugately waved. Occasionally found.

multifida: several very marked multifid forms have been found, sometimes in abundance; but they are not constant when removed. The apices of the fronds and primary pinnae, or those of the secondary pinnae, either together or separately, are more or less dichotomously forked, sometimes producing large tufts of branchlets. Kent, Devon, Guernsey.

This plant, the *Filix femina*, or female fern of old authors, is annual-fronded, and the most common of our indigenous ferns, being found abundantly on every description of soil, except chalk, often entirely occupying the surface in waste places, woods, or thickets, occurring all over Great Britain, and plentiful in Ireland and the Channel Isles. It is common over Europe, and seems to be so in most parts of the world; many exotic species, so called, having no satisfactory distinctions. In Asia, it is found in China; in Sitka, Kamtschatka, and



[*P. aquilina*.]

Siberia; all over India; in the Malayan and adjacent islands. In Africa, it occurs at the Cape of Good Hope, Mauritius and Bourbon, Sierra Leone, Senegambia and Fernando Po; Algiers, Teneriffè, and Madeira. In America, it has been found in California, Guatemala and North-west Mexico, Veraguas (narrower), Sandwich Isles (smaller), and in several parts of North America.

“The *Pteris lanuginosa* of Bory, under which Agardh includes *P. capensis* of Thunberg, is not distinguishable from *P. aquilina* by its approximate segments and the nodose base of the rachides, on which Agardh depends, for we find both these peculiarities strongly marked in specimens from Wicklow and Hampstead; the woolliness of the surface and of the rachis—the latter almost the only difference it presents—is too variable and unimportant a feature to be much depended on; besides which *lanuginosa* itself sometimes has the segments distinct, which is said to be the distinguishing mark of *aquilina*. Hence we are unable to separate *P. lanuginosa* even as a variety, though its forms are probably analogous to those undivided British forms we have called *integerrima*. In like manner the *P. recurvata* of Wallich, under which is included the *P. firma* and *P. Wightiana* of Wallich, and the *P. excelsa* of Blume, offers no distinguishing characters, but again most accords with the states of *integerrima*.”—(*Nat. Print. Ferns.*)

The Bracken is applied to various uses. The underground succulent stems abound in starch, which has been used in different countries to make a kind of bread. They have also been employed in brewing ale. Both the underground stems in winter, and the tender shoots in spring, are, when boiled, a nutritious food for pigs; and the young tender blanched shoots have been recommended as a vegetable. The succulent young fronds make an excellent green manure. The dried fronds make a very durable thatch, for which purpose they should be gathered in October, when perfectly pliant; they are, besides, valuable as litter, and form one of the best of all por-

tecting materials in gardens, besides being much used for packing purposes. The plant abounds in alkali, which is turned to account in the manufacture of soap and glass. The ash of the matured plant mixed with enough water to allow of its being worked up into balls, then dried, and, when required for use, heated to a red heat, and thrown into water, produces, in an hour or so, a strong ley, so that it may be used in the wash-house to economise soap. The plant is astringent, and has been employed for the purpose of tanning kid and chamois leather. The Bracken is said to have had, among the ancients, a medicinal reputation, but is not now esteemed, though the rhizome is sometimes used in the form of powder, as a vermifuge.

No plant can require a less amount of cultivation when it is established, but there is a some imaginary difficulty about transplanting it; and it is even said, on high authority, to be killed by transplantation. There is, however, no difficulty in transplanting it, if the rhizome is removed during winter, while dormant; on the contrary, it is sometimes found troublesome in soils collected for potting purposes. Certainly, none other of our native species are capable of forming such a scene of picturesque beauty as may sometimes be observed in the case of this species, growing eight or ten feet in height in the hedge-banks of a damp shady lane, its expansive fronds gracefully arching out from among the brush-wood which conceals as well as supports their base. For such damp half-shady positions in artificial wilderness scenery, for the margins of plantations in park scenery, and as cover in more open plantations, this fern, common though it be, deserves to be recommended. It will grow freely in any temperature; and though occurring in exposed situations, is very much finer in damp shady places.

Genus 12. **ADIANTUM.** *Linncæus.*

MAIDENHAIR FERN.

Sori indusiate, transverse marginal, reniform oblong or linear, continuous or interrupted; the *receptacles* seated on the under surface of the indusium, and proceeding from the apices of two or more converging venules *Indusium* (inverted membranaceous marginal lobe), venulose sporangiferous beneath on the venules; the receptacles, therefore, resupinate, *Veins* flabellately forked, or forked from a medial costa, the furcations repeated; *venules* parallel, free, continued in the fertile parts into the indusium.

Fronds coriaceous or herbaceous, simple, pinnately or pedately divided, or supra-decompound; pinnæ often articulated, usually dimidiate, the costa wanting. Stipes and rachis ebeneous. Rhizome tufted, or short creeping.—Name from the Greek *adiantos*, dry.

(1.) **Adiantum Capillus-Veneris, Linncæus.**—Common Maidenhair.—Fronds bi-tri-pinnate; pinnules alternate, glabrous, membranaceous, obliquely and broadly wedge-shaped, or roundish with a truncate base, attached by capillary stalks, the superior margin lobed, the sterile lobes dentate, the fertile obtuse or truncate; sori transversely oblong, often occupying the whole width of the lobes; stipes and rachis ebony-black, smooth, glossy.

ADIANTUM CAPILLUS-VENERIS, Linnæus. Bolt. Fil. 24, t. 29. Sm. Eng. Bot. t. 1564; Eng. Fl. iv. 307. Hk and Arn. Br. Fl. 575. Bab. Man. 416. Deak. Flor. Brit. iv. 49. Newm. Hist. l. Moore, Nat. Print. Ferns, t. 45. Sowerby, Ferns 70, t. 40. Jacq. Misc. ii. 77, t. 7.—A. CAPILLUS, Swartz. Link.—A. CORIANDRIFOLIUM, Lamarck, Ill. t. 870, fig. 1.—A. FONTANUM, Salisbury.—A. DEPENDENS, Chapman.—A. REPANDUM, Tausch.—A. AFRICANUM, Brown.—A. TRIFIDUM, Willdenow.—A. MORITZIANUM, Link.—A. CUNEIFOLIUM, Stokes.

Rhizome perennial, slowly creeping, as thick as a small



[*Adiantum Capillus-Veneris*.]

quill, densely clothed with dark-brown, narrow lanceolate, acuminate, striately-venose scales, and having wiry branched shaggy roots. *Vernation* circinate. *Stipes* about as long as the fronds, having a few scattered scales near the base; lateral and adherent to the rhizome, and, as well as the *rachis*, slender, blackish-purple, smooth, shining. *Fronde* usually ovate or triangular, sometimes oblong or lanceolate, thin, dry, membranaceous, glabrous, bright-green, drooping, 6-12 or 18 inches in length, bi-tri-pinnate. *Pinna* and *pinnules* alternate; the latter of various forms,

roundish, with the base truncate, subrhomboidal, or obliquely fan-shaped, but generally more or less enneate at the base, attached by short capillary stalks, the posterior margins entire, the superior lobate; the sterile lobes dentate or ineiso-dentate, the fertile obtuse or truncate, the sori often occupying their entire width. *Venation* (pinnules) consisting of a series of dichotomous ramifications of the vascular bundles of the petioles, the first furcation forming the extreme base of the pinnule, the veins repeatedly forked in a flabellato-radiate manner; in the sterile portions one venule is directed to each marginal tooth, in the apex of which it terminates; in the fertile portions the venules extend to the margin, and are thence continued nearly across the indusium, and there form the receptacles. *Fructification* on the back of the fronds, generally distributed. *Sori* borne on all or most of the apical lobes, oblong, more or less lengthened, according to the width of the lobe, seated on the under surface of the indusium. *Indusium* also oblong, formed, as it were, of a portion of the apex of the lobe, reflexed and changed into a thin bleached membrane. *Spore-cases* globose. *Spores* roundish or angular, ovate, smooth.

This most delicate and graceful evergreen Fern, is found in moist eaves and attached to moist rocks, chiefly in the vicinity of the sea, preferring, it would seem, a perpendicular surface. It is found in Cornwall, Devon, and Somerset, on the mainland and islets of South Wales, and in the Isle of Man, which is its northern ascertained limit. It occurs in several parts of Ireland; and is found, though rarely, in Jersey. The same species, somewhat varying in form, is dispersed over the middle and south of Europe; and in Asia occurs throughout India, in China, Persia, Arabia, Syria, in the Caucasus, and in the Ural provinces of Siberia; while in Africa, it is found in Algiers and Egypt, in Teneriffe, Madeira, the Canaries, the Azores, and Cape de Verd islands, in Madagasear, and the Mascaren islands, at the Cape of Good Hope and Algoa Bay; and in America it

has been found in Florida, Texas, California, Mexico, Guatemala, in Venezuela, and at Para; in the West Indian Islands, the Sandwich Islands, New Caledonia, and the New Hebrides.

It is reported to possess expectorant and diuretic virtues, and to be the plant from which the syrup called *Capillaire* is prepared; *Adiantum pedatum* and *Asplenium Trichomanes* being also employed. In the Arran isles of Galway, a decoction of the leaves is used in place of tea.

This fern does not bear exposure, but flourishes in a confined damp atmosphere, attaining its greatest luxuriance when supplied with a moderate degree of warmth. It is essentially a shade-loving plant, and is peculiarly fitted for a Wardian case. The rhizomes delight to creep over small lumps of soft stone.

Genus 13. **CYSTOPTERIS**, *Bernhardi*.

BLADDER FERN.

Sori indusiate, rotundate; the *receptacles* medial. *Indusium* roundish-ovate, fornicate or subhemispherical, affixed by its broad base, the apex often lacerate, sometimes acuminate. *Veins* simple forked or pinnate, from a central costa; *venules* free.

Fronds membranaceo-herbaceous, bi-tri-pinnate. Rhizome tufted, decumbent, or elongated and creeping.—Name from the Greek *kystos*, a bladder, and *pteris*, a fern.

(1.) **Cystopteris fragilis**, *Bernhardi*. — Brittle Bladder-fern. — Fronds oblong-lanceolate, bipinnate (rarely sub-bipinnate or sub-tripinnate); pinnae ovate-lanceolate or oblong-lanceolate; pinnules ovate lanceolate or oblong, blunt or acute, obscurely toothed, incised with short blunt or long narrow acute teeth, or pinnatifid with ovate or oblong toothed segments.

— (type) fronds lanceolate; pinnules ovate, acute, pinnatifid, with toothed lobes.

CYSTOPTERIS FRAGILIS, *Bernhardi*. Hk. and Arn. Br. Fl. 572. Bab. Man. 412. Deak. Flor. Brit. iv. 85. Newm. Hist. 87. Sowerby, Ferns 36, t. 19-20. Hook. Gen. Fil. t. 52 B. Presl. Tent. 93, t. 3, fig. 1. Moore, Nat. Print. Ferns, t. 46 A, fig. 1. —C. ORIENTALIS, Desvaux.—POLYPODIUM FRAGILE, Linnæus. Bolt. Fil. 50, t. 27 (bad), t. 46.—P. ANTHRISCFOLIUM, CYNAPIFOLIUM, et PEDICULARIFOLIUM, Hoffmann.—P. POLYMORPHUM *b*.

LACINIATUM, et *d. FRAGILE*, Villars, Hist. Dauph. iii. 847, t. 53.—*P. TRIFIDUM*, Withering.—*P. ALBUM a.* Lamarck.—*P. FUMARIOIDES, a. LOBATUM*, Weis.—*P. VIRIDULUM*, Desvaux.—*ASPIDIUM FRAGILE*, Swartz. Schkuhr, Crypt 53, t. 54-56.—*A. TRIFIDUM*, Swartz.—*ATHYRIUM FRAGILE*, Sadler.—*CYATHEA FRAGILIS*, Sm. Fl. Brit. iii. 1139; Eng. Bot. t. 1587.—*C. CYNAPIFOLIA* et *ANTHRISCIFOLIA*, Roth.—*CYSTEA FRAGILIS*, Sm. Eng. Fl. iv. 285.—*C. REGIA*, Sm. in part (alpine plants).—*CYCLOPTERIS FRAGILIS*, Gray.

Narrower-pinnuled forms, often larger and inciso-dentate (*angustate*).—*POLYPODIUM FRAGILE ANGUSTATUM*, Hoffmann, Rœm. and Ust. Bot. Mag. ix. 11, fig. 14 d.—*P. TENUE*, Hoffmann.—*P. RHÆTICUM*, Dickson. Bolt. Fil. 80, t. 45.—*P. POLYMORPHUM a. RHÆTICUM*, Villars, Dauph. iii. 846, t. 53, fig. A.—*P. FUMARIOIDES β. LACINIATUM*, Weis.—*CYSTEA ANGUSTATA*, Smith, Eng. Fl. iv. 288 (excl. syn. *Aspid. rhæticum*).—*CYATHEA FRAGILIS, β* and γ , Sm. Fl. Brit. iii. 1139.—*C. F. ANGUSTATA*, Link.—*C. REGIA*, Roth.—*CYSTOPTERIS RHÆTICA*, Link.—*C. DENTATA β.* Hook. Br. Fl. ed. 1, 445.—*C. FRAGILIS β.* Moore, ed. pr.—*ASPIDIUM FRAGILE β.* Willdenow.—*CYCLOPTERIS FRAGILIS β. RHÆTICA*, Gray.

Blunter-pinnuled forms, less toothed, or blunt-toothed (*dentate*).—*POLYPODIUM DENTATUM*, Dickson. Crypt. iii. 1, t. 7, fig. 1.—*P. PONTEDERÆ*, Allioni.—*ASPIDIUM DENTATUM*, Swartz.—*A. FRAGILE*, Mart. and Galeotti.—*A. PONTEDERÆ*, Willdenow.—*A. COLOBODON*, Kunze.—*ATHYRIUM FUMARIOIDES*, Presl, Rel. Hænk. i. 39, t. 6, fig. 2.—*A. DENTATUM*, Gray.—*CYATHEA DENTATA*, Sm. Fl. Brit. iii. 1141; Eng. Bot. t. 1588.—*C. FRAGILIS*, Roth.—*CYSTEA DENTATA*, Smith.—*CYSTOPTERIS FRAGILIS β. NIGRESCENS*, Hook. Sp. Fil. i. 198.—*C. DENTATA*, Hook. Br. Fl. ed. 1, 445; Sowerby, Ferns 38, t. 21.—*C. RETUSA*, Decaisne.—*C. FUMARIOIDES*, Kunze.—*C. PONTEDERÆ*, Link.—*C. CHILENSIS*, Fée.—*CYCLOPTERIS DENTATA*, Gray.

Var. Dickieana, pinnæ deflexed, overlapping; pinnales crowded, broad obtuse, decurrent, very slightly toothed, or bluntly-toothed with the lobes scarcely toothed; sori sub-marginal, distinct.

CYSTOPTERIS FRAGILIS v. DICKIEANA, Moore, Handbk. ed. 1, 81; ed. 2, 73; Id. Nat. Print. Ferns. t. 46 A, fig. 5, 6.—*C. DICKIEANA*, Sim, Gard. Journ. 1848. 308. Newm. App. xxvi; Id. Hist. 93.—*C. DENTATA v. DICKIEANA*, Babington, Man. 412. Sowerby, Ferns, 39, t. 22.

Rhizome perennial, short, tufted, decumbent, slowly



[*Cystopteris fragilis.*]

spreading, scarcely creeping, furnished with pale brown lanceolate scales, and numerous fibrous roots. *Vernation* circinate. *Stipes* slender, brittle, dark brown, and furnished with a few small scales at the base, smooth upwards; terminal, and adherent to the caudex. *Fronde* from 3-4 to 12-18 inches in length, erect, herbaceous, dull green, smooth; oblong-lanceolate, sub-bipinnate, or rarely tripinnate. *Pinnæ* ovate-lanceolate or oblong-lanceolate, with the pinnules usually distinct, but sometimes more or less decurrent, or connected by the wing of the rachis. *Pinnules* of the more typical forms ovate at the base of the pinnæ, oblong towards the apex, generally acute, sometimes bluntish; the larger deeply pinnatifid, with oblong toothed lobes; the smaller inciso-dentate or more shallowly toothed; the teeth generally acute. In the *angustata* series of forms, the pinnules are narrower, and more conspicuously and acutely toothed; in the *dentata* series, they are not so much separated, and are blunter, usually but not always less deeply toothed, always with the teeth blunt. *Venation* (larger pinnules) consisting of a flexuous mid-vein, from which a vein proceeds along each lobe, giving off secondary branches or venules, mostly simple, one of which proceeds to the tip of each marginal tooth. The smaller pinnules more or less resemble the larger of these lobes, and their venation is similar. *Fructification* scattered over the back of the frond. *Sori* roundish, numerous, borne on nearly all the branches of the veins in fully fructified fronds, and thus, in the more divided forms, appearing to be scattered without order over the whole surface, but in the less divided forms more evidently placed in a line, near the margin of the pinnules, as they often are in the lobes of the larger ones; though, in some forms, they are situated nearer the midrib than the margin, and often in age become confluent. *Indusium* a thin, smooth, delicate hooded membrane, attached behind the sorus, a little to one side, either truncate and thus roundish, or prolonged at the point and thus

acutely or acuminate ovate; at first inflected forwards over the spore-cases, soon, however, becoming reflected backwards and shrivelled; the anterior margin either entire, or split into narrow segments. *Spore-cases*

roundish, obovate. *Spores* round or oblong, strongly echinate.

The *var.* DICKIEANA is the most marked of the many known forms of this species, its chief peculiarities consisting in the deflexed, more or less overlapping, pinnae, and in the crowded, overlapping position of the broad, short, obtuse, bluntly toothed pinnules, which are quite decurrent on the rachis. The colour is a deep bright green. *Fronde*s often scarcely bipinnate, the pinnae and upper pinnules being frequently confluent. *Pinnae* ovate-lanceolate, somewhat twisted round, the lower margin being elevated and brought forwards, more or less de-



[*C. fragilis* Dickieana.]

flexed. *Pinnules* mostly decurrent, sometimes much so, broad, oblong or oblong-ovate, obtuse, having but a few shallow blunt notches on the margin, imbricate; in very luxuriant fronds, the lobes, though blunt, are more distinct, and have blunt inconspicuous teeth. *Sori* placed near the margin, often just within the sinus of the lobes. *Spores* slightly verrucate or tuberculate, not echinately tuberculate. Found by Dr. Diekie on dripping rocks in a cave at Cove, near Aberdeen; and by Dr. Balfour, at

Dunkeld. The fronds and pinnæ are sometimes multifid.

Some other of the forms of this species may be recorded as varieties of the secondary rank:—

angustata: the form to which this name specially belongs is one of larger growth, having the smaller pinnules as well as lobes of the larger ones rather evenly incised, so as to form on their margins longish, narrow teeth; spores roundish, echinate. The name includes all forms approaching this character. There is in cultivation one which is quite constant, and is known by its outline, which



[*C. fragilis angustata*.]

is much attenuated and lengthened at the apex; its pinnæ much narrowed and extended at the point; its pinnules linear-lanceolate, deeply and acutely pinnatifid, or slightly toothed at the margin, the ultimate divisions being oblong or linear and acute. The sori are sub-central. This variety does not appear to be very common.

obtusa: fronds dark green, 8-12 inches high, lanceolate; pinnules short, blunt, ovate, narrowly and shortly

stalked, deeply pinnatifid; the lobes distinct, oblong, notched with small short, even teeth; spores echinate. From Mr. A. Tait.

dentata: this name is given to any of the small blunt-pinnuled, shallowly toothed forms, some of which are, doubtless, inconstant. There are, however, in gardens, some forms referrible here which do not change. These true plants are small, 4-8 inches high; fronds narrow, sometimes scarcely bipinnate; pinnules distinct below, or sometimes all confluent, blunt oblong, simply blunt-toothed or ob-



[*C. fragilis dentata*.]

senrely blunt lobed; spores eehinate, though in a less degree than the ordinary forms. The sori are submarginal. These gradually merge into the normal form, through somewhat larger and more deeply-lobed examples.

decurrens: this form has in some measure the aspect of *Dickiana*, having deflexed pinnae, and decurrent pinnules, but the fronds and pinnae are more acute, and the latter are more prominently toothed; spores echinate. Fifeshire coast, Mr. A. Tait.

interrupta: fronds dissimilar. mostly linear, all more or less narrowed; pinnae mostly interrupted or shortened, though unequally affected, sometimes being reduced to small fan-shaped or three-lobed leaflets along a portion of the primary rachis, the fronds being there narrow-linear; sometimes consisting of 2-6 unequal, irregular, often fan-shaped, pinnules, still producing a narrow contracted outline; pinnules in the interrupted portions variously truncate, laciniated, or depauperated. A curious permanent monstrosity, found by Mr. I. Hudhart, in Westmoreland, and distributed by Mr. Clowes. (Nat. Print. Ferns, t. 46 A, fig. 7).

The form we have named *sempervirens*, in the *Ferns of Great Britain and Ireland*, Na-



[*C. f. interrupta.*]

ture-Printed (t. 46 A, fig. 2, 3), though reputedly found in Devonshire and Kent, is not positively known to be an English plant, though certainly a native of Madeira; it is evergreen under shelter, tough stalked, and has the anterior basal pinnules largest, and the fresh indusium glandular hairy.

This small elegant species, which has annual fronds, is dispersed throughout Great Britain, most abundant on the hilly and mountainous tracts of the north, somewhat rare in the south, found, however, in the extreme south, and extending northwards to Sutherland and the Hebrides. It generally grows in the fissures of rocks or masonry, and, for the most part, in alpine or subalpine situations. It is found in Ireland. It occurs throughout Europe. In Asia it is found in India, Persia, Armenia, in the regions of the Ural and Altai mountains, and Lake Baikal in Siberia, from the frontiers of Chinese Turkestan to Kamtschatka and Unalashka. In America it extends from the countries bordering the Polar Sea, through North and North-west America to California, Mexico, Guatemala, Columbia, Venezuela, and New Grenada, the West Indies, Chili, and Port Famine. In Africa, it is found in the islands of the North Atlantic, and in Abyssinia; and it occurs in Tasmania. Over the African Islands already alluded to, extending to Malaga, is dispersed, the evergreen variety (or probably species) previously mentioned. *C. tenuis* of North America, with a widely creeping rhizome, is sufficiently distinct.

This is a pretty little fern for cultivation, affording some variety, and thriving well either in pots in a frame or greenhouse, or on open shady rockwork, in localities which enjoy a moderately pure atmosphere. The soil may be composed of light turfy peat and loam, with sand in equal parts, and fragments of sandstone or crock are beneficial. The drainage, at least, should be ample. It increases readily by division, or from the spores. The fronds are frequently damaged by the ravages of a yellow fungus (*Uredo filicum*), which spreads rapidly, and,

unless checked, soon spoils those plants which are attacked.

(2.) **Cystopteris regia**, Presl. —Alpine or Royal Bladder Fern.—Fronds lanceolate, bi-subtri-pinnate; pinnæ ovate; pinnules ovate-oblong, united by a wing, deeply pinnatifid, the lobes linear or linear-oblong, with two or three short blunt or retuse teeth; rachis winged above; veins terminating in the apical notch of the emarginate teeth.

CYSTOPTERIS REGIA, Presl. Moore, Nat. Print. Ferns, t. 46 B. —C. ALPINA, Desvaux. Hook and Arn. Br. Fl. 572. Bab. Man. 412. Moore, Handbk, ed. 2, 73. Sowerby, Ferns, 40, t. 23. —POLYPODIUM REGIUM, Linnæus.—P. ALBUM β . Lamarek.—P. POLYMORPHUM c. REGIUM, Villars, Dauph. iii. 817, t. 53, fig. C.—P. ALPINUM, Wulfen, Jacq. Icon. Pl. iii, t. 642.—P. CRISPUM, Gouan.—ASPIDIUM REGIUM, Swartz.—A. ALPINUM, Swartz. Schkuhr, Crypt. 60, t. 62, 62 b —A. TAYGETENSE, Bory and Chamb. —CYATHEA INCISA, Smith, Eng. Bot. t. 163.—C. REGIA, Forster.—C. ALPINA, Smith.—CYSTEA REGIA, Sm. Eng. Fl. iv. 289 (excl. syn. With. and alpine hab.).—C. ALPINA, Sm. Eng. Fl. iv. 291. —ATHYRIUM ALPINUM, Sprengel.—A. REGIUM, Gray.—CYCLOP-TERIS REGIA, Gray.

Rhizome perennial, short, decumbent, spreading, tufted, the crown furnished with few narrow pale scales. *Termination* circinate. *Stipes* variable in length, usually one-third to one-half the length of the frond, sometimes quite short, pale, except at the brownish base; brittle, slender; terminal and adherent to the rhizome; *secondary rachis* narrowly margined. *Fronds* 3 to 6-8 inches long, herbaceous, pale green, erect, smooth, lanceolate, bipinnate, or almost tripinnate in luxuriant fronds. *Pinnæ* ovate, acute, unequal. *Pinnules* bluntly or sometimes acutely ovate, with a narrow stalk-like attachment, deeply pinnatifid, the lobes linear or linear-oblong, blunt, obscurely toothed or sometimes with short distinct erect teeth, which are blunt-pointed or retuse. In the larger pin-

nules the lobes, though still decurrent, and not truly separate, are distant and almost divided to the rachis, producing almost a tripinnate mode of division. *Venation* (pinnales) consisting of a straightish midvein, with alternate lateral veins directed into each lobe, and there branching into several venules, which terminate in the retuse apex of the teeth, and are thus apparently directed towards the marginal sinuses. *Fructification* scattered over the back of the frond.

Sori numerous, sometimes crowded, small, round, medial on the veins, indusiate. *Indusium* a small delicate transparent membrane, which is ovate, acute, slightly jagged in front, attached behind the sori, projected forwards over them, and at length reflexed. *Spore-cases* roundish, obovate. *Spores* oblong, echinate.

The only authenticated habitat for this plant is a wall at Low Leyton, in Essex, where, at the close of the last century, it existed in so great plenty, as to forbid the notion of its being at that early date an introduced species. The plant is now nearly destroyed by repairs, though it exists in more than one station in the neighbourhood. Specimens have been received from Mr. Shepherd, said to have been gathered in Derbyshire and Yorkshire, but without more particular habitats assigned. The various alpine stations which have been reported for this species probably belong rather to small much divided forms of *C. fragilis*. We have not seen a mountain specimen of *C. regia*, unless it be one from Saddleback, in Cumberland, gathered



[*Cystopteris alpina*.]

many years since by Mr. S. F. Gray. The species is plentiful in many localities in the Alps of Switzerland, Carinthia, Styria, &c., and is found also in the Pyrenees, and on Mount Taygetos in the Moræa, and Mount Taurus. The plant found at Leyton, is generally assumed to be the *Polypodium regium* of Linnæus, and is, certainly, also, the *P. alpinum* of Wulfen. It seems, therefore, proper to adopt, as Presl has done, the former specific name: nevertheless, Linnæus's specimen is unsatisfactory as evidence in support of this view. The species is, no doubt, distinct from *C. fragilis*, being analogous in size to the smaller forms of that species, but more finely divided. The segments of its pinnules are either narrow oblong or linear; the teeth are either blunt or more commonly emarginate; and the veins very frequently terminate in the notch at the apex of the tooth, instead of at the projecting point of the tooth, as in *C. fragilis*.

The fronds of this fern are annual, produced rather late in the spring. It is an easily grown plant, either in well-drained pots of free open soil, such as light loam and turfy peat with sand, or in good, *i. e.* sheltered situations, well drained, and with congenial soil, in open rockeries. It is more liable, than the allied plants, to suffer from damp while at rest in winter, and hence should not be too much watered at that season. There is no other difficulty in cultivating it, and it is increased with facility by division.

(3.) **Cystopteris montana, Bernhardi.**—Mountain Bladder-fern.—Fronds triangular tripinnate; pinnæ spreading; pinnules ovate or oblong, inciso-dentate or pinnatifid, the lobes obtusely sub-falcate, toothed at the apex; rhizome creeping.

CYSTOPTERIS MONTANA, Bernhardi. Link. Hook and Arn. Br. Fl. 572. Deak. Flor. Brit. iv. 88. Newm. Hist. ed. 2. 159. Bab. Man. 413. Sowerby, Ferns, 4, t. 24. Moore, Nat. Print. Ferns t. 46 C.—C. ALLIONI, Newm. App. xxv.—C. MYRRHIDI-

FOLIUM, Newm. Hist. ed. 3, 97.—POLYPODIUM MONTANUM, Lamarck (1778).—P. MYRRHIDIFOLIUM, Villars (1785); Id. Dauph. iii. 851, t. 53 (1789).—ASPIDIUM MONTANUM, Swartz. Schkuhr, Crypt. 61, t. 63.—ATHYRIUM MONTANUM, Roehling.—CYATHEA MONTANA, Smith.

Rhizome perennial, creeping, about as thick as a crow-quill, producing the fronds at intervals, almost black, with a few scattered ovate scales on the younger por-



[*Cystopteris montana*.]

tions. *Vernation* circinate. *Stipes* lateral and adherent to the rhizome; slender, longer, often much longer, than the frond, dark brownish-purple at the base, paler upwards, sparingly furnished, especially below, with ovate, lan-

ceolate scales; *rachis* narrowly margined above, and together with the secondary rachides, which are also margined, sometimes tinged with purple. *Fronde*s 4-12 inches high, including the stipes, the leafy portion being 3-4 inches long, and the same in breadth; herbaceous, deep green, smooth; triangular, tripinnate. *Pinnæ* unequal, ascending, the lower pair considerably largest, obliquely ovate, their posterior pinnules twice as long as the anterior ones; some of the other pinnæ are also unequal-sided, the posterior pinnules being largest, but they become nearly equal upwards. *Pinnules* (the larger posterior ones) ovate pinnate, or (the smaller upper ones) pinnatifid. *Pinnulets* (basal) of the larger pinnules, ovate, with a distinct narrowed stalk-like attachment, but connected by a narrow wing, pinnatifid, with oblong-ovate obtuse lobes, cut into linear teeth, which are generally bifid at the extremity. In its ultimate divisions it is thus very much like *C. alpina*. *Venation* (pinnules) consisting of a nearly straight midvein, with alternate veins directed one into each lobe; a venule is given off towards each tooth, and is continued to the margin, where it is lost in the sinus formed by the bifid apex of the tooth, thus ending in a depression rather than a projection of the margin. *Fructification* occupying the whole under surface. *Sori* consisting of numerous moderate-sized roundish masses of spore-cases, medial on the veins, indusiate. *Indusium* a delicate, transparent, concave subrotund membrane irregular at the margin, placed at the back of the sorus, and soon obliterated. *Spore-cases* obovate. *Spores* oblong, muricate.

[*C. montana*.]

This plant is at once known from the other British species of *Cystopteris* by its long creeping rhizome, and triangular and tripinnate fragile fronds. It has much more the aspect of *Polypodium*

Dryopteris, for which it might, perhaps, be mistaken, the more readily as its indusia becomes soon obliterated, and the sori then seem to consist of round naked masses of spore-cases. It is, however, not three-branched as that is, and is more divided. It was first found in Great Britain by Mr. W. Wilson, in 1836, on Ben Lawers, in Perthshire; and was subsequently met with by the late Mr. W. Gourlie, Rev. W. Little, Dr. Arnott, Mr. Borrer, Mr. Westcombe, and others, on the mountains dividing Glen Lochey and Glen Doehart, in the same county. Recently it has been gathered in the same district by Dr. Balfour and Mr. G. Maw, and in Glen Isla, Clova, Forfarshire, by Mr. J. Baekhouse, to whom we are indebted for specimens. It is further recorded in the *Naturalist*, as having been found, in 1855, on Benrinnes (query, Belrinnes, a mountain in Banffshire). The species is found in the extreme north of Europe, and is thence scattered here and there southwards to Spain, Italy, and Hungary. According to Ledebour, it is met with in Kamtschatka. It is also found on the Rocky mountains of North-West America.

This plant has often proved difficult to cultivate, probably on account of the slight information which was, for some time possessed, of the peculiarities of its native habitats. Now, however, that it is known, that its rhizomes thread their way on the ledges of dripping rocks, among beds of sphagnum, or occupy similar moist situations, less difficulty may be expected to attend its cultivation. These natural conditions suggest the employment of broad shallow vessels, instead of pots; a very open medium for the roots, such as light turfy peat and sphagnum, intermixed and blended with sand, and constantly abundant, yet not stagnant moisture. The creeping rhizomes afford every facility for propagation.

Genus 14. **WOODSIA**, R. Brown.

Sori involucrate, *i. e.* with inferior indusia, globose: the *receptacles* medial or terminal. *Involucre* soft membranaceous, pateriform and fimbriately erinite, or calyciform with the margin lobed, or subglobose with a contracted mouth. *Veins* simple or forked, or pinnate from a central costa; *venules* free.

Fronds membranaceo-herbaceous, small, pinnate pinnato-pinnatifid or bipinnate. Rhizome tufted, erect, or decumbent. —Name in compliment to Joseph Woods, Esq.

(1.) **Woodsia ilvensis**, R. Brown.—Oblong Woodsia. —Fronds oblong, lanceolate pinnate, with numerous broadly subulate chaffy scales beneath; pinnæ oblong obtuse, deeply pinnatifid, with bluntly ovate or oblong obtuse lobes; stipes and rachis chaffy-erinite.

WOODSIA ILVENSIS, R. Brown. Sm. Eng. Fl. iv. 309; Eng. Bot. Supp. t. 2616. Deak. Flor. Brit. iv. 45. Hook and Arn. Brit. Fl. 567. Bab. Man. 409 in part. Newm. Hist. 71. Sowerby, Ferns, 14, t. 5. Moore, Nat. Print. Ferns, t. 47 A.—W. VESTITA, Sprengel?—W. RALANA, Newm. Hist. ed. 2, 140.—W. RUFIDULA, Beck.—ACROSTICHUM ILVENSE, Linnæus. Bolt. Fil. 14, t. 9.—A. MARANTÆ, Hænke.—POLYPODIUM ILVENSE, Villars. Schkuhr, Crypt. 16, t. 19.—P. ARVONICUM, Withering.—POLYSTICHUM? MARANTÆ, Roth.—ASPIDIUM RUFIDULUM, Swartz.—A. DISTANS, Viviani.—NEPHRODIUM RUFIDULUM, Michaux.—LASTREA RUFIDULA, Presl.

Caudex perennial, short, erect or decumbent, tufted, furnished with a few lanceolate, much acuminate or

subulate pale brown scales, and having wiry branched fibres. *Vernation* circinate, the young fronds becoming liberated in the form of a shepherd's crook. *Stipes* pale reddish-brown, 1-2 inches



[*Woodsia ilvensis*.]

long, articulated above the base; terminal and adherent to the caudex, crinite as well as the rachis, with numerous pallid subulate scales. *Fronde* 2-6 inches long, thick, membranaceous, dull deep green, more or less rusty beneath from the abundant scales, lanceolate-oblong, pinnate. *Pinnæ* opposite or alternate, ovate-oblong obtuse, deeply pinnatifid, sessile or very shortly stalked, more distant below. *Lobes* 8-12, oblong-obtuse, the basal ones largest, their margins obscurely crenate, and, as well as the upper surface, furnished with coarse scattered hairs, in addition to which, on the under surface, are numerous long subulate scales on the rachis and veins. *Venation* (lobes) consisting of a flexuous, not very distinct, midvein, from which arise alternate veins, the lower ones usually forked some

distance from their base, the venules extending nearly to the margin, and bearing the sori near the apex, but below it; the upper veins, also fertile, are simple. *Fructifica-*

tion scattered over the back of the frond, sometimes copious, and becoming confluent. *Sori* circular, consisting of few spore-cases seated within, that is above, a small membranaceous scale, whose margin is fringed with jointed shining hairs which curve inwards, involving the spore-cases, hence they are involucrate. *Spore-cases* roundish-obovate. *Spores* oblong, roundish, or irregularly three-cornered, muriculate.

This is one of the rarest of our indigenous ferns, occurring in the crevices of moist rocks, in limited quantity, and in few and distant stations, among the mountains of Scotland, Wales, and the north of England. In Scotland it has been found in the Clova mountains in Forfarshire; and has been reported from Ben Lawers in Perthshire, and from the vicinity of Stirling. Mr. Gray has also favoured us with specimens from his herbarium, which appear to have been gathered at Forres, in Morayshire. It occurs again rather plentifully in deep ravines among the hills dividing the counties of Dumfries, Peebles, and Selkirk. Mr. I. Hudhart, Mr. Clowes, and others, have recently found it in Westmoreland; and near Bowness, in Cumberland. Teesdale, in Durham, is another old locality, in which it has probably been nearly eradicated. In Wales it is met with, rarely, in the county of Caernarvon, in the Snowdon district. This fern is more abundant in the north of Europe than with us; and is found in Iceland, Lapland, Norway, Sweden, and Russia; extending southwards into Italy and Spain. In Asia it occurs in Siberia, in the regions of the Altai mountains and Lake Baikal, and extends to Kamtschatka and Awatschka Bay. It is found in Arctic America, about the Saskatchewan and the Rocky Mountains in north-west America; in Canada, and in the United States.

This species is known from *W. alpina* by its broader fronds, more oblong pinnae, and very scaly under surface. The fronds, as in *W. alpina*, are annual, and separate spontaneously at the joint or articulation of the stipes.

(2.) **Woodsia alpina**, Gray.—Alpine Woodsia.—Fronds linear pinnate, slightly hairy, not broad scaly; pinnæ bluntly triangular, or triangular-ovate, obtuse, pinnatifid or lobed, the lobes roundish-obovate, nearly or quite entire; stipes and rachis very slightly hairy.

WOODSIA ALPINA, Gray, Brit. Pl. ii. 17 in part (1821). Newm. Nat. Alm. 1844, 13; Id. Hist. 79. Deak. Flor. Brit. iv. 46. Moore, Nat. Print. Ferns, t. 47 B.—W. ILVENSIS, β and γ . Babington, Man. 409. W. HYPERBOREA, R. Brown, Trans. Linn. Soc. xi. 173, t. 11. Sm. Eng. Fl. iv. 310. Hk. and Arn. Br. Fl. 567. Sowerby, Ferns, 15, t. 6 (too hairy). Moore, Handkb, ed. 2, 68.—ACROSTICHUM ALPINUM, Bolt. Fil. 76, t. 42.—A HYPERBOREUM, Liljebld, Stockh. Trans. 1793, 201, t. 8.—POLYPODIUM HYPERBOREUM, Swartz. Sm. Ebg. Bot. t. 2023 (too hairy). Sebkuhr. Crypt. 189, t. 17 b.—P. ILVENSE, Withering.—P. ARVONICUM, Smith.—P. FONTANUM, Linnæus Herb.—CETERACH ALPINUM, De Candolle.

Caudex perennial, short, erect or decumbent, furnished above with a few lanceolate pale-brown scales, and having wiry branched roots. *Vernation* circinate. *Stipes* pale reddish-brown, articulated above the base, sparingly furnished with subulate pale-brown membranaceous scales; terminal and adherent to the caudex; the *rachis* slightly coloured, and very sparingly scaly. *Fronds* $1\frac{1}{2}$ -6 inches long, membranaceous, tender, green, linear, pinnate. *Pinnæ* not rarely sub-opposite, more frequently alternate, triangular-ovate obtuse, sessile or very shortly stalked, pinnatifid, the lower ones distant, the upper more closely placed, all nearly horizontal. *Lobes* 5-7, roundish-obovate, largest at the base, the lowermost sometimes divided nearly to the midvein, the upper ones more confluent, the margins entire, or obscurely crenate, furnished with a few scattered tubular jointed hairs and hair scales, others occurring here and there on both the upper and the under surface. *Venation* (lobes) consisting of a flexuous indistinct midvein, which is alternately branched, the branches or veins

forked, rarely more than once, the upper ones undivided; both veins and venules terminate within the margin in a slightly thickened point; the anterior venules of the



forked veins, and some or all of the simple ones bear sori. *Fructification* on the back of the frond, more copious towards the upper part, often becoming confluent over the lobes. *Sori* circular, medial on the veins, consisting of few spore-cases seated within, that is above, a small membranaceous scale, whose margin is fringed with jointed hairs, which curve inwards, involving the spore-cases, hence they are involucre. *Spore-cases* roundish-obovate. *Spores* roundish-oblong, granulate or tuberculate.

This species is still rarer than *Woodsia ilvensis*. Its head-quarters are the mountains of Perthshire, Ben Chonzie, Ben Lawers, Craig-Challiaeh, Mael-dun-Crosk, &c.; and it is said to grow in Glen Fiadh in Forfarshire. The reported habitat on the Moffat Hills, Dumfriesshire, is not clearly referred to this species.

[*Woodsia alpina*.]

In addition, the rocky precipices of Snowdon, in Carnarvonshire, are the only places in which it is known to grow naturally within the United

Kingdom. In Europe it has besides been found in Lapland, Norway, Sweden, Russia, Germany, Hungary, Switzerland, France, and Spain. In Asia it occurs in Siberia, in the region of Lake Baikal; as well as in Kalm in the Punjab, on the southern slope of the Himalaya. In America it is found on the mountains of Massachusetts, at Saskatchewan, and in the Rocky Mountains. In the same region, about Great Bear Lake, and on the islands of Davis's Straits occurs the *Woodsia glabella* of Brown, which has probably small claim to specific rank, and is rather to be considered as a somewhat more slender state of *W. alpina*, in which the few hairs of the latter (which themselves replace the scales in the closely connected *W. ilvensis*) are wanting.

The Woodsias are best cultivated in moderate-sized well-drained pots, kept in a cold frame, facing the north in the summer season, and should have a moderate degree of ventilation. They are very impatient of sunshine and stagnant moisture, although preferring a damp cool atmosphere. The crown of the plants may, in potting, be advantageously elevated a little between three small pieces of freestone; and neither crown nor roots must be kept too damp, especially during winter, though the opposite extreme must be avoided. A shady shelf, in a cool greenhouse, where there is a free circulation of air, or a dryish cold frame are good situations in which to preserve them during the dormant season. When it is required to divide the tufts, it should be done very carefully in spring, about the time they commence their seasonal growth; but it is wiser, in the case of a plant which has become well established, not to disturb the roots. In obtaining plants from their wild habitats for the purpose of cultivation, as with most other of the rare ferns, it is found that small plants are much more successfully transplanted than the large and older masses.

Genus 15. **TRICHOMANES**, *Linnæus*.

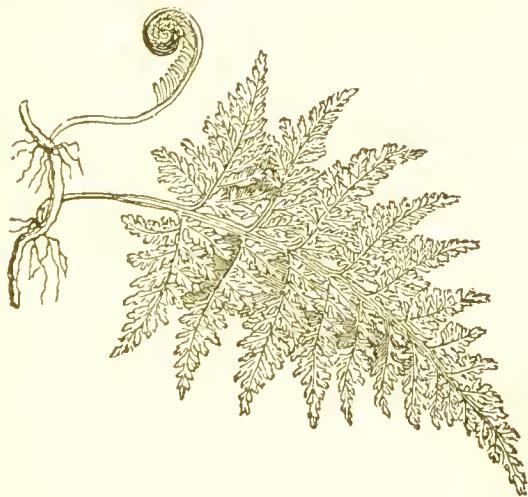
BRISTLE FERN.

Sori involucrate, scated in extrorse-marginal (rarely recurved) cysts, sunk in or free on the margins of the fronds; the veins continued into the filiform exserted, sometimes capitate, *receptacles*, which are free within the cysts, and bear sessile lenticular spore-cases at their base. *Involucres* funnel-pitcher-shaped or shortly bell-shaped, truncate and entire at the mouth, or two lipped. *Veins* simple forked or pinnate, from a central costa, or simple costæform in the ultimate segments, or flabellato-dichotomous; *venules* free, sometimes excurrent in the marginal teeth.

Fronds simple, pinnate or decomposed, pellucid membranaceous, rarely coriaceous. Rhizome creeping (sometimes filiform) or caespitose.—Name, an ancient Greek word, supposed to have been applied to the *Asplenium Trichomanes*.

(1.) **Trichomanes radicans**, *Swartz*.—European Bristle Fern.—Fronds pellucido-membranaceous, ovato-lanceolate, or triangular-ovate, tri-quadri-pinnatifid; the rachis everywhere, and the upper part or whole of the stipes winged; ultimate segments linear, entire or obtusely bifid; involucres cylindrical scarcely two-lipped, solitary in the axils of the upper segments, more or less margined or winged; rhizome long creeping, tomentose.

TRICHOMANES RADICANS, Swartz. Hook Sp. Fil. t. 125 (excl. syn. *Hym. rupestre*, and *T. anceps*.) Hook. and Arn. Br. Fl. 576. Deak. Flor. Brit. iv. 119. Bab. Man. 416. Newm. Hist. ed. 3, 253. Sowerby, Ferns, 72, t. 41. Moore, Nat. Print. Ferns, t. 48. Presl, Hym. 16, t. 2 B.—*T. SPECIOSUM*, Willdenow. Newm. Hist. ed. 2, 305.—*T. EUROPEUM*, Smith.—*T. HIBERNICUM*, Sprengel. *T. BREVISETUM*, R. Brown. Sm. Eng. Fl. iv. 311.—*T. ALATUM*, R. Brown. Hook. Fl. Lond. iv. t. 53.—*T. PYXIDIFERUM*, Hudson. Bolt. Fil. 56, t. 30.—*T. UMBROSUM*, Wallich.—*T. SCANDENS*, Hedwig (t. 6. excl. syn.)—*T. DIAPHANUM*, H.B.K.—*T. AMBIGUUM*, Sieber.—*HYMENOPHYLLUM ALATUM*, Smith, Eng. Bot. t. 1417—*DIDYMOGLOSSUM ALATUM*, Desvaux.



[*Trichomanes radicans*.]

Var. Andrewsii: fronds narrow, lanceolate-ovate; primary divisions narrow, and, as well as the secondary distant; involucre immersed; receptacles much elongated.

TRICHOMANES RADICANS *v.* ANDREWSII, Moore, Handbk. ed. 1, 139; Id. Nat. Print. Ferns, t. 48 C. Newm. Hist. ed. 2, 292, with fig.—*T. SPECIOSUM*, *v.* ANDREWSII, Newm. Hist. ed. 2, 315.—*T. ANDREWSII*, Newm. Hist. ed. 2, 14.—*T. BREVISETUM*, β . ANDREWSII, Hensley, Franc. Anal. ed. 5, 67.

Rhizome perennial creeping elongated tomentose, with small, thick-set, articulated, dark-coloured, jointed hairs. *Vernation* circinate. *Stipes* from one fourth to one half the length of the frond, terete, margined above with a narrow membranaceous wing, which is sometimes continued to the base; lateral, adherent to the rhizome; the base clothed with articulated hairs; *rachis* everywhere margined with a narrow membranaceous wing. *Fronde* 6-12 inches or more in length, pellucido-membranaceous, dark olive green, darker when dry, quite smooth; ovate-lanceolate, or triangular-ovate, more or less attenuated at the apex; tri-pinnatifid, or quadri-pinnatifid. *Primary divisions* (pinnæ-like segments) ovate-lanceolate, the secondary ovate obtuse, euneate at the base, the tertiary oblique oblong, the ultimate lobes oblong toothed, with short, linear, entire emarginate or bifid teeth. In highly-developed fronds of the triangular form, the secondary divisions are often longer, and comparatively narrower, and the ultimate divisions are more distant. The teeth at the apices of each series of divisions are frequently more elongated. *Venation* consisting of a

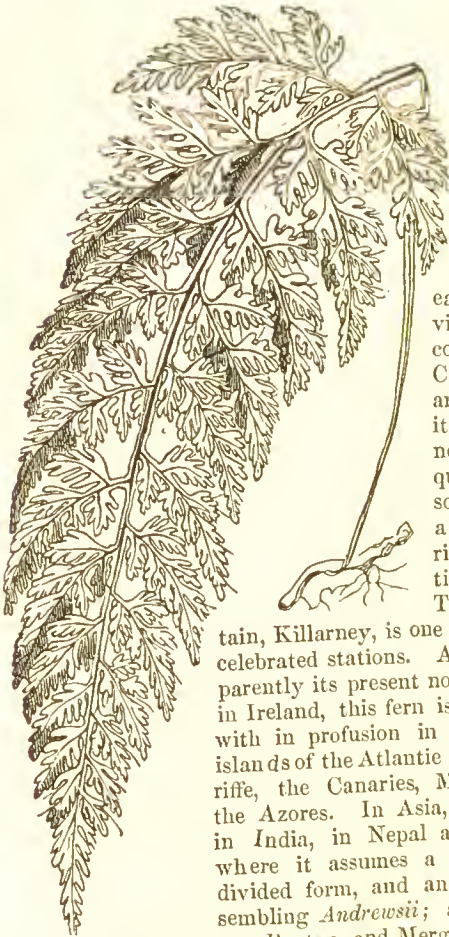


[*T. radicans.*] series of forked ramifications of the wiry ribs, which issue alternately from the main rachis, and enter the primary divisions: these are everywhere bordered with a pellucid wing, of a loosely cellular texture. The lowest anterior branch, or *veinlet* of these veins in the ultimate segments is, in the fertile fronds, continued beyond the margin, and forms the receptacle, but in the barren portions the apices of the veinlets do not quite reach the margin. *Fructification* scattered over the fronds, extra-marginal, *i. e.*, the tubular involucre is projected outwards from the margin, the opening being exterior. *Sori* consisting of sessile spore-cases clustered around the base of the filiform receptacle, which is free within

the involucre, with its apex more or less projected beyond it. *Involucres* cylindrical cup-shaped, somewhat tapering below, open exteriorly, supra-axillary, that is, produced in the upper axils of the (ultimate) lobes, more or less sunk in the apex of one of the lobes or teeth, the mouth sometimes slightly spreading or shortly two-lipped. *Spore-cases* sessile, oblique, latero-vertically compressed, roundish or obovate. Spores irregularly roundish or oblong, sometimes three-cornered, minutely papillose.

The fronds of this fern are said to be three years reaching maturity, full development being attained in the second year, and fructification produced in the third, after which they show symptoms of decay. The sterile fronds, however, retain their freshness under congenial conditions, for many years. The extra-marginal urn-shaped, or tubular involucre, the columnar receptacle, and the oblique ring which girds the obliquely-compressed sessile spore-cases, together with the much-divided pellucid fronds, distinguish it from all other British species. There are, at least, three forms, or states, met with in Ireland: one, in which the fronds are more ovate-lanceolate, with the segments broader and blunter-looking, most nearly accords, perhaps, with *T. radicans* of Swartz, as illustrated by Hedwig; another, more triangular in the outline of its fronds, the segments appearing narrower, seems to represent the *T. speciosum* of Willdenow; while a third, having the fronds narrower and more lanceolate, the primary divisions narrow, and as well as the secondary ones more distant or distinct, the receptacles also, when perfect, much more elongated than usual, is the *T. Andrewsii* of Newman, the *var. ANDREWSII* of a preceding page. [255].

The *Trichomanes* is not now found in England, though it formerly grew at Bellbank, near Bingley, Yorkshire, where, in 1758, Bolton, who certainly figures it, states it was growing "in plenty," and where, he also states, "I found" in 1782, the specimen figured. Its



[*T. radicans*, v.
Andrewsii.—*Newm.*]

present habitats are confined to the south west of Ireland, where in the rocks, g l e n s, caves, and ravines of the counties of Cork, Kerry, and Wicklow, it is met with not unfrequently, and sometimes in a most luxuriant condition. The Turk moun-

tain, Killarney, is one of the most celebrated stations. Attaining apparently its present northern limit in Ireland, this fern is again met with in profusion in the African islands of the Atlantic ocean, Teneriffe, the Canaries, Madeira, and the Azores. In Asia, it is found in India, in Nepal and Sikkim, where it assumes a more finely divided form, and an outline resembling *Andrewsii*; and in Khasya, Bootan, and Mergui. It occurs again in the West Indies, *e. g.*,

Jamaica, Martinique; in Alabama (small slender form); in Mexico, Panama, New Grenada, and Venezuela (large and much divided); in Brazil; in the Galapagos, and the Society Isles. A variety with almost sessile fronds and a spreading involucre, is found in Brazil, Equador, Mexico, and the Sandwiah Isles; and several other forms, probably varieties of this species, occur in various parts of South America.

In cultivation this fern requires that its rhizome should be fixed to a firm and durable medium, for which purpose such material as porous stone or earthenware, or brick, are most suitable, and this must be kept constantly moist with trickling water. The rhizome then, as it grows, attaches itself in the manner of ivy. To induce this growth of the rhizome, and also healthy growth of the fronds, a constantly damp atmosphere is essential; indeed, the fronds themselves should be almost constantly dripping, and always shaded. Hence, in well-ordered closed cases, or under large bell-glasses, the plants succeed admirably. They like warmth, and succeed very well under a glass in a shady part of a plant-stove, or greenhouse. The following method of planting has been found suitable both to this and to the *Hymenophyllums*:—Place a mass of porous free-stone or sandstone (the larger the better) in the mouth of a pot or pan (which should be a good sized one, as the plants should be seldom disturbed.) After filling the latter so full of broken crocks for drainage, as to admit of the stone lying firmly on a level with, or rather above, the rim, strew a little silver sand over the stone, and with incorrosive wire, fix the rhizome firmly on the surface, then add a little more sand, and give a gentle watering. If necessary, the plant must be supported in a firm position by means of small stakes; place a bell-glass over the plant, and remove it to a shady place, either in a stove or greenhouse, or sitting-room. Subsequently careful, and rather abundant and frequent, but gentle sprinkling, sufficient at least to maintain a constant

dampness about the plant is all that is required. If once the rhizome can be induced to spread and lay hold of the stone by its fibrils, the plant is safely established. Mr. Andrews, in September, 1841, formed a case purposely for cultivating this fern; he lined the bottom with zinc, and covered the framework with oiled lawn, and then planted the specimens in well drained pots in a compost of loam and coarse sand, interspersed with pieces of turf; suspending also some of the rhizomes across the roof of the case, attached to rods, covered with moss. The plants were kept cool, and were well moistened daily. In October, 1843, the entire case was filled with fronds of large and strong growth. Mr. Ward, and many others, have for many years cultivated this species with entire success, even amidst the smoke of London, in closed cases. Mr. Calwell, another very successful grower of this species, received in the spring of 1843, a small portion of rhizome, five or six inches long, with one frond partially developed, and one other just appearing, which was placed within a bell-glass about fifteen inches diameter. In December, 1846, it quite filled the glass, and was removed into a case 3ft. 10in. by 2ft. 6in., and 3ft. 4in. in height. The space beneath, about twelve inches in depth, was filled with upturned flower-pots, charcoal, cocoa-nut husks, and light earth and peat. The plant, in 1852, filled this case, having about two hundred and thirty fully developed fronds, from fourteen to twenty inches in length. When removing it to the case in December, 1846, five or six fronds which had been injured by contact with the glass, were cut away, but since that time, up to 1852, not one of the fronds then existing, nor any of those subsequently formed, had shown any symptoms of decay.

Genus 16. **HYMENOPHYLLUM**, *Smith.*

FILM FERN.

Sori involucrate, *i.e.*, seated within an extrorse-marginal oblong or sub-orbicular two-valved *involucre*; the veins continued into the *receptacle*, which is free included, cylindrical or globose at the apex, and bears sessile or sub-sessile lenticular or turbinate spore-cases. *Veins* dichotomously branched, simple and costæform in the ultimate segments, or simple parallel, from a central costa in undivided fronds; *venules* free.

Fronds simple or decompound, pellucid, membranaceous. Rhizome creeping, usually filiform.—Name derived from the Greek *hymen* a film or membrane, and *phyllon* a leaf.

This group, which is rather extensive, is in general well distinguished from *Trichomanes*, by the involucre consisting of two separate valves, instead of being blended into a cup. In some few species, however, where the valves are combined below, this difference becomes merely one of degree. Film-fern seems preferable to filmy-fern as the English name of the group.

(1.) **Hymenophyllum tunbridgense**, *Smith.*—Tunbridge Film Fern.—Fronds pellucido-membranaceous, ovate or oblong, more or less elongated, pinnate; pinnae subvertical, pinnatifid, decurrent forming a wing to the rachis; segments linear, undivided or bifid, and as well as the upper margin of the roundish valves of the axillary solitary sessile compressed involucre, spinulosely serrate.

HYMENOPHYLLUM TUNBRIDGENSE, Smith, Mem. Acad. Tur. v. 418; Eng. Bot. t. 162; Eng. Fl. iv. 313. Hook. Sp. Fil. l. 95; Id. Fl. Lond. iv. t. 71. Hook and Arn. Br. Fl. 577. Bab. Man. 416. Deak. Flor. Brit. iv. 122. Newm. Hist. 297. Sowerby, Ferns, 75. t. 42. Moore, Nat. Print. Ferns, t. 49 A.—H. ASPERULUM, Kunze.—H. THUNBERGII, Ecklon.—TRICHOMANES TUNBRIDGENSE, Linnæus. Hedw. Fil. (t 17.)—T. PULCHELLUM, Salisbury.

Rhizome perennial, rigid, filiform, dark brown, ereeping, branched, and forming dense entangled masses. *Vernation* circinate. *Stipes* slender, wiry, terete, varying about one-third the length of the frond, often slightly margined above; lateral at intervals on the rhizome, to which it is adherent; *rachis* winged. *Fronde*s smooth, pellucid-membranaceous, minutely cellular, deep olive, or sometimes brightish green, from 1-4 to 6 inches long, usually ovate, lanceolate-ovate, or oblong, more or less elongated, pinnate below. *Pinnæ* or primary divisions alternate, decurrent so as to form, everywhere except at the base of the larger fronds, a narrow entire wing to the rachis; distichous, ascending or sub-vertical, sub-rhomboid in circumscription; furcately bipinnatifid, that is to say, twice divided with the ramifications on a dichotomous or forked plan, the divisions alternating, and so placed as to show an apparent excess of development on the anterior side from the medial or axial vein (which is to be recognised) curving upwards. *Ultimate segments* linear obtuse, spinulose serrate. *Vernation* consisting of a series of



[*H. tunbridgense*.]

dichotomous ramifications (two or three times repeated) of the wiry ribs which branch alternately from the main rachis, each ultimate segment having one of these

divisions along its centre, and not quite reaching to its apex. *Fructification* usually produced on the upper half of the fronds, extra-marginal, *i.e.*, the two-valved involucre are projected outwards from the margin, the opening being exterior. *Sori* consisting of sessile spore-cases, clustered around the receptacle. *Receptacle* formed of the altered apex of the lowest anterior vein of the pinnæ, spongy, oblong-obovate, free central, shorter than the valves of the involucre; therefore, included. *Involucre*: sessile, supra-axillary, *i.e.*, borne in the axils of the pinnæ or primary divisions, short, compressed, the base somewhat inflated cuneate, and more or less sunk in the segment; the anterior part two-valved, the valves semi-circular, flattish, spinulose serrate at the upper margin. *Spore-cases* sessile, affixed obliquely, vertically-compressed, thus lenticular, with a transverse ring. *Spore*: minute, irregularly-oblong, angular. Normally the lower anterior branch of the pinnæ only is fertile, but sometimes one or more others are also soriferous.

The British *Hymenophyllums*, which both have persistent fronds, may be best known from each other by the form of the valves of the involucre. In *H. tunbridgense* they are roundish and flattish, and the upper margin is spinulose-serrate, whilst in *H. unilaterale* they are ovate and convex, and the margin is quite even.

This fern is found in mountainous and rocky situations, usually carpeting the damp surface of the rocks themselves, but sometimes growing on the ground in moist places, or, moss-like on the trunks of trees. It is extensively dispersed, being found in many parts of England, in Wales, in the Lowlands and Highlands of Scotland, and in Ireland; it is abundant and remarkably fine in the neighbourhood of Killarney. Mr. Newman notices that it exhibits a preference for shade, warmth, and shelter; whilst *H. unilaterale* establishes itself on bleak and exposed rocks. The species occurs over the greater part of Europe, growing in alpine and sub-alpine districts. It is found in India; in the island of Mauri-

tius, in the Azores and Madeira, and in South Africa; in Chili and Brazil; and in New Zealand. There also occurs in New Zealand, as well as in Tasmania and New Holland, and again at the Cape of Good Hope and in the Organ Mountains of Brazil, a variety which differs in its narrower recurved segments.

(2.) **Hymenophyllum unilaterale**, *Willdenow.*
—Wilson's Film Fern. — Fronds pellucido-membranaceous, pinnate, oblong-elongate or linear; pinna decurved, digitately pinnatifid sub-unilateral, slightly decurrent, forming a narrow wing in the upper part of the rachis; segments linear undivided or bifid, spinulose serrate; involucre axillary, solitary, stalked, ovate, inflated, the valves entire.

HYMENOPHYLLUM UNILATERALE Bory: Willdenow. Newm. Hist. 301, Sowerby, Ferns, 76, t. 43. Moore, Nat. Print. Ferns, t. 49 B.—H. WILSONI, Hook. Br. Fl. ed. 1. 450; Sp. Fl. i. 95. Wilson, Eng. Bot. Supp. t. 2686. Hook. and Arn. Br. Fl. 577. Bab. Man. 416. Deak. Flor. Brit. iv. 124.—H. TUNBRIDGENSE, Schkuhr, Crypt. 134, t. 135 d (excl. syn.)—H. PELTATUM, Desvauux.—H. MENZIESII Presl.—H. MEYERI. Presl.—TRICHOMANES PELTATUM, Poiret.—T. TUNBRIDGENSE, Bolt. Fil. 58, t. 31.

Rhizome perennial, rigid, filiform, dark brown, creeping, branched, and forming dense entangled masses. *Vernation* circinate. *Stipes* slender, wiry, terete, one-third the length of the frond, often less; distant, lateral, and adherent on the rhizome; *rachis* terete below, narrowly winged above. *Fronds* smooth, pellucid-membranaceous, minutely cellular, dark green, 1-2 to 5-6 inches long, oblong or linear *i.e.* elongate-oblong, pinnate. *Pinnæ* decurrent in the upper part, and there forming a narrow wing to the rachis, distinct below, decurved backwards, sub-unilateral, wedge-shaped in circumscription, digitately-pinnatifid, *i.e.*, two or three times dichotomously forked, without an axial vein, the segments developed on the anterior side. *Ultimate seg-*

ments linear obtuse, spinulosely serrate. Luxuriant



[*Hymenophyllum unilaterale*.]

fronds have a tendency to become branched.

Venation consisting of two or three dichotomous ramifications of the wiry ribs, which branch alternately from the main rachis, each ultimate segment having one of these divisions along its centre, not quite reaching to the apex. *Fructification* produced on the upper parts of each annual growth, extra-marginal, as in the *H. tunbridgense*. *Sori* consisting of sessile spore-cases, clustered around the short receptacle. *Receptacle* free, central, spongy, oblong, club-shaped,

shorter than the valves of the involucre. *Involucres* supra-axillary, more or less obviously stalked, curved forwards. *i.e.*, in a direction opposite to that of the segments, inflated, two-valved, the valves ovate-oblong strongly convex, and quite entire at the edges, which are at first closed, but at length become gaping. *Spore-cases* sessile, vertically-compressed, thus lenticular, obliquely affixed. *Spores* minute, irregularly oblong. In some instances, especially where the frond becomes branched at the apex, numerous sori are borne without order on the segments; but usually they are confined to one on each pinnæ next the rachis, as in *H. tunbridgense*.

We are indebted to Mr. Clowes for the interesting

observation, that the fronds of this species of *Hymenophyllum* resume their growth after the first year, unlike those of *H. tunbridgense*, which complete their growth in one season.

This species is more extensively distributed than *H. tunbridgense*, though the two species very frequently occur in company. The present is met with in the south-west of England, in several of the midland counties, in North and South Wales; and in the north of England, especially in the Lake district in the north-west, it becomes plentiful. It is the commoner of the two species in Scotland, occurring both in the Lowlands and Highlands, and extending to the Northern and Western isles. In Ireland, it is found plentifully, and in all the provinces. It also occurs in the north of Europe, in Norway, and the Faroe Islands, and is probably equally dispersed over Europe; but its records are scanty. We have met with no Asiatic specimens. It is, however, found in the island of Bourbon, and in South Africa; in the latter assuming a somewhat different form, the segments being narrower. It is again met with towards the extremity of the South American continent, at Valdivia, in Terra del Fuego, at Cape Horn, and in the Falkland Islands. It is found abundantly in Tasmania, and, apparently scarce, in New Zealand.

The cultivation of the Film Fern is an object of much interest to the fanciers of British ferns. The plants require a glass covering, to preserve about them a constantly moist atmosphere, and constant but not stagnant moisture should be maintained about their roots. These are their main requirements, and it matters little how they are applied, whether in a Wardian-case, or beneath a common bell-glass. We learn from Mr. Clowes, who is remarkably successful, that the bell-glasses ought always to have two small apertures, as vents, near the top of the glass.

Genus 17. **OSMUNDA**, *Linnaeus*.

ROYAL FERN.

Fructifications paniculate, terminal or lateral on contracted rachiform portions of fronds, or occupying distinct contracted fronds. *Spore-cases* crowded on the margins or over the surface of the segments, obovate-globose, pedicellate or sessile, having an incomplete or rudimentary gibbous ring (represented by a few parallel striæ) near the apex, and bursting vertically in two equal hemispherical valves. *Veins* forked from a central costa; *venules* free

Fronds coriaceous or herbaceous, pinnate or bi-pinnate, the pinnæ or segments often articulate; fertile segments contracted, usually rachiform, simple or compound, terminal, medial or basal on the fronds, or sometimes occupying distinct contracted fronds. Rhizome caudiciform or tufted.—Name of uncertain derivation. There is a legend that it commemorates Osmund, a waterman of Loch Tyne. It is also said to come from the Saxon *osmund*—domestic peace.

(1.) **Osmunda regalis**, *Linnaeus* — Royal or Flowering Fern, or Osmund Royal.—Fronds bipinnate (rarely tri-pinnate); pinnules oblong, nearly entire, dilated and more or less auricled at the base; spore-cases clustered in twice-branched panicles at the apex of the fronds.

OSMUNDA REGALIS, Linnæus. Bolt. Fil. 6. t. 5. Sm. Eng. Bot. t. 209; Id. Eng. Fl. iv. 314. Hk. and Arn. Br. Fl. 578. Hk. Fl. Lond. v. t. 150; Id. Gen. Fil. t. 46 A. Bab. Man. 417. Newm. Hist. 308. Deak. Flor. Brit. iv. 36. Sowerby, Ferns, 78, t. 44. Moore, Nat. Print. Ferns, t. 50. Schkuhr, Crypt. 147, t. 145.—APHYLLOCALPA REGALIS, Cavanilles.—STRUTHIOPTERIS REGALIS, Bernhardt.

The Royal Fern is the most stately of the British species. *Caudex* perennial, stout, firm, growing in tufts, spreading, or erect and trunk-like, often attaining an elevation of two feet or more. *Vernation* circinate. *Stipes* nearly or quite as long as the leafy part of the frond; and, as well as the *rachis*, succulent, tinged with red, and clothed with loose deciduous pale-brown eobwebby wool, when young; firm, smooth, and pale green when mature; terete, somewhat flattened in front; the base dilated, with a membranaceous margin. *Fronde* numerous, terminal, and adherent to the caudex; erect or sometimes arching; 2-4 feet in exposed and drier localities, 6-8 or 10-12 feet in damp sheltered spots; membranaceous, smooth, bright yellow-green, paler beneath; broadly-lanceolate, bipinnate, occasionally tripinnate; some entirely barren, others having several of the upper pinnae transformed into a terminal panicle. *Pinnæ* (sterile) nearly opposite, lanceolate or ovate-lanceolate, imparipinnate, distant. *Pinnules* opposite or alternate, one or two inches long, sessile, oblong or oblong-ovate, obtuse, sometimes slightly falcate, rounded or somewhat dilated at the base, especially on the posterior side; sometimes distinctly annuleted, occasionally deeply lobed, sometimes with the lobes separated; the terminal ones, which are more acute than the rest, usually lobed at the base; the margins are obscurely crenated, or sometimes serrated. *Venation* (sterile pinnules) consisting of stout midveins giving off nearly opposite veins, which are forked once near their base, and again once or twice before reaching the margin, in which they are lost; they are parallel, and slightly curved. *Fructification* consisting of the upper pinnae (usually wholly, sometimes only in part,



[*Osmunda regalis.*]

changed into a bipinnate panicle of contracted rachiform capsuliferous divisions; each short spike-like branch of this panicle represents one of the pinnules, the spore-cases being collected on it into little more or less evident nodules, each of the nodules corresponding to a fascicle of the veins. This is at once evident in the case of the partially-transformed pinnules. *Spore-cases* sub-globose, reddish-brown, reticulated, shortly stalked, two-valved, opening vertically. *Spores* smooth, globose, yellowish.

The Flowering or Royal Fern grows in wet, springy, or boggy places, and is widely and plentifully dispersed, scattered here and there, in suitable localities, over the United Kingdom, from Cornwall and Suffolk, to Shetland and the Western Isles. It is abundant in many parts of Ireland, and is found in the island of Jersey. It is also common throughout Europe. In Asia, it is found in Mingrelia, and in the Himalaya; in Africa, in the Azores, in Algeria, and at the Cape of Good Hope; and both North and South America yield very similar plants, which are probably to be regarded as distinct varieties of this species. One of the most striking and elegant of these is the *O. spectabilis* of North America.

The caudex is said to possess tonic and styptic properties, but has fallen into disuse.

This species is of easy cultivation, preferring moist situations, and a peaty soil. It is well adapted for planting about the base of rockwork, in places where its habits can be accommodated—that is, when abutting a piece of water. Though most luxuriant in a sheltered position, it does not refuse to grow when moderately exposed. It is propagated by detaching and planting any lateral offshoots from the caudex; but the best way to establish it, is to procure the most vigorous plants from the localities where it is spontaneous, as an immediate effect is thus secured.

Genus 18. **BOTRYCHIUM**, Swartz.

MOONWORT.

Fructifications paniculate, consisting of numerous secund spikelets on a distinct branch of the frond. *Spore-cases* erect, sessile, free, bi-serial, globose, fleshy-coriaceous, bursting vertically in two equal hemispherical valves. *Veins* flabellato-dichotomous or dichotomofurcate, from a central costa; *venules* free.

Fronde herbaceous or sub-carnose, pinnatifid pinnate or ternately decomposed; the sterile and fertile branches distinct. Rhizome short, erect, fleshy.—Name from the Greek, *botrys*, a bunch or cluster.

(1.) **Botrychium Lunaria**, Swartz.—Common Moonwort.—Fronde solitary; barren branch oblong pinnate; pinnæ lunate or fan-shaped, the margin jagged or crenate.

BOTRYCHIUM LUNARIA, Swartz. Sm. Eng. Fl. iv. 315. Hook. Fl. Lond. iv. t. 66; Id. Gen. Fil. t. 47 A. Hook and Arn. Br. Fl. 578. Bab. Man. 417. Deak. Flor. Br. iv. 34. Newm. Hist. 314. Sowerby, Ferns 97, t. 45. Moore, Nat. Print. Ferns, t. 51 A. Schkuhr, Crypt. 156, t. 154.—**B. LUNATUM**, Gray.—**OSMUNDA LUNARIA** Linnæus. Bolt. Fil. 4, t. 4. Sm. Eng. Bot. t. 318.—**O. LUNATA**, Salisbury.—**OPHIOGLOSSUM PENNATUM**, Lamarck.

Var. rutaceum: barren branch deltoid, pinnate; pinnæ linear-pinnatifid.

BOTRYCHIUM LUNARIA δ . Smith. Eng. Fl. iv. 315.—**B. RUTACEUM**, Swartz. Schkuhr, Crypt. 157, t. 155 fig. *b*. (excl. fig. *a*.) Newm. Hist. 320. Bab. Man. ed. 4, 429. Moore Nat. Print. Ferns, under t. 51 A.—**B. MATRICARIFOLIUM**. A. Braun.—**OSMUNDA LUNARIA** β . **RAMOSA**, Roth.

Corm-like crown, forming a small, scarcely thickened, wiry-rooted, descending axis (rhizome *Presl*) enclosed by brown sheaths, terminated by a bud or growing point. *Roots* stoutish, fleshy, brittle, branched, growing in an irregular spreading manner from about the crown, and also branching in a sub-verticillated way from the perpendicular descending axis. When at rest, the plant consists of the crown or bud or growing point, seated among the wiry roots, enclosing the incipient or rudimentary fronds, and encased by the membranaceous sheaths, or remains of the former fronds. *Stipes* erect,



[*Botrychium Lunaria*.]

smooth, cylindrical, hollow, succulent, having two or three vascular bundles embedded in its tissue, its base surrounded by the brown sheaths already mentioned, and bearing at its apex, which is about half the height of the entire frond, two branches, of which one is leafy, the other fertile. *Vernation* plicate, or folded straight, the fertile branch clasped by the sterile, before unfolding. *Fronde* from 3 to 8-10 inches high, firm, stout, fleshy. *Sterile branch* smooth, dark, glaucous green, pinnate. *Pinnæ* 4-7 pairs, flabellate or lunate, the margins nearly entire, somewhat crenate, or more

or less lobed; sometimes partially fertile. *Fertile branch*

pinnate or bipinnate, the contracted rachiform divisions, (whether answering to pinnæ or pinules) fleshy, flattened, and bearing on the face towards the sterile branch, a double row of erect spore-cases, the spikelets thus secund, more or less incurved or suberect. Sometimes more than one fertile branch is produced, and occasionally spore-cases occur on the edges of the barren branch. *Venation* (barren pinnæ) flabellato-furcate, *i. e.*, the vein enters at the base, and is repeatedly forked, so that the whole space is traversed by contiguous, slightly radiating veins and venules, which do not extend quite to the margin. *Fructification* occupying the flattened rachiform divisions of the separate fertile branch of the frond; sessile, standing erect, *i. e.*, at a right angle to the plane of the segments, in two rows along each of these segments near the margins. *Spore-cases* smooth, spherical, without apparent ring or reticulations, bursting transversely, at first green, becoming golden brown. *Spores* smooth, pale, roundish, oblong, or angular.

The crowns and roots are doubtless perennial, but the fronds are annual.

The *var. RUTACEUM*, which is perhaps entitled to specific rank, differs in its broader, triangular, twice-divided, barren branch, as though the form of the fertile branch were transferred to the barren; and by the linear form of the secondary divisions. It is reported to have been found near Buxton, in Derbyshire, and on the sands of Barry, near Dundee, but very sparingly. We have not seen a native specimen.

This is a widely-diffused, but local species, found here and there over the whole of England, Wales, and Scotland, extending to the Islands of Orkney and Shetland. It has been less frequently found in Ireland, but is reported thence from all the provinces. It is found in dry, open, elevated pastures and waste lands, generally skirting the bushes which occur in such localities. Though abundant in some of its habitats, and general in its distri-

bution, it can hardly be considered as a common species. It is reported to occur in various parts of Europe, from Iceland, the North Cape, and Lapland, to Sicily and Spain, and the Russo-Caucasian Provinces. In North America : Newfoundland, Greenland, Bear Lake, the Saskatchewan, the Rocky Mountains, to Behrings Bay in North-West America. In Asia, in Siberia, in the region of the Ural and Altai Mountains, and Lake Baikal, extending to Kamstchatka and Unalashka. It also occurs in Fuegia and in Tasmania, and has been recently met with on the Australian Alps, in Victoria. *B. rutaceum* is a native of the northern and central parts of Europe, and, therefore, although scarcely an admitted member of our flora, it is not unlikely to be indigenous.

No very marked success has been met with in cultivating the *Botrychium*. Mr. Newman regards it as an underground parasite, which view, at least, is doubtful, as the plants have been dug out with the utmost care without any trace of adhesion to the roots of surrounding plants being discovered. The difficulty of growing it is probably after all chiefly owing to the almost unavoidable fluctuations of moisture to which artificially-cultivated plants are subject. The best chances of success are to dig up the plants while growing, with sods of the natural soil large enough to enclose the roots uninjured. Or, to take them with less soil at the dormant period, the position of the plants having been of course previously marked, and to plant them in considerable masses of soil made up so as to imitate the natural soil from which they are taken as closely as possible, whether it be sandy loam or an unctuous peat; care being also taken to keep this soil cool, and moderately, as well as equally moistened. Probably the shade afforded by other herbage, such as grass, to the surface of the soil, is beneficial to the plants.

Genus 19. **OPHIOGLOSSUM**, *Linnaeus*.

ADDER'S TONGUE.

Fructifications in a distichous spike, terminating a distinct branch of the frond, or on distinct fronds. *Spore-cases* uniserial along each margin of the compressed spike with which they are connate, horizontal, globose, bursting in two equal hemispherical valves. *Veins* uniformly reticulated in roundish or elongated hexagonal areoles, sometimes from an indistinct costa, occasionally obscure; the ultimate areoles with or without included free *veinlets*.

Fronds sub-carnose, two or many-branched, the sterile branch simple, dichotomously-parted, or palmato-lobate, the fertile simple; sometimes the fronds simple, the fertile and sterile distinct and dissimilar. Rhizome fleshy, sub-globose or short cylindrical ovate.—Name derived from *ophios* a serpent, and *glossa* a tongue.

(1.) **Ophioglossum vulgatum**, *Linnaeus*.—Common Adder's Tongue.—Fronds usually solitary; barren branch ovate-obtuse; fertile linear.

OPHIOGLOSSUM VULGATUM, *Linnaeus*. Bolt. Fil. 2, t. 3. Sm. Eng. Bot. t. 108; Eng. Fl. iv. 316. Hook. and Arn. Br. Fl. 578. Bab. Man. 417. Newm. Hist. 326. Deak. Flor. Br. iv. 33. Sowerby, Ferns. 81, t. 46. Moore, Nat. Print. Ferns, t. 51 B. Hook. Fl. Lond. iv. t. 75; Id. Gen. Fil. t. 59 B. Schkuhr, Crypt. 155, t. 153.—O. OVATUM, Salisbury.—O. RIEHLII, Hb. Imp. Vienna.—O. UNIFOLIUM, Glibert.

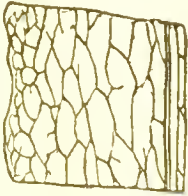
Corm-like crown forming a thickened fusiform descending axis (rhizome *Presl*), terminated by a bud or growing point, enclosed by a few brown sheaths. *Roots* coarse, brittle, fleshy, spreading horizontally, unbranched,

growing in a somewhat whorled manner from the crown and the perpendicular descending axis; one (or more) elongated underground in a stolon-like manner, and producing a new crown at a distance from the parent. When at rest, the rudimentary plant forms a growing point, exterior to the former fronds, at the apex of the crown. *Vernation* plicate or folded straight, the sterile branch folded around the spike of fructification. *Stipes* erect, smooth, cylindrical, hollow, succulent, usually elongated to about two-thirds the height of the



[*Ophioglossum vulgatum*.] frond traversed by two or three vascular bundles, the base enclosed by membranaceous sheathing scales; divided above into a separate fertile and barren branch. *Fronds* from 3-4 to 12 inches in height, thin but somewhat fleshy in texture. *Sterile branch* smooth, entire, sessile, broadly-ovate or ovate-elongate, acutish or obtuse, pale yellowish green. *Fertile branch* erect, consisting of a simple spike, terminating a more or less elongated foot-stalk, which appears to spring from the inner base of the sterile branch. *Spike* linear, very slightly tapering upwards. Rarely, more than one fertile spike is produced, but it is very seldom that more than one frond is produced from each crown. *Venation* (barren branch) consisting of a series of uniform veins (no midvein) everywhere anastomosing, and forming a series of narrow

elongated, hexagonal areoles, those towards the circumference becoming shorter and broader; within these are a series of lesser veins (venules) dividing the areoles into other smaller ones of similar form; from the sides of the areoles branch, more or less abundantly, short variously-directed free included veinlets, usually more numerous near the margin. *Fructifications* occupying the margins of the linear spike, which terminates the contracted fertile branch. *Spore-cases*

[*O. vulgatum*.]

smooth, spherical, without ring or reticulations, embedded in a single series in each margin of the spike, bursting transversely, and then forming gaping concavities, which give a toothed appearance to the margins. *Spores* verrucate, roundish, pale-coloured.

The crowns and roots are perennial; but the fronds are annual, like the Moonwort, growing up in May, reaching maturity in June or July, and then gradually drying up and perishing.

There is a somewhat marked *var.*—MINOR, which is probably the *O. azoricum* of Presl (Hochstett, Hb. Azor, Un. Itin. 165). This has been found, by Mr. Syme, in Orkney, and is a much smaller plant; the barren branches narrow, oval, and the plant reaching maturity in September, at which period the common form has decayed. The venation is the same as in the common form. The small size and narrow outline of this form of the plant, have induced some botanists to unite *O. vulgatum* with *O. lusitanicum*, as forms of one species.

The common Adder's Tongue is, in England, a widely-dispersed plant, and generally abundant where it occurs. The situations in which it is found are moist, loamy pastures and meadow-land. It seems less common in Wales, as well as in Scotland, but extends northwards to Orkney and Shetland. Few Irish habitats are re-

corded, but it is found in the widely-separated counties of Antrim, Galway, Dublin, and Cork. This species is dispersed over nearly the whole of Europe, from the north of Russia to Tuscany. In Asia, it occurs in Siberia, in the Ural region, and in the island of Unalashka. It is also met with in various parts of North America. The *O. ovatum* of Bory, from the Mascaren Islands and Java, and the *O. costatum* and *O. elongatum* of New Zealand, appear to be very doubtfully distinct from this species, differing more in the *presence* of a central costa than in aspect or external structure.

Though of similar habit to the *Botrychium*, this plant is more readily cultivated. The roots should be taken up without being broken, in sods of the soil in which they grow, and these should be planted in similar earth in any moderately-exposed situation where the soil may be moist and cool, but not liable to excessive wetness. Loamy soil is generally preferred. It is one of those plants which seem to derive benefit from the shade of surrounding herbage, and in consequence gardenesque neatness is inimical to it. An ointment is made of the fresh leaves, and is used as a vulnerary to green wounds.

(2) **O. lusitanicum**, *Linnaeus*.—Dwarf Adder's Tongue.—Fronds solitary, or two-three from each crown; barren branch linear or linear-lanceolate, fleshy, small; fertile branch linear-oblong apiculate.

OPHIOGLOSSUM LUSITANICUM, *Linnaeus*. Moore, *Pop. Hist. Brit. Ferns*, 2 ed. 195, t. 22, fig. 3: *Id. Nat. Print. Ferns*, t. 51 C. Newm. *Hist.* 331. Sowerby, *Ferns*, 82, t. 47. Bab. *Man.* 4. ed. 429. Hook. and Grev. *Icon. Fil.* t. 80. Lindl. *Veg. King.* ed. 2, 77, with fig.

Corm-like crown forming a thickened, oblong, fusiform, blunt, descending axis (rhizome *Presl*) the terminal bud, or growing point conical, and enclosed by a few membranaceous sheaths. *Roots* coarse, brittle, fleshy, spreading or descending, unbranched, growing irregularly from the axis, one (or more) becoming elongated in a

stolon-like manner, and producing a new crown towards the extremity. *Vernation* plicate or folded straight. *Stipes* erect and smooth, cylindrical, succulent, one-third to one-half the height of the frond, furnished with two or three slender vascular bundles, the base enclosed by membranaceous sheathing scales, which are taper-pointed above, dilated below; divided into a separate fertile and barren branch, or terminating in a barren frond. *Fronde* from one to three inches high, thick and fleshy, or succulent in texture, of a pale green colour. *Sterile radical frond* commonly, but not always accompanying the fertile frond, linear-lanceolate, smooth, tapering below into the stalk or stipes. *Sterile branch* of the fertile frond linear, or more frequently linear-lanceolate, tapered below to its junction with the fertile branch, spreading, bluntish at the apex, from three-fourths of an inch, to one and a half inch long, somewhat elevated at the margins. *Fertile branch* erect, taller than the barren, consisting of a spike supported on a longish stalk, which is thickened upwards, and becomes broad, fleshy, and flattened at the base of the spike; *spike* linear-oblong, apiculate, about half an inch long, often rather widened a little above the base, fleshy, and bearing along each margin from three to six spore-cases. A barren frond frequently accompanies the fertile frond, and sometimes more than one fertile frond is produced from one crown. *Venation* (barren branch) consisting of a series of uniform veins (no midvein) furcately branching, so as to produce a series of nearly parallel venules, which here and there anastomose, forming a few long narrow areoles; there are, apparently, no free included veinlets. *Fructifications* occupying the margins of the spike. *Spore-cases* smooth, spherical, without ring or reticulations, embedded in a single series of from three to six in each margin of the spike, bursting transversely. *Spores* smooth, roundish or angular, pale-coloured.

The crown and roots appear to be perennial, though it

has been suggested that they are biennial. The perennial character of the plant may, perhaps, be maintained by the successive production of crowns. The habits of the whole group, *Ophioglossaceæ*, are little known. The fronds are annual, growing up in winter, and fully developed by the middle of January.



[*O. lusitanicum*.]

This diminutive species was found in 1854, by Mr. G. Wolsey, in the neighbourhood of Petit Bot Bay, on the south coast of the island of Guernsey; it has since been found abundantly in other localities in that island. It seems probable that a diligent search would be rewarded by its discovery in the western counties of England, or in Ireland; it must, however, be sought in mid-winter. It has been found in the European countries bordering the Mediterranean: Portugal, Spain, France, Italy, Sicily, and Greece, as well as in many islands of that

sea. It grows also at Tangiers, Algiers, and, probably, elsewhere on the African coast, and in the Atlantic islands, the Canaries, Madeira, Teneriffe, and the Azores.

The most successful attempts that have been made to cultivate this little plant have consisted in taking up the plants in little clods of soil, and planting them in a compost of sandy loam, which resembles the soil in which they naturally grow. In this way, the plants may be occasionally preserved, and induced to re-appear at the proper season; but, like all the allied species, it can hardly be considered as a manageable plant in the cultivator's hands.

INDEX.

	PAGE.		PAGE.
ACROPTERIS , <i>Link.</i>		ALLOSORUS (<i>continued</i>).	
<i>septentrionalis</i> , <i>Link</i>	194	<i>hottentottus</i> , <i>Presl</i> ...	224
ACROSTICHUM , <i>Lin.</i>		<i>lanuginosus</i> , <i>Presl</i> ...	223
<i>alpinum</i> , <i>Bolt.</i> ...	251	<i>recurvatus</i> , <i>Presl</i> ...	223
<i>crispum</i> , <i>Vill.</i> ...	71	<i>villosus</i> , <i>Presl</i> ...	223
<i>hyperboreum</i> , <i>Lilj.</i> ...	251	<i>tauricus</i> , <i>Presl</i> ...	223
<i>ilvense</i> , <i>Lin</i> ...	248	AMESIUM , <i>Newman.</i>	
<i>laciniatum</i> , <i>Gilib.</i> ...	193	<i>germanicum</i> , <i>Newm.</i>	181
<i>leptophyllum</i> , <i>De Cand.</i>	74	<i>Ruta-muraria</i> , <i>Newm.</i>	188
<i>Marantæ</i> , <i>Hænke</i> ...	248	<i>septentrionale</i> , <i>Newm.</i>	194
<i>Thelypteris</i> , <i>Lin.</i> ...	97	ANOGRAMMA , <i>Link.</i>	
<i>septentrionale</i> , <i>Lin.</i>	193	<i>leptophylla</i> , <i>Link</i> ...	74
<i>Spicant</i> , <i>Vill.</i> ...	218	APHYLLOCALPA , <i>Cav.</i>	
ADIANTUM , <i>Lin.</i>	229	<i>regalis</i> , <i>Cav.</i> ...	268
<i>africanum</i> , <i>R. Br.</i> ...	230	ASPIDIUM , <i>Swartz.</i>	
CAPILLUS-VENERIS , <i>L.</i>	229	<i>aculeatum</i> , <i>Schkuhr</i>	81
<i>Capillus</i> , <i>Swartz</i> ...	230	<i>aculeatum</i> , <i>Kunze</i> ...	85
<i>coriandrifolium</i> , <i>Lam.</i>	230	<i>aculeatum</i> , <i>Swartz</i> ...	81
<i>cuneifolium</i> , <i>Stokes</i>	230	<i>æmulum</i> , <i>Swartz</i> ...	139
<i>dependens</i> , <i>Chapm.</i> ...	230	<i>affine</i> , <i>Wall.</i> ...	81
<i>fontanum</i> , <i>Salisb.</i> ...	230	<i>affine</i> , <i>Fisch. et Mey.</i> ...	103
<i>Moritzianum</i> , <i>Link</i>	230	<i>alpestre</i> , <i>Hoppe</i> ...	59
<i>pygmæum</i> , <i>Lin. Hb.</i>	188	<i>alpinum</i> , <i>Swartz</i> ...	242
<i>repandum</i> , <i>Tausch</i> ...	230	<i>angulare</i> , <i>Kit.</i> ...	85
<i>trapeziforme</i> , <i>Huds.</i>	177	<i>asperum</i> , <i>Gray</i> ...	78
<i>trifidum</i> , <i>Willd.</i> ...	230	<i>colobodon</i> , <i>Kze.</i> ...	234
ALLOSORUS , <i>Bernh.</i>	70	<i>crinitum</i> , <i>M et Gal.</i> ...	103
<i>aquilinus</i> , <i>Presl</i> ...	223		
CRISPUS , <i>Bernh.</i> ...	70		

	PAGE.		PAGE.
ASPIDIUM (<i>continued</i>).		ASPIDIUM (<i>continued</i>).	
<i>cristatum</i> , Swartz ..	117	<i>paleaceum</i> , Don ..	103
<i>dentatum</i> , Swartz ...	234	<i>pallidum</i> , Link ...	114
<i>depastum</i> , Schkuhr...	103	<i>patentissimum</i> , Wall.	103
<i>dilatatum</i> , Willd. ...	125	<i>parallelogrammum</i> ,	
<i>dilatatum</i> , Smith ...	124	<i>Kunze</i> ...	103
— <i>recurvum</i> ...	139	<i>Plukenetii</i> , Steud. ...	81
— <i>concauum</i> ...	139	<i>Pontederæ</i> , Willd. ...	234
<i>discretum</i> , Don ...	81	<i>recurvum</i> , Bree ...	139
<i>distans</i> , Viv. ...	248	<i>regium</i> , Swartz ...	242
<i>Donianum</i> , Spr. ...	103	<i>rhæticum</i> , Swartz ...	59
<i>dumetorum</i> , Smith ...	125	<i>rhæticum</i> , Spr. ...	145
<i>erosum</i> , Schkuhr ...	125	<i>rigidum</i> , Swartz ...	114
<i>Filix-mas</i> , Swartz ...	102	<i>rufidulum</i> , Swartz ...	248
— <i>erosum</i> , Hook. & Arn.	103	<i>spinulosum</i> , Smith ...	126
— <i>pumilum</i> ...	104	<i>spinulosum</i> , Ilk. & Arn.	117
— <i>recurvum</i> ...	104	<i>spinulosum</i> , Schkuhr	125
<i>Filix-fœmina</i> , Swartz	144	<i>spinulosum</i> , Sw. 117,	124
<i>fœnisecii</i> , Kunze ...	139	— <i>uliginosum</i> , A. Br.	117
<i>fontanum</i> , Swartz ...	163	<i>taygetense</i> , Bory et Ch.	242
<i>fragile</i> , Swartz ...	234	<i>Thelypteris</i> , Swartz	97
<i>fragile</i> , M. et Gal. ...	234	<i>trifidum</i> , Swartz ...	234
<i>fragrans</i> , Gray ...		<i>Wallichianum</i> , Spr.	103
<i>Halleri</i> , Willd. ...	163		
<i>hastulatum</i> , Ten. ...	85	ASPLENIUM, Linn.	162
<i>intermedium</i> , Sadl. ...	81	<i>acutum</i> , Bory ...	170
<i>irriguum</i> , Smith ...	145	ADANTUM NIGRUM, L.	170
<i>lentum</i> , Don ...	81	<i>v. obtusatum</i>	170, 173
<i>lobatum</i> , Swartz ...	81	<i>v. acutum</i>	170, 173
<i>lobatum</i> , Schkuhr ...	81	<i>v. decompositum</i> ...	176
<i>Lonchitis</i> , Swartz ...	78	<i>v. fissum</i> ...	175
<i>montanum</i> , Swartz ...	245	<i>v. intermedium</i> ...	175
<i>munitum</i> , Sadl. ...	81	<i>v. oblongum</i> ...	175
<i>nemorale</i> , Gray ...	102	<i>v. oxyphyllum</i> ...	176
<i>odoriferum</i> , Gray ...	100	<i>v. variegatum</i> ...	175
<i>ocellatum</i> , Wall. ...	81	<i>Adiantum nigrum</i> ,	
<i>Oreopteris</i> , Swartz ...	100	<i>Bory</i> ...	170
<i>palustre</i> , Gray ...	97	— <i>angustatum</i> ...	170

	PAGE.		PAGE.
ASPLENIUM (<i>continued</i>).		ASPLENIUM (<i>continued</i>).	
—obtusum	... 170	microdon, <i>Moore</i>	166, 168
Adiantum-lanceola-		murale, <i>Bernh.</i>	... 188
tum, <i>Hoffm.</i>	... 170	murorum, <i>Lam.</i>	... 188
alternifolium, <i>Wulf.</i>	181	nigrum, <i>Bernh.</i>	... 170
argutum, <i>Klfs.</i>	... 170	Onopteris, <i>Lin.</i>	... 170
Bilottii, <i>F. Schultz</i>	... 166	patens, <i>Gaud.</i>	... 170
Breynii, <i>Retz.</i>	... 181	productum, <i>Lowe</i>	... 117
capense, <i>Lin. Hb.</i>	... 170	REFRACTUM, <i>Moore</i>	165
Cetrach, <i>Lin.</i>	... 214	rotundatum, <i>Klfs.</i>	... 166
cuneatum, <i>F. Schultz.</i>	166	RUTA-MURARIA, <i>Lin.</i>	188
cuneifolium, <i>Viv.</i>	... 170	<i>v. cristatum</i>	... 190
elongatum, <i>Salisb.</i>	... 197	<i>v. cuneatum</i>	... 190
Filix-fœmina, <i>Bernh.</i>	144	<i>v. dissectum</i>	... 190
—latifolium	... 145	<i>v. pinnatum</i>	... 190
—molle	... 144	<i>v. unilaterale</i>	... 190
—trifidum	... 144	Scolopendrium, <i>Lin.</i>	197
—rhæticum	... 145	SEPTENTRIONALE, <i>H.</i>	193
FONTANUM, <i>Bernh.</i>	... 162	Spicant, <i>Bernh.</i>	... 217
GERMANICUM, <i>Weis</i>	191	sinuatum, <i>Salisb.</i>	... 214
Halleri, <i>R. Br. : Spr.</i>	163	tabulare, <i>Schrad.</i>	... 170
LANCEOLATUM, <i>Huds.</i>	166	trichomanoides, <i>Lumn.</i>	170
<i>v. MICRODON</i>	... 166	saxatile, <i>Salisb.</i>	... 181
<i>v. crispatum</i>	... 169	—incisum	... 181
<i>v. laciniatum</i>	... 169	TRICHOMANES, <i>Lin.</i>	181
leptophyllum, <i>Cav.</i>	... 74	<i>v. INCISUM</i>	183, 184
lucidum, <i>Salisb.</i>	... 170	<i>v. bifurcum</i>	... 183
MARINUM, <i>Lin.</i>	... 177	<i>v. cristatum</i>	... 183
<i>v. SUBBIPPINATUM,</i>	179	<i>v. depauperatum</i>	... 184
<i>v. acutum</i>	... 179	<i>v. lobatum</i>	... 185
<i>v. assimile</i>	... 180	<i>v. multifidum</i>	... 183
<i>v. crenatum</i>	... 179	<i>v. ramosum</i>	... 183
<i>v. cuneatum</i>	... 179	<i>v. subæquale</i>	... 184
<i>v. incisum</i>	... 180	—pinnatifidum	... 181
<i>v. ramosum</i>	... 179	Trichom.-ramosum, <i>L.</i>	186
<i>v. trapeziforme</i>	... 179	trichomanoides, <i>Wcb.</i>	
—microdon	... 166	<i>et M.</i>	... 181
melanocaulon, <i>Willd.</i>	181	Virgilia, <i>Bory</i>	... 171

	PAGE.		PAGE.
ASPLENIUM (<i>continued</i>).		ATHYRIUM (<i>continued</i>).	
VIRIDÆ, <i>Huds.</i>	... 186	<i>v. laxum</i>	... 159
<i>v. acutum</i>	... 187	<i>v. obtusum</i>	... 158
<i>v. bipinnatum</i>	... 187	<i>v. odontomanes</i>	... 158
<i>v. multifidum</i>	... 187	<i>v. ovatum</i>	... 158
ATHYRIUM , <i>Roth.</i>	143	<i>v. polyclados</i>	... 160
alpium, <i>Spr.</i>	... 242	<i>v. præmorsum</i>	... 159
alpestre, <i>Nyland.</i>	... 59	<i>v. pruinosum</i>	... 158
convexum, <i>Newm.</i>	... 145	<i>v. ramosum</i>	... 160
cyclosorum, <i>Rupr.</i>	... 144	<i>v. stenodon</i>	... 156
dentatum, <i>Gray</i>	... 234	<i>v. thyssanotum</i>	... 160
depauperatum, <i>Schum.</i>	144	<i>v. undulatum</i>	... 158
FILIX-FÆMINA, <i>Roth.</i>	143	—convexum	... 145
<i>v. CRISPUM</i>	146, 155	—furcatum	... 146
<i>v. CORYMBIFERM.</i>	145, 155	—incisum	... 144
<i>v. DEPAUPERATUM</i>	146, 155	—molle	... 144
<i>v. LATIFOLIUM</i>	145, 150	—multifidum	... 146
<i>v. MARINUM</i>	145, 152	—præmorsum	... 63
<i>v. MULTIFIDUM</i>	146, 153	—ramosum	... 146
<i>v. POLYDACTYLON</i>	145, 153	—Smithii	... 146
<i>v. RHÆTICUM</i>	144, 149	—vivipara	... 146
<i>v. acuminatum</i>	... 156	flexile, <i>Moore</i>	... 59
<i>v. caudiculatum</i>	... 160	fontanum, <i>Roth</i>	... 163
<i>v. confluens</i>	... 156	fragile, <i>Sadl.</i>	... 234
<i>v. davallioides</i>	... 158	fumarioides, <i>Presl</i>	... 234
<i>v. diffissum</i>	... 159	Halleri, <i>Roth</i>	... 163
<i>v. dissectum</i>	... 159	incisum, <i>Newm.</i>	... 144
<i>v. erosum</i>	... 159	irriguum, <i>Gray</i>	... 145
<i>v. excurrens</i>	... 157	lætum, <i>Gray</i>	... 144
<i>v. frondosum</i>	... 158	latifolium, <i>Bab. MS.</i>	... 145
<i>v. furcatum</i>	... 160	laxum, <i>Schum.</i>	... 144
<i>v. gracile</i>	... 158	molle, <i>Roth</i>	... 144
<i>v. inexpletum</i>	... 160	montanum, <i>Roehl.</i>	... 245
<i>v. interruptum</i>	... 159	ovatum, <i>Newm.</i>	... 145
<i>v. irregulare</i>	... 159	ovatum, <i>Roth</i>	... 144
<i>v. laciniatum</i>	... 159	rhæticum, <i>Roth</i>	... 145
		Thelypteris, <i>Spr.</i>	... 97
		trifidum, <i>Roth</i>	... 144

	PAGE.		PAGE.
BLECHNUM , <i>Lin.</i> ...	217	CTENOPTERIS , <i>Newm.</i>	
<i>boreale</i> , <i>Swartz</i> ...	217	<i>vulgaris</i> , <i>Newm.</i> ...	49
<i>crispum</i> , <i>Hartm.</i> ...	71	CYATHEA , <i>Smith.</i>	
<i>linguifolium</i> , <i>Stokes</i> ...	197	<i>alpina</i> , <i>Smith</i> ...	242
<i>septentrionale</i> , <i>Wallr.</i> ...	194	<i>anthriscifolia</i> , <i>Roth</i> ...	234
SPICANT , <i>Smith</i> ...	217	<i>cynapifolia</i> , <i>Roth</i> ...	234
<i>v. RAMOSUM</i> ...	218, 220	<i>dentata</i> , <i>Smith</i> ...	234
<i>v. MULTIFURCATUM</i>		<i>fragilis</i> , <i>Smith</i> ...	234
... 218, 220		<i>fragilis</i> , <i>Roth</i> ...	234
<i>v. bifidum</i> ...	222	<i>incisa</i> , <i>Smith</i> ...	242
<i>v. crispum</i> ...	222	<i>montana</i> , <i>Roth</i> ...	245
<i>v. fissum</i> ...	222	<i>regia</i> , <i>Forster</i> ...	242
<i>v. heterophyllum</i> ...	221	<i>regia</i> , <i>Roth</i> ...	234
<i>v. lancifolium</i> ...	221	CYSTEIA , <i>Smith.</i>	
<i>v. multifidum</i> ..	222	<i>alpina</i> , <i>Smith</i> ...	242
<i>v. serratum</i> ...	222	<i>angustata</i> , <i>Smith</i> ...	234
<i>v. strictum</i> ...	222	<i>dentata</i> , <i>Smith</i> ...	234
<i>v. trinervium</i> ...	222	<i>fragilis</i> , <i>Smith</i> ...	234
<i>squamosum</i> , <i>Stokes</i> ...	214	<i>regia</i> , <i>Smith</i> ...	234, 242
BOTRYCHIUM , <i>Sw.</i> ...	271	CYCLOPTERIS , <i>Gray.</i>	
<i>LUNARIA</i> , <i>Swartz</i> ...	271	<i>fragilis</i> , <i>Gray</i> ...	234
<i>v. rutaceum</i> ...	271	<i>dentata</i> , <i>Gray</i> ...	234
<i>lunatum</i> , <i>Gray</i> ...	271	<i>regia</i> , <i>Gray</i> ...	242
<i>matricariæfolium</i> , <i>A. B.</i> ...	271	CYSTOPTERIS , <i>Beruh.</i>	
<i>rutaceum</i> , <i>Swartz</i> ...	271	<i>Allioni</i> , <i>Newm.</i> ...	244
CETERACH , <i>Willd.</i> ...	213	<i>alpina</i> , <i>Desvaux</i> ...	242
<i>alpinum</i> , <i>De Cand.</i> ...	251	<i>chilensis</i> , <i>Fée</i> ...	234
<i>OFFICINARUM</i> , <i>Willd.</i> ...	213	<i>dentata</i> , <i>Hook.</i> ...	234
<i>v. crenatum</i> ...	215	— <i>Dickieana</i> ...	234
<i>v. depauperatum</i> ...	215	<i>Dickieana</i> , <i>Sim</i> ..	234
CINCINALIS , <i>Gleditsch.</i>		<i>Filix-fœmina</i> , <i>C. et G.</i> ...	144
<i>aquilina</i> , <i>Gleditsch</i> ...	224	<i>fumarioides</i> , <i>Kze.</i> ...	234
CRYPTOGRAMMA , <i>R. Br.</i>		<i>FRAGILIS</i> , <i>Beruh.</i> ...	233
<i>crispa</i> , <i>R. Br.</i> ...	71	<i>v. DICKIEANA</i> ...	234, 237

	PAGR.		PAGE.
CYSTOPTERIS (<i>cont.</i>)		GYMNOPTERIS , <i>Bernh.</i>	
<i>v. angustata</i>	... 238	<i>Ceterach</i> , <i>Bernh.</i>	... 214
<i>v. decurrens</i>	... 240	GYMNOCARPIUM , <i>Newm.</i>	
<i>v. dentata</i>	... 239	<i>Dryopteris</i> , <i>Newm.</i> ...	65
<i>v. interrupta</i>	... 240	<i>Phegopteris</i> , <i>Newm.</i> ...	56
<i>v. obtusa</i>	... 239	<i>Robertianum</i> , <i>Newm.</i>	67
MONTANA , <i>Bernh.</i>	... 244	GYMNOGRAMMA ,	
<i>myrrhidifolium</i> , <i>Newm.</i>	244	<i>Desv.</i>	74
<i>orientalis</i> , <i>Desv.</i>	... 233	<i>Ceterach</i> , <i>Sprengel</i> ...	214
REGIA , <i>Presl</i>	... 242	LEPTOPHYLLA , <i>Desv.</i>	74
<i>rhætica</i> , <i>Link</i>	... 234	<i>novæ-zelandiæ</i> , <i>Col.</i>	74
<i>retusa</i> , <i>Dcne.</i>	... 234	<i>palliserense</i> , <i>Col.</i>	... 74
<i>Pontederæ</i> , <i>Link</i>	... 234	HEMESTHEUM , <i>Newm.</i>	
<i>sempervirens</i> , <i>Moore</i>	240	<i>montanum</i> , <i>Newm.</i> ...	100
DICHASIMUM , <i>A. Braun.</i>		<i>Thelypteris</i> , <i>Newm.</i> ...	97
<i>patentissimum</i> , <i>A. Br.</i>	103	HEMIONITIS , <i>Lin.</i>	
DICRANODIUM , <i>New.</i>	74	<i>leptophylla</i> , <i>Lag.</i>	... 74
DIDYMOGLOSSUM , <i>Dsv.</i>		HYMENOPHYLLUM ,	
<i>alatum</i> , <i>Desv.</i>	... 255	<i>Smith</i>	... 261
DRYOPTERIS , <i>Adans.</i>		<i>alatum</i> , <i>Smith</i>	... 255
<i>abbreviata</i> , <i>Newm.</i>	... 104	<i>asperulum</i> , <i>Kze.</i>	... 262
<i>affinis</i> , <i>Newm.</i>	... 103	<i>Menziesii</i> , <i>Presl</i>	... 264
<i>Borreri</i> , <i>Newm.</i>	... 103	<i>Meyeri</i> , <i>Presl</i>	... 264
<i>cristata</i> , <i>A. Gray</i>	... 117	<i>peltatum</i> , <i>Desv.</i>	... 624
<i>dilatata</i> , <i>A. Gray</i>	... 124	<i>Thunbergii</i> , <i>Eckl.</i>	... 262
<i>Filix-mas</i> , <i>Schott</i>	... 102	TUNBRIDGENSE , <i>Smith</i>	261
— <i>abbreviata</i>	... 104	<i>tunbridgense</i> , <i>Schkr.</i>	264
— <i>affinis</i>	... 103	UNILATERALE , <i>Bory</i>	264
— <i>Borreri</i>	... 103	<i>Wilsoni</i> , <i>Hooker</i>	... 264
<i>Thelypteris</i> , <i>A. Gray</i>	97	HYPOPELTIS , <i>Bory.</i>	
EUPTERIS , <i>Newm.</i>		<i>lobulata</i> , <i>Bory</i>	... 85
<i>aquilina</i> , <i>Newm.</i>	... 224		
GRAMMITIS , <i>Swartz.</i>			
<i>Ceterach</i> , <i>Swartz</i>	... 214		
<i>leptophylla</i> , <i>Swartz</i>	74		

	PAGE.
LASTREA , <i>Presl</i> ...	96
abbreviata, <i>Woll.</i> ...	104
abbreviata, <i>Moore</i> ...	104
affinis, <i>Moore</i> ...	103
ÆMULA, <i>Brack.</i> ...	139
calcarea, <i>Newm.</i> ...	67
Callipteris, <i>Newm.</i> ...	117
Chanteriæ, <i>Moore</i> ...	126
collina, <i>Newm.</i> ...	125
concaua, <i>Newm.</i> ...	137
CRISTATA, <i>Presl</i> ...	116
v. ULIGINOSA	117, 119
v. SPINULOSA	117, 121
DILATATA, <i>Presl</i> ...	124
v. ALPINA	126, 135
v. ANGUSTA	126, 134
v. CHANTERLE	126, 133
v. COLLINA	125, 132
v. DUMETORUM	125, 130
v. GLANDULOSA	126, 136
v. LEPIDOTA	... 136
v. NANA	125, 130
v. SMITHII	126, 137
v. TANACETIFOLIA	124, 129
v. deltoidea	... 137
v. distans	... 138
v. fuscipes	... 137
v. interrupta	... 138
v. micromera	... 138
v. obtusa	... 138
v. pumila	... 137
v. Schofieldii	... 138
v. valida	... 138
—collina	... 125
—linearis	... 117
—maculata	... 125
Dryopteris, <i>Bory</i> ...	65
dumetorum, <i>Moore</i> ...	125

	PAGE.
LASTREA (<i>continued</i>).	
erosa, <i>Deak.</i> ...	103
FILIX-MAS, <i>Presl</i> ...	102
v. ABBREVIATA	103, 109
v. CRISTATA	104, 111
v. INCISA	103, 106
v. PALEACEA	103, 108
v. PINDERI	103, 109
v. POLYDACTYLA	104, 111
v. PUMILA	104, 109
v. deorso-lobata	... 112
v. elongata	... 111
v. interrupta	... 112
v. Jervisii	... 112
v. multifida	... 112
v. monstrosa	... 112
v. paleaceo-lobata	... 112
v. producta	... 111
v. subintegra	... 112
v. triangularis	... 112
—abbreviata	... 104
—Borreri	... 103
fœniseeii, <i>Watson</i> ...	139
glandulosa, <i>Newm.</i> ...	127
lepidota, <i>Moore</i> ...	136
maculata, <i>Deakin</i> ...	125
MONTANA, <i>Moore</i> ...	99
v. crispa	... 102
v. truncata	... 101
multiflora, <i>Newm.</i> ...	124
—collina	... 125
—nana	... 125
Oreopteris, <i>Presl</i> ...	99
paleacea, <i>Moore</i> ...	103
parallelogramma, <i>Lbm.</i>	103
patentissima, <i>Presl</i>	103
Phegopteris, <i>Bory</i> ...	56
pseudo-mas, <i>Woll.</i> ...	103

	PAGE.		PAGE.
LASTREA (<i>continued</i>).		NEPHRODIUM (<i>cont.</i>)	
<i>pumila</i> , Moore ...	104	<i>Oreopteris</i> , Desv. ...	100
<i>recurva</i> , Newm. ...	139	<i>pallidum</i> , Bory ...	114
RIGIDA , Presl ...	114	<i>rufidulum</i> , Mich. ...	248
<i>Robertiana</i> , Newm. ...	67	<i>Thelypteris</i> , Strempt. ...	97
<i>rufidula</i> , Presl ...	248	NOTOLEPEUM , Newm.	
<i>spinosa</i> , Newm. ...	117	<i>Ceterach</i> , Newm. ...	214
<i>spinulosa</i> , Presl ...	117	ONOCLEA , Linnæus.	
THELYPTERIS , Presl ...	97	<i>crispa</i> , Hoffm. ...	71
<i>truncata</i> , Brack. ...	103	<i>Spicant</i> , Hoffm. ...	217
<i>uliginosa</i> , Newm. ...	117	OPHIOGLOSSUM , L. ...	275
LOMARIA , Willd.		<i>LUSITANICUM</i> , Lin. ...	278
<i>borealis</i> , Link ...	218	<i>ovatum</i> , Salisb. ...	275
<i>Spicant</i> , Desv. ...	218	<i>pennatum</i> , Lam. ...	271
LOPHODIUM , Newm.		<i>Riehlii</i> , Hb. Vien. ...	275
<i>abbreviatum</i> , Newm. ...	104	<i>unifolium</i> , Gilib. ...	275
<i>Callipteris</i> , Newm. ...	117	<i>VULGATUM</i> , Lin. ...	275
<i>collinum</i> , Newm. ...	125, 126	OSMUNDA , Lin. ...	267
<i>erosum</i> , Newm. ...	103	<i>borealis</i> , Salisb. ...	217
<i>Filix-mas</i> , Newm. ...	102	<i>crispa</i> , Lin. ...	70
<i>fœniseeii</i> , Newm. ...	139	<i>leptophylla</i> , Lam. ...	74
<i>glanduliferum</i> , Newm. ...	127	<i>Lunaria</i> , Lin. ...	271
<i>glandulosum</i> , Newm. ...	127	<i>lunata</i> , Salisb. ...	271
<i>multiflorum</i> , Newm. ...	124	<i>REGALIS</i> , Lin. ...	267
<i>recurvum</i> , Newm. ...	139	<i>rupestris</i> , Salisb. ...	79
<i>rigidum</i> , Newm. ...	114	<i>Spicant</i> , Lin. ...	217
<i>spinosum</i> , Newm. ...	118	PHEGOPTERIS , Fée.	
<i>uliginosum</i> , Newm. ...	117	<i>alpestris</i> , Mett. ...	59
NEPHRODIUM , Richard.		<i>calcareia</i> , Fée ...	67
<i>affine</i> , Lowe ...	103	<i>Dryopteris</i> , Fée ...	65
<i>cristatum</i> , Mich. ...	117, 124	<i>Oreopteris</i> , Fée ...	100
<i>dilatatum</i> , Desv. ...	124	<i>polypodioides</i> , Fée ...	56
<i>Dryopteris</i> , Mich. ...	67	<i>vulgaris</i> , Mett. ...	56
<i>Filix-fœmina</i> , Strempt. ...	144		
<i>fœniseeii</i> Lowe ...	137		

	PAGE.
PHIOROLOBUS, <i>Desv.</i>	
<i>crispus, Desv.</i> ...	71

PHYLLITIS, <i>Auct.</i>	
<i>crispa, J. Bauh.</i> ...	198
<i>heterophylla, Mænoch</i>	191
<i>lancifolia, Mænoch</i> ...	170
<i>multifida, Ger: Ray</i>	198
<i>polyschides, Ray</i> ...	198
<i>rotundifolia, Mænoch</i>	181
<i>Ruta-muraria, Mænoch</i>	188
<i>Scolopendrium, Newm.</i>	197

POLYPODIUM, Lin.	49
<i>aculeatum, Lin.</i> ...	81
<i>aculeatum, Bolt.</i> ...	81
<i>aculeatum, Huds.</i> ...	85
<i>adiantoides, Poir.</i> ...	166
<i>æmulum, Ait.</i> ...	139
ALPESTRE, <i>Spr.</i> ...	59
<i>v. FLEXILE</i>	59, 61
<i>v. lanceum</i> ...	63
<i>v. tripinnatifidum</i> ...	63
<i>album, Lam.</i>	234, 242
<i>alpinum, Lam.</i> ...	163
<i>alpinum, Wulf.</i> ...	242
<i>angulare, Fries</i> ...	85
<i>anthriscifolium, Hoffm.</i>	233
<i>aopendiculatum, Hoff.</i>	85
<i>aristatum, Villars</i> ...	125
<i>arvonicum, With.</i> ...	218
<i>arvonicum, Smith</i> ...	251
<i>bifidum, Hoffm.</i> ...	144
<i>boreale, Salisb.</i> ...	49
<i>calcareum, Smith</i> ...	66
<i>Callipteris, Ehrh.</i> ...	117
<i>cambricum, Lin.</i> ...	50
— <i>crispum, Desv.</i> ...	50

	PAGE.
POLYPODIUM (cont).	
<i>connectile, Mich.</i> ...	56
<i>crispum, Gouan</i> ...	242
<i>cristatum, Lin.</i> ...	117
<i>cristatum, Huds.</i> ...	124
<i>cynapifolium, Hoffm.</i>	233
<i>dentatum, Dicks.</i> ...	234
<i>dentatum, Hoffm.</i> ...	144
<i>dilatatum, Hoffm.</i> ...	124
DRYOPTERIS, <i>Lin.</i> ...	64
<i>Filix-fœmina, Lin.</i> ...	144
— <i>crenata, Weis</i> ...	144
— <i>dentata, Weis</i> ...	144
— <i>spinosa, Weis</i> ...	117
<i>Filix-mas, Lin.</i> ...	102
<i>flexile, Moore</i> ...	59
<i>fontanum, Lin.</i> ...	163
<i>fontanum, Lin. Hb.</i> ...	251
<i>fragrans, Huds.</i> ...	100
<i>fragrans, Vill.</i> ...	114
<i>fragile, Lin.</i> ...	233
— <i>angustatum</i> ...	234
<i>funarioides, Weis</i> ...	234
<i>Heleopteris, Bkh.</i>	103, 114
<i>hyperboreum, Swartz</i>	251
<i>ilvense, With.</i> ...	251
<i>ilvense, Vill.</i> ...	248
<i>incisum, Hoffm.</i> ...	144
<i>lætum, Salisb.</i> ...	144
<i>laciniatum, Lam.</i> ..	50
<i>latebrosum, Salisb.</i> ...	56
<i>leptophyllum, Lin.</i> ...	74
<i>limbospermum, All.</i> ...	100
<i>lobatum, Huds.</i> ...	81
<i>Louchitis, Lin.</i> ...	78
<i>molle, Schreb.</i> ...	144
<i>montanum, Vogler</i> ...	100
<i>montanum, Lam: All.</i>	245

	PAGE.
POLYPODIUM (<i>cont.</i>)	
multiflorum, <i>Roth.</i> ...	124
myrrhidifolium, <i>Vill.</i>	245
nemorale, <i>Salisb.</i> ...	102
oblongo-dentatum, <i>Hff.</i>	144
officinale, <i>Guld.</i> ...	49
Oreopteris, <i>Ehrh.</i> ...	100
ovato-crenatum, <i>Hoff.</i>	144
palustre, <i>Salisb.</i> ...	97
pedicularifolium, <i>Hoff.</i>	233
PHEGOPTERIS , <i>Lin.</i> ...	56
pinnatifidum, <i>Gilib.</i> ...	49
Plukenetii, <i>Loisel.</i> ...	81
polymorphum, <i>Vill.</i>	232
	234, 242
Pontederæ, <i>All.</i> ...	234
pteroïdes, <i>Vill.</i> ...	100
pulchellum, <i>Salisb.</i> ...	65
regium, <i>Lin.</i> ...	242
rhæticum, <i>Pallas.</i> ...	59
rhæticum, <i>Dicks.</i> ...	234
rhæticum, <i>Lin.</i> ...	145
rigidum, <i>Hoffm.</i> ...	114
ROBERTIANUM , <i>Hoffm.</i>	66
setiferum, <i>Forsk.</i> ...	85
spinulosum, <i>Mull.</i> ...	117
tanacetifolium, <i>Hoffm.</i>	125
tenue, <i>Hoffm.</i> ...	234
Thelypteris, <i>Huds.</i> ...	100
Thelypteris, <i>Lin.</i> ...	97
triidum, <i>Hoffm.</i> ...	144
trifidum, <i>With.</i> ...	234
virginianum, <i>Hort.</i> ...	49
viterbiense, <i>Bocc.</i> ...	49
Villarsii, <i>Bellardi.</i> ...	114
viridulum, <i>Desv.</i> ...	234
VULGARE, <i>Lin.</i> ...	49
v. SEMILACERUM	50, 51

	PAGE.
POLYPODIUM (<i>cont.</i>)	
v. CAMBRICUM	50, 52
v. acutum	... 52
^π v. auritum	... 53
^ε v. bifidum	... 52
v. crenatum	... 55
v. denticulatum	... 55
v. hibernicum	... 50
v. interruptum	... 53
v. laciniatum	... 53
v. marginatum	... 53
v. multifidum	... 53
v. omnilacerum	... 55
v. ovatum	... 55
v. serratum	... 54
v. serrulatum	... 53
v. sinuatum	... 53
v. truncatum	... 55
POLYSTICHUM , <i>Sch.</i>	78
abbreviatum, <i>De C.</i> ...	104
ACULEATUM, <i>Roth.</i> ...	81
v. LOBATUM	... 81
v. ARGUTUM	... 82
aculeatum, <i>Link.</i> ...	81
aculeatum, <i>A. Gray.</i>	85
aculeatum, v. alatum	86
affine, <i>Presl.</i> ...	81
affine, <i>Wall.</i> ...	35
affine, <i>Ledeb.</i> ...	103
ANGULARE, <i>Presl.</i> ...	85
v. ALATUM	86, 89
v. CRISTATUM	87, 90
v. IMBRICATUM	85, 89
v. PROLIFERUM	86, 90
v. SUBTRIPINNATUM	87, 90
v. TRIPINNATUM	87, 90
v. acutum	... 92

	PAGE.		PAGE.
POLYSTICHUM (<i>cont.</i>)		PSEUDATHYRIUM , <i>N.</i>	
<i>v. aristatum</i> ...	92	<i>alpestre</i> , <i>Newm.</i> ...	59
<i>v. biserratum</i> ...	93	<i>flexile</i> , <i>Newm.</i> ...	59
<i>v. confluens</i> ...	94	PTERIS , <i>Lin.</i> ...	223
<i>v. decompositum</i> ...	94	AQUILINA , <i>Lin.</i> ...	223
<i>v. densum</i> ...	94	<i>v. crispa</i> ...	226
<i>v. depauperatum</i> ...	94	<i>v. integerrima</i> ...	226
<i>v. dissimile</i> ...	90	<i>v. multifida</i> ...	226
<i>v. grandidens</i> ...	94	<i>borealis</i> , <i>Salisb.</i> ...	223
<i>v. hastulatum</i> ...	92	<i>brevipes</i> , <i>Tausch</i> ...	223
<i>v. incisum</i> ...	94	<i>caudata</i> , <i>Link</i> ...	223
<i>v. intermedium</i> ...	92	<i>capensis</i> , <i>Thunb.</i> ...	223
<i>v. irregulare</i> ...	93	<i>crispa</i> , <i>Lin.</i> ...	70
<i>v. præmorsum</i> ...	93	<i>excelsa</i> , <i>Blume</i> ...	223
<i>v. prol. Wollastoni</i> ...	90	<i>firma</i> , <i>Wall.</i> ...	223
— <i>angustatum</i> ...	87	<i>fœmina</i> , <i>Gray</i> ...	223
<i>Callipteris</i> , <i>De Cand.</i> ...	117	<i>lanuginosa</i> , <i>Bory.</i> ...	223
<i>cristatum</i> , <i>Roth</i> ...	117	<i>nudicaulis</i> , <i>Guld.</i> ...	223
<i>dilatatum</i> , <i>De Cand.</i> ...	124	<i>recurvata</i> , <i>Wall.</i> ...	223
<i>Dryopteris</i> , <i>Roth</i> ...	65	<i>septentrionalis</i> , <i>Smith</i> ...	194
<i>Filix-mas</i> , <i>Roth</i> ...	102	<i>tenuifolia</i> , <i>Lam.</i> ...	71
<i>lobatum</i> , <i>Presl</i> ...	81	<i>terminalis</i> , <i>Wall.</i> ...	223
<i>lobatum</i> , <i>Smith</i> ...	81	<i>villosa</i> , <i>Fée</i> ...	223
<i>LONCHITIS</i> , <i>Roth</i> ...	78	<i>Wightiana</i> , <i>Wall.</i> ...	223
<i>Marantæ</i> , <i>Roth</i> ...	248	SCOLOPENDRIUM ,	
<i>montanum</i> , <i>Roth</i> ...	100	<i>Smith</i> ...	196
<i>multiflorum</i> , <i>Roth</i> ...	124	<i>alternifolium</i> , <i>Roth</i> ...	191
<i>Oreopteris</i> , <i>De Cand.</i> ...	100	<i>Ceterach</i> , <i>Symons</i> ...	214
<i>ocellatum</i> , <i>Schott</i> ...	81	<i>Lingua</i> , <i>Cav.</i> ...	197
<i>Plukenetii</i> , <i>De Cand.</i> ...	81	<i>officinale</i> , <i>De Cand.</i> ...	197
<i>Phegopteris</i> , <i>Roth</i> ...	56	<i>officinarum</i> , <i>Swartz</i> ...	197
<i>rigidum</i> , <i>De Cand.</i> ...	114	— <i>crispum</i> ...	198
<i>setiferum</i> , <i>Moore</i> ...	85	— <i>multifidum</i> ...	199
<i>spinosum</i> , <i>Roth</i> ...	118	— <i>dædaleum</i> ...	199
<i>spinulosum</i> , <i>De Cand.</i> ...	124	— <i>ramosum</i> ...	199
<i>strigosum</i> , <i>Roth</i> ...	114	<i>Phyllitis</i> , <i>Roth</i> ...	197
<i>tanacetifolium</i> , <i>De C.</i> ...	125		
<i>Thelypteris</i> , <i>Roth</i> ...	97		

SCOLOPENDRIUM	PAGE.	SCOLOPENDRIUM	PAGE.
	<i>(continued)</i>		<i>(continued)</i> .
Ruta-muraria, <i>Roth</i>	188	- <i>v. lanceolum</i>	... 208
septentrionale, <i>Roth</i>	194	<i>v. macrosorum</i>	... 205
VULGARE, <i>Smith</i>	197	<i>v. multiforme</i>	... 210
<i>v. CORNUTUM</i> ,	198, 201	<i>v. muricatum</i>	... 201
<i>v. CRISPUM</i>	198, 202	<i>v. nudicaule</i>	... 207
<i>v. LACERATUM</i>	199, 204	<i>v. obtusidentatum</i>	... 205
<i>v. MARGINATUM</i>	198, 201	- <i>v. pachyphyllum</i>	... 208
<i>v. MULTIFIDUM</i>	198, 203	<i>v. papillosum</i>	... 209
<i>v. POLYSCHIDES</i>	198, 201	<i>v. periferum</i>	... 208
<i>v. RAMOSUM</i>	199, 204	<i>v. pocilliferum</i>	... 208
<i>v. abruptum</i>	... 207	<i>v. proliferum</i>	... 209
- <i>v. apicilobum</i>	... 207	<i>v. ramo-marginatum</i>	211
<i>v. bimarginatum</i>	... 210	<i>v. ramosum majus</i>	211
<i>v. bireniforme</i>	... 207	<i>v. resectum</i>	... 206
<i>v. chelæfrons</i>	... 210	<i>v. retinervium</i>	... 208
<i>v. compositum</i>	... 207	<i>v. rimosum</i>	... 206
- <i>v. constrictum</i>	... 209	<i>v. rugosum</i>	... 207
- <i>v. coriaceum</i>	... 208	<i>v. sagittifolium</i>	... 208
<i>v. crenato-lobatum</i>	... 206	<i>v. sagittato-cristatum</i>	208
<i>v. crispatum</i>	... 203	- <i>v. salebrosum</i>	... 206
<i>v. crista-galli</i>	... 210	- <i>v. scalpturatum</i>	... 209
<i>v. cristatum</i>	... 211	- <i>v. siciforme</i>	... 209
<i>v. depauperatum</i>	... 211	<i>v. sinuatum</i>	... 206
<i>v. digitatum</i>	... 210	<i>v. spirale</i>	... 207
<i>v. fimbriatum</i>	... 209	<i>v. striatum</i>	... 207
<i>v. fissum</i>	... 205	<i>v. subcornutum</i>	... 201
<i>v. flabellatum</i>	... 211	<i>v. submarginatum</i>	... 209
<i>v. glomeratum</i>	... 211	<i>v. subvariegatum</i>	... 207
<i>v. imperfectum</i>	... 209	- <i>v. supra-lineato-resec-</i>	
<i>v. inæquale</i>	... 206	tum	... 210
<i>v. inops</i>	... 206	<i>v. supralineatum</i>	... 210
<i>v. irregulare</i>	... 206	<i>v. undulato-lobatum</i>	203
<i>v. jugosum</i>	... 209	<i>v. undulatum</i>	... 203
<i>v. lacerato-marginatum</i>	211	<i>v. variabile</i>	... 207
<i>v. laciniatum</i>	... 206	- angustifolium	... 198
		- lobatum	... 198

	PAGE.		PAGE.
SCOLOPENDRIUM		TRICHOMANES, L.	254
	(continued)	alatum, <i>R. Br. : Hook.</i>	255
—dædaleum	... 198	ambiguum, <i>Sieb.</i>	... 255
—serratum	... 200	Andrewsii, <i>Newm.</i>	... 255
—palmatum	... 200	brevisetum, <i>R. Br.</i>	... 255
—endiviaefolium	... 200	—Andrewsii	... 255
SPICANTA, Presl.		crenata, <i>Gilib.</i>	... 181
borealis, <i>Presl</i>	... 218	diaphanum, <i>H. B. K.</i>	255
STEGANIA, R. Br.		europæum, <i>Smith</i>	... 255
borealis, <i>R. Br.</i>	... 218	hibernicum, <i>Spr.</i>	... 255
crispa, <i>R. Br.</i>	... 71	peltatum, <i>Poir.</i>	... 264
onocleoides, <i>Gray</i>	... 71	pulchellum, <i>Salisb.</i>	... 262
STRUTHIOPTERIS, W.		pyxidiferum, <i>Huds.</i>	... 255
crispa, <i>Wallr.</i>	... 71	RADICANS, Swartz	... 254
regalis, <i>Bernh.</i>	... 268	v. ANDREWSII	... 255
Spicant, <i>Weis</i>	... 217	scandens, <i>Hedw.</i>	... 255
TARACHIA, Presl.		speciosum, <i>Willd.</i>	... 255
acuta, <i>Presl</i>	... 170	tunbridgense, <i>Lin.</i>	... 262
Adiantum-nigrum,		tunbridgense, <i>Bolt.</i>	... 264
<i>Presl</i>	... 170	umbrosum, <i>Wall.</i>	... 255
arguta, <i>Presl</i>	... 170	VITTARIA, Sm.	
germanica, <i>Presl</i>	... 191	Ceterach A. <i>Bernh.</i>	... 214
lanceolata, <i>Presl</i>	... 166	WOODSIA, R. Brown	248
Ruta-muraria, <i>Presl</i>	188	ALPINA, <i>Gray</i>	... 251
THELYPTERIS, Schott.		hyperborea, <i>R. Br.</i>	... 251
palustris, <i>Schott</i>	... 97	ILVENSIS, <i>R. Br.</i>	... 248
		Raiana, <i>Newm.</i>	... 248
		rufidula, <i>Beck</i>	... 248
		vestita, <i>Spr. ?</i>	... 248

P. 94. **Polystichum angulare**—add:—

—*affine* (*P. affine*, Wollaston). A long-stiped form, which Mr. Wollaston regards as a distinct species. Fronds somewhat firm in texture, dark-coloured, and attenuated at the apex; pinnules stalked, blunt, bluntly auricled, rather convex, and finely and indistinctly serrated, scarcely lobed. An elegant form, with the aspect of a slender *P. aculeatum*. Hants, Mr. Wollaston.

—*angustifrons*. Fronds small, slender, scarcely a foot high, and about one and a quarter inch wide: narrow-linear, tapered towards the top, distinctly bipinnate, the pinnules small, normal in character. Remarkable, if constant; fronds moderately fertile. Devon, Mr. C. Jackson.

—*linearis*. A very elegant monstrosity. Fronds nearly two feet high, bipinnate, the apex and apices of pinnæ confluent into a linear lobato-serrate apex; the pinnules narrow linear-oblong, with a large acute auricle where perfect, but here and there depauperated; a bipinnate analogue of *confluens*. Devon, Mr. C. Jackson.

—*plumosum*. An elegant pale-green feathery-looking variety, in outline ovate, with an elongated apex, remarkably thin in texture, the pinnules inciso-lobate acutely aristato-serrate. Devon, Mr. Wollaston; Somersetshire, Mr. Elworthy.

—*pterophorum*. A distinct variety, having the secondary rachides (of the pinnæ) winged by the confluence of the decurrent basis of the pinnules, as in *alatum*, but the pinnules are smaller, more imbricated, and less crispy-toothed, than in that, giving a different aspect to the plant. Devonshire, Mr. Wollaston.

P. 111. **Lastrea Filix-mas**—add:—

—*cristata angustata*. A beautiful small narrow-fronded form of *cristata*, raised from spores by Mr. R. Sim, and quite constant. It is densely crested both at the tips of the fronds and pinnæ, and the fronds being nearly linear, in outline, appear to consist almost wholly of a frill bordering the rachis.

P. 217, read **Blechnum Spicant**, *Smith*.



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