SOME TAXA WITHIN THE
DRYOPTERIS AFFINIS COMPLEX

A FIELD GUIDE

KEN TREWREN

British Pteridological Society
Special Publication No. 13

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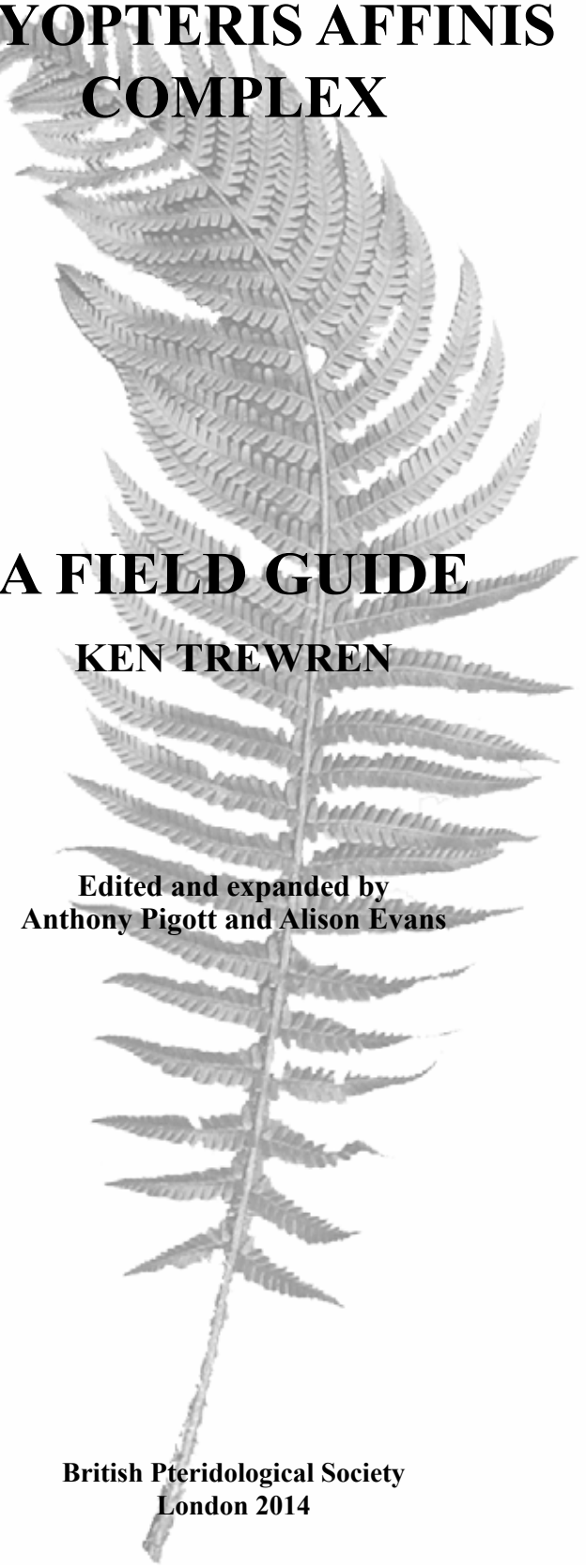

A FIELD GUIDE

KEN TREWREN

Edited and expanded by
Anthony Pigott and Alison Evans

British Pteridological Society
London 2014

Trewren, K.
Some Taxa within the *Dryopteris affini*s complex
Eds. Pigott, A.C. and Evans, A.J.

Published by
The British Pteridological Society
The Natural History Museum
Cromwell Road
LONDON SW7 5BD
England

Special Publication No. 13
Original text by Ken Trewren
Edited and expanded by Anthony Pigott and Alison Evans

ISBN 978-0-9926120-2-3

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The BRITISH PTERIDOLOGICAL SOCIETY was founded in 1891 and is still a focus for fern enthusiasts, its wide membership including gardeners, nurserymen and botanists, both amateur and professional. It provides a wide range of information about ferns through its publications and website, and also organises indoor and field meetings, garden visits, a plant exchange, a spore exchange and fern book sales. The Society's journals, *The Fern Gazette*, *Pteridologist* and *Bulletin* are published annually. *The Fern Gazette* publishes matter chiefly of specialist interest on international pteridology, the *Pteridologist*, topics of more general appeal, and the *Bulletin* deals with Society business and meetings reports.

Design by Alec Greening

Printed by MTP Media Ltd
The Sidings
Beezon Fields
Kendal LA9 6BL

Cover picture
Croziers of *Dryopteris borreri*
Photo: Ken Trewren

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Introduction

This guide is the work of the late Ken Trewren, a life-long fern enthusiast whose powers of observation and attention to detail were extraordinary. Ken spent most of his working life overseas, so although his interest in *Dryopteris* started many years ago with a student project on male-ferns, it was mainly in retirement that he worked on describing the British taxa of the *Dryopteris affinis* complex and their hybrids. He was the first to discover *Dryopteris pseudodisjuncta* in a British location. He was a key member of the Yorkshire Fern Group of the British Pteridological Society (BPS), and also led several national workshops on *Dryopteris affinis*. He produced this version of the guide in September 2009, since when it has been available to those who knew Ken, and has been used widely in the field by those of us trying to make sense of this complex group of plants.

Since the 3rd edition of Clive Stace's *New Flora of the British Isles* in 2010 gave separate species status to *Dryopteris affinis* (with three subspecies), *D. borreri*, and *D. cambrensis* (with two subspecies), there has been a demand from general botanists, and Botanical Society of Britain and Ireland (BSBI) recorders in particular, for more guidance on identifying these taxa. This guide describes these taxa, and goes further in describing their hybrids with *D. filix-mas* and *D. oreades*.

Plants of the *Dryopteris affinis* complex are apogamous, that is they produce spores that have the same chromosomes as the parent, and a new sporophyte grows directly from the prothallus without fusion of gametes. This new sporophyte is effectively a clone of its parent. Some of these clones can look quite different from the type species, and several different varieties have been described. Some of the more distinct varieties have been included in the guide. Ken followed Jermy and Camus (1991) and Pigott (1997) in using the term 'morphotype' for these taxa. Ken discussed these at great length with British and German botanists, and made great efforts to achieve a consensus. There is still debate about some of these taxa; however, we feel that Ken's work provides a platform for further exploration and clarification, and should be made widely available to botanists[1].

Ken used the formal names for taxa that had been formally described, and the informal morphotype names for others; we have followed his approach in this guide. Arthur Chater, in his *Flora of Cardiganshire,* used both formal names and informal morphotype names together for all the *Dryopteris affinis* taxa[2]. This scheme is used in the full taxonomic list on page 42. We have used italics for formal names, bold roman type in single quotes for informal morphotype names, and put Ken's proposed but unpublished names in double quotes[3].

If you are just starting to learn about the *D. affinis* complex, we recommend that you concentrate on the typical forms of the three main species, *D. affinis, D. borreri,* and *D. cambrensis*, as these are the taxa you will find most commonly. Ken's guide did not include the features separating scaly male-ferns from our other male-ferns. We have added a brief guide to this on page 46. The *Dryopteris* account in *The Plant Crib 1998* gives sound advice on how to segregate the male-ferns. James Merryweather's book *The Fern Guide* (3rd Edition) also goes into this and has helpful pictures.

We have followed Ken's arrangement of the guide, so that the subspecies, as described by Stace (2010), follow the species, and then the morphotypes are described. Finally, the known hybrids of these taxa are described. We have changed the layout from A4 to make for a more practical field guide, and photo captions have been added by Alison Evans using Ken's descriptions.

The prothalli of the *D. affinis* complex can produce antherozoids and so act as the male parents in hybridisation with *D. filix-mas* and *D. oreades*. The resulting hybrids often have a high proportion of abortive spores, but as they inherit the apogamous nature of the *affinis* parent, they can produce some viable spores and offspring. Ken made a detailed study of these hybrids and described the different nothosubspecies.

Ken Trewren cultivated all of these plants in his garden near Whitby. He kept a database in which he recorded morphological features, times of frond flushing, and in some cases the

results of chromosome examination to determine ploidy level. Members of the BPS are able to visit the garden by arrangement. In addition to the plants in the garden, Ken left a large collection of sporelings, which have been grown on by members of the BPS. It may in future be possible to establish further living collections in gardens open to the public.

Ken's notes to accompany the guide, written in September 2009, have been included with only minor changes and added endnotes to help clarify.

We have not included a key in this guide because authorities on the *D. affinis* complex agree that keys to these taxa are not reliable. In addition, published keys do not include all the taxa described in this guide. The notes and the text on the figures highlight the distinguishing features of the taxa.

We have included a section on the historical context of the *D. affinis* complex by Anthony Pigott, in order to relate the taxa to previously published work.

To facilitate accurate recording of specimens, fronds may be sent to Anthony, the BSBI referee for the *Dryopteris affinis* complex, for determination at the following address:

Anthony Pigott
Kersey's Farm
Mendlesham
Stowmarket
Suffolk IP14 5RB

Please email Anthony.Pigott@btinternet.com prior to sending fronds to check that he is available to receive them. See his web site at http://www.Dryopteris.org for further details.

Alison Evans
May 2013

Endnotes

1 The Editors want this to be Ken Trewren's Guide, as he wrote it in 2009. It is not an 'official' BPS guide to the *Dryopteris affinis* complex and the Editors do not necessarily agree with all of Ken's views.

2 For a definition of the concept of morphotype, we can do no better than to quote Arthur Chater:

"These morphotypes, which are in fact distinctive apogamous taxa, are, like the clones of *Ulmus* and *Populus* and the species of *Rubus* and *Hieracium*, the recognisably distinct entities that one sees in the field and that can be reliably recorded by someone with sufficient knowledge and experience, ..."

3 This work is issued with the disclaimer that it is not intended to be used for the purposes of botanical nomenclature, and any apparent new names should be taken as being provisional.

Acknowledgments:
Our thanks go to Kate Trewren for giving us access to Ken's files and his plants, to Frank McGavigan for his encouragement and drive, to Arthur Chater for his wisdom and encouragement to both Ken and Anthony, to Alec Greening for his patience and his extensive work on the lay-out of this guide, to Alison Paul for her detailed proof-reading and wise counsel, and to the several BPS members who commented on earlier drafts.

An Historical Note on the Study of the *Dryopteris affinis* complex

Wollaston's paper in 1875 can be seen as the beginning of the modern understanding of the *Dryopteris affinis* complex. In it he separated the British male ferns into three species, *filix-mas, oreades* and *affinis* (as *Filix-mas*, *propinqua* and *pseudo-mas*) using a table of comparative characters, not unlike a modern spread-sheet.

Von Tavel, in 1937, listed eleven apparently true-breeding continental European forms, most of which can be readily associated with currently recognised forms. Other German botanists continued this approach of studying the variation of the group, then seen as very minor by most British botanists.

Manton's ground-breaking work in 1950 included studies of the British male-ferns (then known as *filix-mas*, *abbreviata* and *borreri*) in which she provided cytological evidence for the species described by Wollaston, showing that *D. filix-mas* was a sexually-reproducing tetraploid, *D. oreades* a sexual diploid and that *D. affinis* was apomictic. She found *D. affinis* included diploid and triploid forms along with tetraploids and pentaploids believed to be hybrids with *D. filix-mas*.

The work of Manton and others following led to the conclusion that three ancestral diploid genomes were involved in the male ferns, *oreades* and *caucasica*, which together form the parentage of *D. filix-mas*, and another 'affinis-ancestor', involved in the forms of *D. affinis*, in combination with *oreades* and *caucasica*.

Corley worked extensively on *Dryopteris*, developing a detailed understanding of the variation within the *D. affinis* complex and postulated various combinations of ancestral genomes to explain it. Unfortunately, little of his work on *D. affinis* was published but his influence can be seen in the work of others.

Fraser-Jenkins, in 1980, published a comprehensive treatment of the *affinis* complex in Britain and the rest of Europe, treating the group as one species, *Dryopteris affinis*, with the variation represented by a hierarchy of subspecies and varieties. The subspecies generally were associated with different putative compositions of diploid genomes.

Page's book in 1982, coupled with his regular attendance on field trips at that time, led to a significant growth in interest and knowledge of the group within the BPS and elsewhere.

Beitel and Buck, in 1988, although not specialists in the group, felt that it was inappropriate to rank at subspecies level those taxa which were known to have a distinct genome composition. They published a note recognising three species, *D. affinis*, *D. borreri* and *D. cambrensis*.

By the time Jermy and Camus produced their guide in 1991, a number of people studying the group felt that although there were at least three 'good' species in the *D. affinis* complex, there was insufficient evidence to put all the forms in a formal taxonomic hierarchy. Accordingly, five distinct forms were described as 'morphotypes', a term outside the formal rules of the Botanical Code, which allowed all the observed natural forms to be given names without the need to specify their relationships.

In 1997, Pigott published a note on the group, giving a table of detailed comparative descriptions for nine morphotypes covering Britain and Ireland.

Fraser-Jenkins, in 2007, published a further paper on the *Dryopteris affinis* complex, revising some taxa and generally raising everything by one level such that the subspecies of *D. affinis* in his 1980 paper became species in the 2007 one. He reiterated his preference for putting the taxa in a formal hierarchy.

Ken Trewren was familiar with this literature, and frequently discussed his work and findings with other *D. affinis* complex experts. His untimely death in 2010 prevented him from completing and publishing this work himself.

The taxonomy and nomenclature of the *Dryopteris affinis* complex is involved. The table below shows the three most commonly used treatments of the taxa.

Fraser-Jenkins 1980/1996; Stace 1991	Fraser-Jenkins 2007; Stace 2010	Jermy and Camus 1991; Pigott 1997
affinis subspecies *affinis* var. *affinis*	= *affinis* subspecies *affinis*	= *affinis* complex morph. '**affinis**'
		+ *affinis* complex morph. '**convexa**'
affinis subspecies *affinis* var. *paleaceolobata*	= *affinis* subspecies *paleaceolobata*	= *affinis* complex morph. '**paleaceo-lobata**'
affinis subspecies *affinis* var. *kerryensis*	= *affinis* subspecies *kerryensis*	= *affinis* complex morph. '**kerryensis**'
affinis subspecies *cambrensis* var. *paleaceocrispa*	= *cambrensis* subspecies *cambrensis*	= *affinis* complex morph. '**cambrensis**'
affinis subspecies *cambrensis* var. *pseudocomplexa*	= *cambrensis* subspecies *pseudocomplexa*	= *affinis* complex morph. '**arranensis**'
affinis subspecies *borreri*	= *borreri*	= *affinis* complex morph. '**borreri**'
		+ *affinis* complex morph. '**insolens**'
		+ *affinis* complex morph. '**robusta**'
		affinis complex "forma *foliosum*" (Trewren, see note)

Anthony Pigott

June 2013

Note: The synonymy between Fraser-Jenkins 1980/1996 and Fraser-Jenkins 2007 is as stated in Fraser-Jenkins 2007. The synonymy between Pigott 1997 and Fraser-Jenkins 2007 is as stated and implied by Fraser-Jenkins 2007; it is not necessarily agreed by Pigott in the cases of morphotypes 'convexa', 'insolens' and 'robusta'. Ken's "forma *foliosum*" is included with the morphotypes for completeness as he used the name in a similar way.

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Photo: Ken Trewren

Dryopteris affinis subspecies *affinis*

Dryopteris affinis complex

Ken Trewren. September 2009

It is now accepted by most who have been studying this group that the former subspecies should be treated as distinct species. A paper using the new terminology has been published in the *Fern Gazette* (February 2007), by Christopher Fraser-Jenkins. The main reasons for treating the three main taxa as species are:

1. They have different genetic origins:

   Dryopteris affinis is diploid, with one genome derived from *D. oreades* and the other from *D. wallichiana* or *D. crassirhizoma*.[1]

   D. borreri is triploid, with one genome each from *D. oreades, D. caucasica* and *D. wallichiana* or *D. crassirhizoma.*[2]

   D. cambrensis is triploid, with two genomes from *D. oreades* and one from *D. wallichiana* or *D. crassirhizoma.*[3]

2. With a little practice, it is not too difficult to identify each of the species, from their characteristic features.

This book is intended to give an introduction to those taxa, including subspecies and hybrids, most likely to be found; other taxa are mentioned only briefly.

The main diagnostic features of each taxon are given on the photographs. More detailed descriptions are given below.

Dryopteris affinis

D. affinis* subspecies *affinis[4] is common in a range of different habitats and on different soil types. It is usually darker green than the other species, except in exposed situations, and is also **usually more vigorous and more robust, and the texture is thick and leathery. It is fully evergreen**, although the fronds can be broken by snow. The outline of the frond is broadest in the middle, tapering progressively towards the base. The sori are highly characteristic**. When the sporangia are ripe (black) the sides of the indusia are vertical, with the margins tucked under the sporangia**. When the spores are shed the indusia rise like a pie-crust, usually with one or two radial splits. On all pinnae the basal pair of pinnules are no longer than the adjacent pair of pinnules, and are not fully stalked, being at least ¼ adnate to the costa. The basal pinnules on the basal pair of pinnae are usually smaller than the corresponding pinnules on the pinnae immediately above. All pinnules are either untoothed or with just a few blunt lobes on the basal pinnules (except in uncommon clones, which may be prominently lobed or with sharp teeth).

D. affinis* subspecies *paleaceolobata is uncommon, but widely distributed. It is also thick and leathery, with a very glossy surface to the pinnae, and it is fully evergreen. It differs from subsp. *affinis* mainly in having **pinnules which are crimped in at the sides, curved up at the ends and twisted away from the rachis in a highly characteristic manner**. Other characteristic features include:

- The scales are dense, narrow and deep reddish brown. Thin wispy scales are also prominent on the upper surface of the rachis.
- As the sporangia dehisce the indusia usually develop several radial splits, and then lift to form separate wedges, resembling the wings on a butterfly cake (see picture).
- The basal pinnules on each pinna are fully stalked, with prominent bluntly lobed teeth, and are longer than the adjacent pair of pinnules on the same pinna.
- The basal pinnae are well developed, resulting in a truncate outline to the base of the frond. The basal pinnules on the basal pinnae are much longer than the adjacent pair of pinnules, and also larger than those on the pinnae immediately above. They are fully stalked and have large rounded lobes along their sides.
- The new fronds develop much later in spring than any of the other taxa except subspecies *kerryensis*, being 3-4 weeks later than subspecies *affinis*, and they are a characterisic bright yellow colour when young.

D. affinis* subspecies *kerryensis is found only in south-west Ireland. **It is characterized by crowded and noticeably flat pinnules and blackish scales**. The fronds develop nearly a month later in the season than those of *D. affinis* subspecies *affinis.*

***D. affinis* morphotype 'convexa'** has been informally described by Anthony Pigott. It has stiff fronds with a markedly glossy upper surface to the pinnules, the sides of which are deflexed downwards. It is rare, found mainly in Wales, with one plant beside Coniston Lake in Cumbria, and Kirkbean Glen near Dumfries[5].

There are also two other distinct taxa within *D. affinis*, both of which are found in south-west Ireland, one of which is also found in Wales, but no decision has yet been made about how these ought to be classified.

Occasionally, localized clones of *D. affinis* are found in which the frond outline may be truncate at the base, or the pinnule segments have sharply toothed or prominently lobed margins.

Dryopteris borreri

D. borreri[6] is the commonest of the taxa, being found in most areas of woodland, as well as roadside ditches and hedgebanks. **The texture of the fronds is much softer than that of other taxa, and they are only slightly glossy**. The fronds die back progressively through winter, but not so quickly as those of *D. filix-mas.* The outline of the frond is broad, broadest in the middle, tapering slightly to a truncate base (although occasional clones taper progressively towards the base). The scales are not dense, rather broad, and usually of a straw-brown colour. The stipes are slender. As the sporangia dehisce **the indusia normally lift to form a narrow**

inverted cone like that of a chanterelle fungus (although in some clones the indusia lift to form a raised pie-crust, or *Agaricus*-like structure – see pictures). The basal pinnules on each pinna are fully stalked to half way up the frond, they are usually **prominently toothed with pointed teeth**, and are usually slightly longer than the adjacent pinnules on the same pinna. The basal pinnules on the basal pinnae are usually larger and better developed than the corresponding pinnules on the pinnae immediately above. Unfortunately this species exhibits numerous distinct forms which, in their extreme forms, are highly distinct, but the existence of intermediate forms makes it difficult to draw dividing lines between them, and opinions are divided as to how they should be classified, if at all. Anthony Pigott has described two of these forms as morphotypes '**robusta**' and '**insolens**', both of which are widespread, but these taxa are not accepted by Christopher Fraser-Jenkins (due to the presence of intermediate forms). **Morphotype 'robusta'** is highly distinctive, having prominent rhomboid teeth on the sides of the pinnules, and broad overlapping pinnae and pinnules. If this taxon is eventually formally named, it will have to be something other than *robusta* (perhaps *rhombidentata*), because the taxon as described by him is quite different from the type specimen of var. robusta, as established by von Tavel. Unfortunately, despite the distinctiveness of the 'classic' type, there is a whole series of intermediates linking it with normal *D. borreri*.

With **morphotype 'insolens'** there are several quite distinct forms which all fit Anthony Pigott's description of the taxon, but the frond pictured here is believed to be one which was identified as such by him, from a site in Cardiganshire.

A further distinct taxon which may be worthy of formal recognition has been given the provisional name of **"forma *foliosum*"**[7]. This is characterized by broad overlapping pinnae and pinnules, with the pinnules being irregularly crimped and curled. The taxon is widespread, common and easily recognized.

Dryopteris cambrensis

D. cambrensis* subspecies *cambrensis is uncommon in England, less so in Wales, but is common in Scotland. The frond outline is narrow and tapering towards the base. The scales are fairly dense, glossy and twisted, of a deep brown colour with a darker patch at the base of each scale (some forms of *D. borreri* also have this characteristic). The stipes are moderately thick. As the sporangia dehisce the indusia lift to form a pie-crust, with some lifting further to an inverted cone, and others may split radially. The proportions of the different types of indusia vary from one clone to another, but in all clones **the indusia have a noticeably thinner margin. The pinnae are usually concave in cross-section, a characteristic which the species has inherited from its two genomes of *D. oreades*.** The expression of this characteristic is also rather variable from one clone to another, and from one plant to another within the same population, with some plants having markedly concave pinnae whilst others, especially immature plants, may be flat. As well as being curved up at the ends, the pinnules are often crimped in at the sides, as in *D. affinis* subspecies *paleaceolobata*, and these two taxa are often confused with each other. The basal pinnules on each pinna are fully stalked to half way up the frond, **and are significantly longer than the adjacent pinnules on the same pinna. There is also a prominent lobe at the base of the basal pinnule, next to the rachis, and protruding over it (see picture).** The basal pinnules on the basal pinnae are larger than the corresponding pinnules on the pinnae immediately above, and have prominent blunt lobes along their sides.

D. cambrensis* subspecies *pseudocomplexa has been found only on Skye, Arran, Islay, Kirkbean Glen near Dumfries and a couple of sites in south-west Ireland. It has narrow, distant pinnules, a thin stipe and pale brown scales.

Dryopteris pseudodisjuncta

D. pseudodisjuncta was found in July 2008 in Kirkbean Glen near Dumfries. There are just 10 plants at the site, which makes it the scarcest species of fern in Britain, and one of the scarcest vascular plants. The species is found mainly in southern Germany, Austria and Switzerland, and rarely in France, Belgium, Luxembourg, Norway and Austria. The identification of the species has been confirmed by two German botanists, Jens Freigang and Gunther Zenner. The main taxonomic characters are given on the photographic page.

Hybrids

Of the hybrids, ***D.* × *complexa* nothosubspecies *complexa*** is much the commonest, frequently found where the parents, *D. affinis* subspecies *affinis* and *D. filix-mas,* are growing in close proximity. **Hybrid vigour is usually prominent, and it is less glossy than *D. affinis*, with larger, more foliose pinnules, which are prominently lobed and often crimped and crinkled.** Once seen, it is easily recognized in the field.

D.* × *complexa* nothosubspecies *contorta is rare, believed to have been found in a couple of places in which both its parents, *D. affinis* subspecies *paleaceolobata* and *D. filix-mas,* grow together (North Yorkshire and Ceredigion), but the only cytologically confirmed specimen is of unknown origin.

This taxon is not featured in this guide.

The hybrid between *D. affinis* subspecies *kerryensis* and *D. filix-mas* has only recently been found in only one site in Ireland. The plant has been confirmed cytologically. It is provisionally called ***D.* × *complexa* "nothosubspecies *hibernica*"**.

D.* × *critica is intermediate between its parents, *D. borreri* and *D. filix-mas,* but it is by no means common. Confirmation of its identity must always be made by examination of the spores, because forms of *D. borreri* can be morphologically almost identical to the hybrid.

D.* × *convoluta, the hybrid between *D. cambrensis and D. filix-mas,* is rare, even in Scotland. **Nothosubspecies *occidentalis*** (*D. cambrensis* subspecies *cambrensis* × *D. filix-mas*) has been identified by Fraser-Jenkins on the basis of morphology, abortive spores and association with the parent species from about a dozen sites, mostly in Scotland, but none of these have been confirmed cytologically. Several plants which were previously thought to be this hybrid have been shown to be *D. cambrensis*, despite having almost totally abortive spores. Recently, two plants have been confirmed cytologically, both from Meall nan Tarmachan.

D.* × *convoluta* nothosubspecies *inconspicua is known only from a single plant on Arran, having been found by Tony Church (although he didn't realize what it was at the time). This is the hybrid between *D. cambrensis* subspecies *pseudocomplexa* and *D. filix-mas.*

Finally, recently discovered plants which require further study include putative *D. affinis* × *D. oreades*, provisionally called ***D.* × "*protocambrensis*"**, found by Tony Church on Arran[8], and putative *D. borreri* × *D. oreades*, provisionally called ***D.* × "*ogwenensis*"**, found by Clive Jermy in the Nant Ffrancon valley in North Wales.

A good time to check putative hybrids in the field is late July and August, when the sporangia are black but before shedding of the spores has begun. At this time a small proportion of brown sporangia will be seen amongst the black ones. Subsequent microscopical examination will reveal that these brown sporangia contain only necrotic cells which have failed to develop, whereas the black ones contain spores which have developed, but are of all different shapes and sizes. In the field, care must be taken not to confuse brown sporangia containing necrotic material with sporangia which have already shed their spores, which are also brown.

Endnotes added by A.C. Pigott

1,2,3 *D. wallichiana* and *D. crassirhizoma* have been proposed as origins of the unknown 'pure affinis' genome; there are other possibilities.

4 The plant that Ken chose to represent the 'standard' form of *D. affinis* subspecies *affinis* in his photographs corresponds to morphotype '**affinis**'**.**

5 It appears to be rather more common than Ken suggests, although still largely confined to the regions that Ken mentions.

6 The plant that Ken chose to represent the 'standard' form of *D. borreri* in his photographs corresponds to morphotype '**borreri**'**.**

7 It is treated here as being equivalent to a morphotype.

8 This taxon would amount to *D. cambrensis* reforming. As such it would be of very similar genetic makeup and it may not be appropriate to assign it a distinct name. However, it is an interesting plant and is included here.

Photo: Ken Trewren

Croziers of *Dryopteris cambrensis* subspecies *cambrensis*

Dryopteris affinis subspecies *affinis*

Key features:

Very glossy, robust, evergreen. Frond outline tapering towards base.

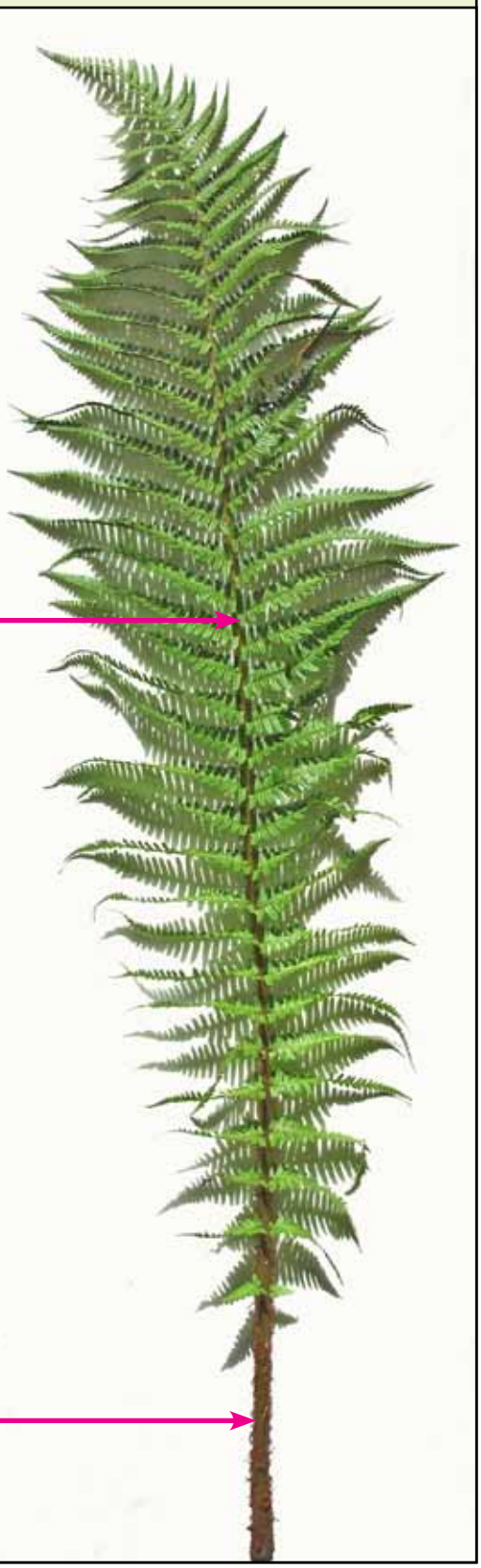
Indusia tall, helmet-shaped at first, lifting to 'pie-crust' then splitting.

Stipes and rachis densely covered with golden brown scales, robust.

Pinnules untoothed or with blunt lobes.

Rachis

Robust stipe



Tall indusia with margins tucked under the ripe sporangia

Indusia lifting to ‘pie-crust’

Indusia with radial splits, sporangia dehisced

Pinnules not fully stalked, usually at least ¼ adnate to the costa

Pinnules either untoothed or with a few blunt lobes. Basal pairs of pinnules no longer than adjacent pairs.

Dryopteris affinis subspecies *paleaceolobata*

Key features:

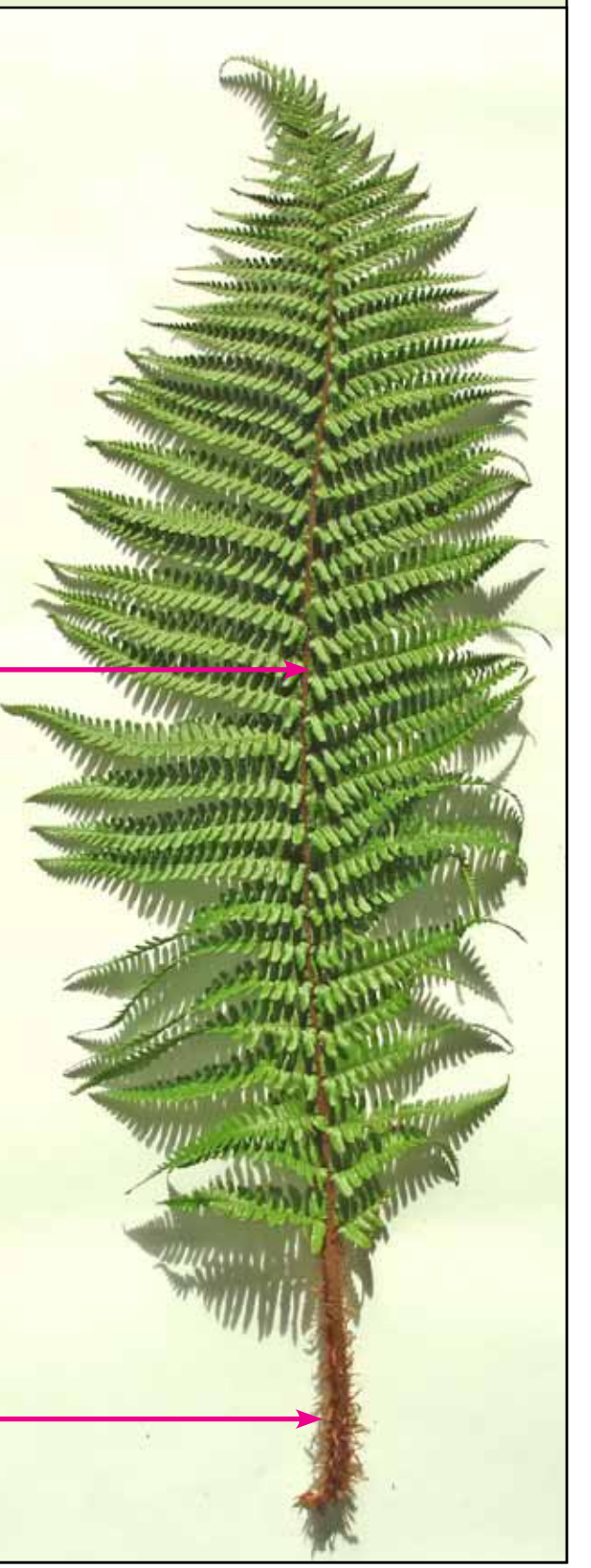
Frond very glossy, outline broad, truncate at base. Stipes robust.

Indusia are tall, helmet-shaped and split radially.

Pinnules 'crimped', toothed with obtuse lobes.

Scales narrow, dense, deep reddish brown.

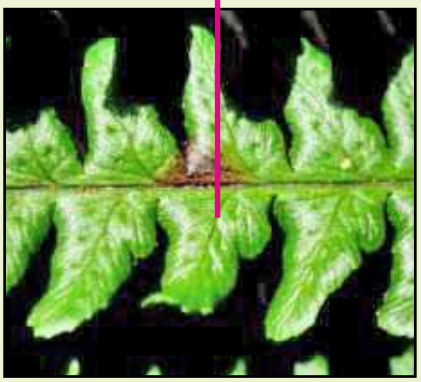
Scales also prominent on upper surface of rachis



Tall, helmet-shaped indusia

Indusia split radially

'Butterfly-wing' appearance of indusia



Pinnules crimped in at the sides, curved up at the ends, and curved away from the rachis

Stalked basal pinnules with bluntly lobed teeth

Long basal pinnae form a truncate frond base. Lowest basiscopic pinnules longer than the adjacent pair, fully stalked, with rounded lobes.

Dryopteris affinis subspecies *kerryensis*

Key features:

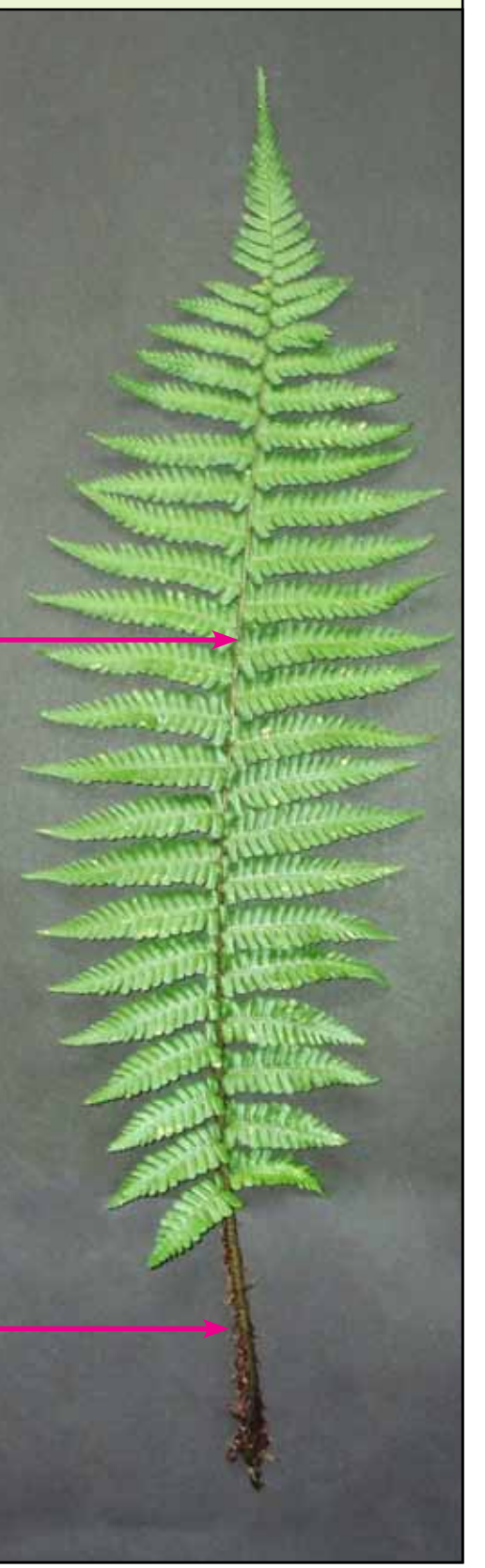
Pinnae and pinnules markedly crowded, flat.

Scales dark brown to blackish.

Fronds develop very late spring.

Endemic to south-west Ireland.

Dark scales, flat frond



Indusia splitting radially and lifting

Pinnules flat, crowded, some with sloping apices

Lowest basiscopic pinnule usually ¼ to ½ adnate to the costa

Dryopteris affinis morphotype '**convexa**'

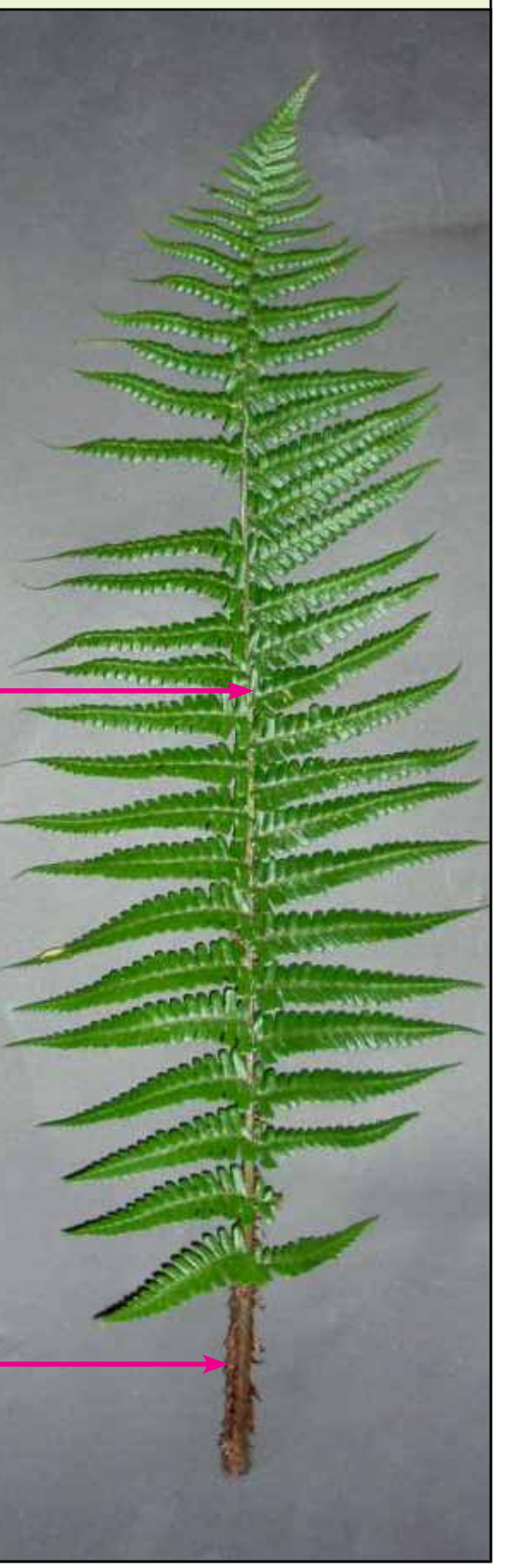
Key features:

Frond very stiff and leathery.

Scales blackish.

Pinnae very glossy with pinnules convex in cross section.

Basal pinnules on basal pinnae stalked.



Indusia over ripe sporangia

Indusia splitting radially

Very glossy pinnules with sides curved downwards

Dryopteris borreri

Key features:

Only slightly glossy, not robust, semi-deciduous.

Frond outline usually truncate at base.

Indusia shrivelling and lifting to an inverted cone.

Stipes slender, scales straw-brown, not dense.

Lower pinnules stalked and with obvious teeth.

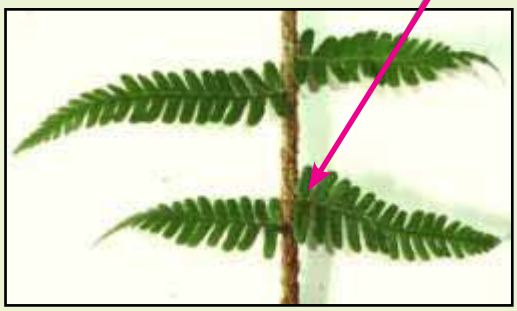
Soft-textured frond with pale scales

Indusia not tucked under the ripe sporangia

Indusia lifting to form narrow inverted cone

Indusia may lift to ‘pie-crust’ shape

Basal pinnules stalked, with obvious teeth, and may be slightly longer than adjacent pinnules



Dryopteris borreri morphotype '**insolens**'

Key features:

Frond broad, slightly glossy, base truncate. Semi-deciduous.

Pinnae distinctly stalked, pinnules broad but not overlapping.

Basal pinnules prominently toothed with rectangular teeth.

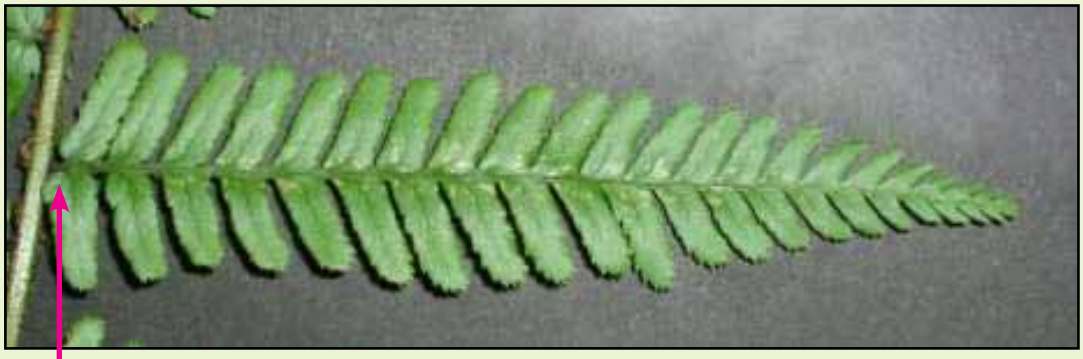
Stipes slender.

Indusia shrivelling and lifting to inverted cone.

Scales deep brown with darker centre, rather appressed.

Indusia not tucked under

Indusia lifting and shrivelling



Lower pinnules toothed, and also stalked, giving a 'boot-shaped' space between pinnules

Dryopteris borreri morphotype '**robusta**'

Key features:

Pinnae and pinnules broad and overlapping.

Pinnules prominently toothed with broad rectangular teeth.

Stipes robust or slender in different clones.

Scales with dark patch at base.

Indusia over ripe sporangia

Indusia shrivel to inverted cones

Pinnules have prominent rhomboid teeth, pinnules and pinnae overlap

Dryopteris borreri "forma *foliosum*"

Key features:

Frond broad, pinnae broad,
outline markedly uneven.

Pinnules crisped and curled in different directions, often deflexed downwards.

Pinnules prominently toothed with broad rhomboid teeth.

Basal pinnae large, well developed.

Stipes moderately robust, plant often large, vigorous.

Spores about 50% abortive. Indusium falls soon after spores are shed.

Note.
The frond depicted is a rather extreme form of the type.

Indusia over ripe sporangia

Dehisced sori

Pinnules crisped and curled in different directions,
with prominent broad rhomboid teeth

Basal pinnae large and well developed

Dryopteris cambrensis subspecies *cambrensis*

Key features:

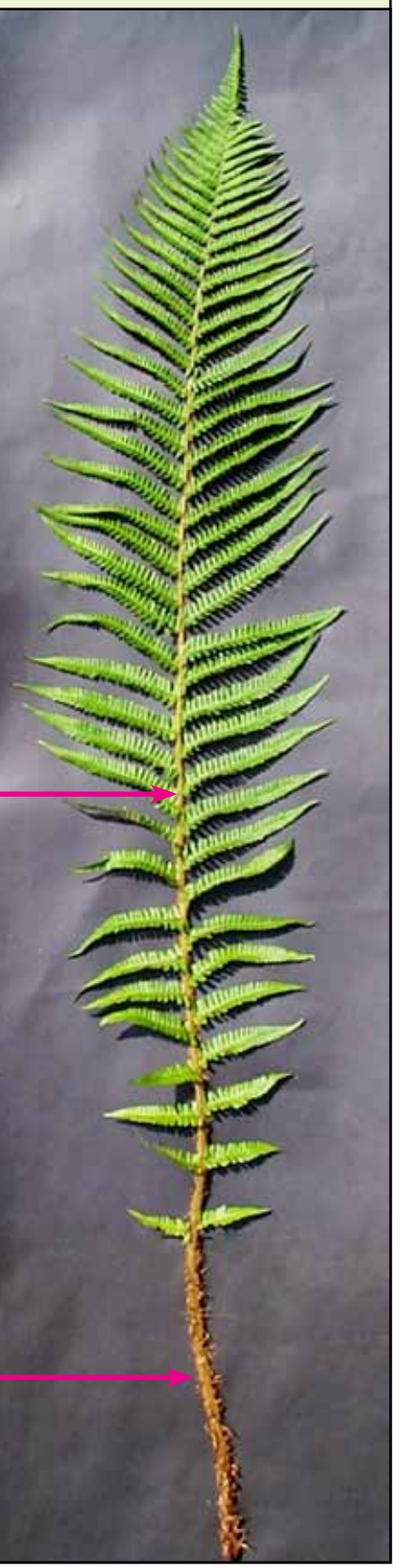
Frond outline narrow, tapering towards base.

Pinnae concave, pinnules ‘crimped’ and curved upwards.

Pinnule teeth prominent, as blunt lobes.

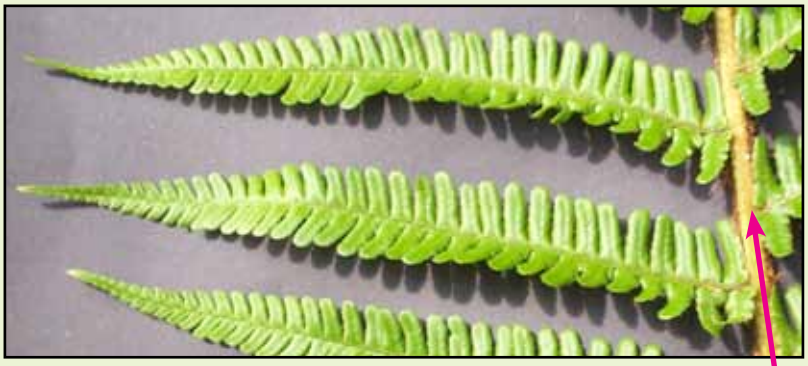
Basal pinnules on each pinna longer than adjacent pair.

Scales fairly dense, narrow and twisted, deep brown with dark base.



Indusial margin is thinner than the dome

Some indusia lift to pie-crust, some to inverted cone, and others split radially



Pinnules curved upwards and crimped at the sides

Basal pinnules stalked to halfway up frond, and longer than adjacent pinnules

Dryopteris cambrensis subspecies *pseudocomplexa*
(morphotype ‘**arranensis**’)

Key features:

Narrow frond outline.

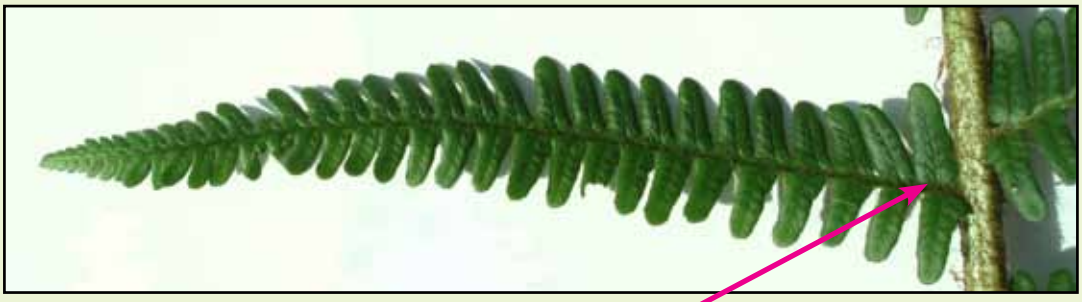
Frond tapering towards base.

Pinnules distant and almost untoothed.

Scales pale coloured, not dense.

Mature sori

Thin-edged indusia



Pinnules distant and almost untoothed

Dryopteris pseudodisjuncta

Key features:

Mature sorus with indusium margins curled under. Later lifting with marked darker depression in centre.

Basal pinnae equal to those immediately above.

Lowest pinnules on each pinna longer than adjacent pair, no auricle.

Pinnules narrowing from base to pointed or narrowly rounded apices.

Scales pale coloured, narrow with dark patch at base.

Narrow wispy scales on underside of pinna costa.

High percentage of spores abortive.

Indusium margin turned under

High % of spores abortive

Indusium with darker central spot

Pinnules narrowing from base to pointed or narrowly rounded apices

OR

Wispy scales on underside of pinna costa

Dryopteris × *complexa* nothosubspecies *complexa* (*D. affinis* subspecies *affinis* × *D. filix-mas*)

Key features:

Hybrid vigour – often >1.5 m tall, robust, fairly glossy.

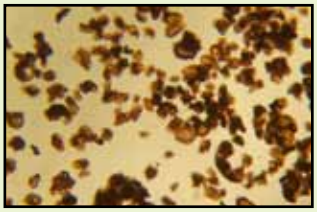
Pinnules prominently toothed/lobed.

Sori intermediate between parents.

Spores abortive.

Stipes robust and densely scaly.

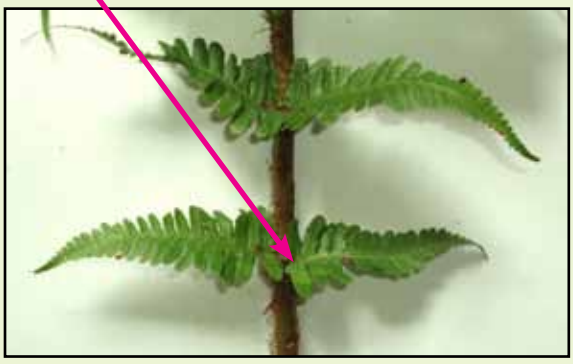
Sori intermediate between those of parents



Abortive spores

Lifting indusia

Pinnules prominently lobed, often crimped, and fairly glossy



Dryopteris × *complexa* "nothosubspecies *hibernica*" (*D. affinis* subspecies *kerryensis* × *D. filix-mas*)

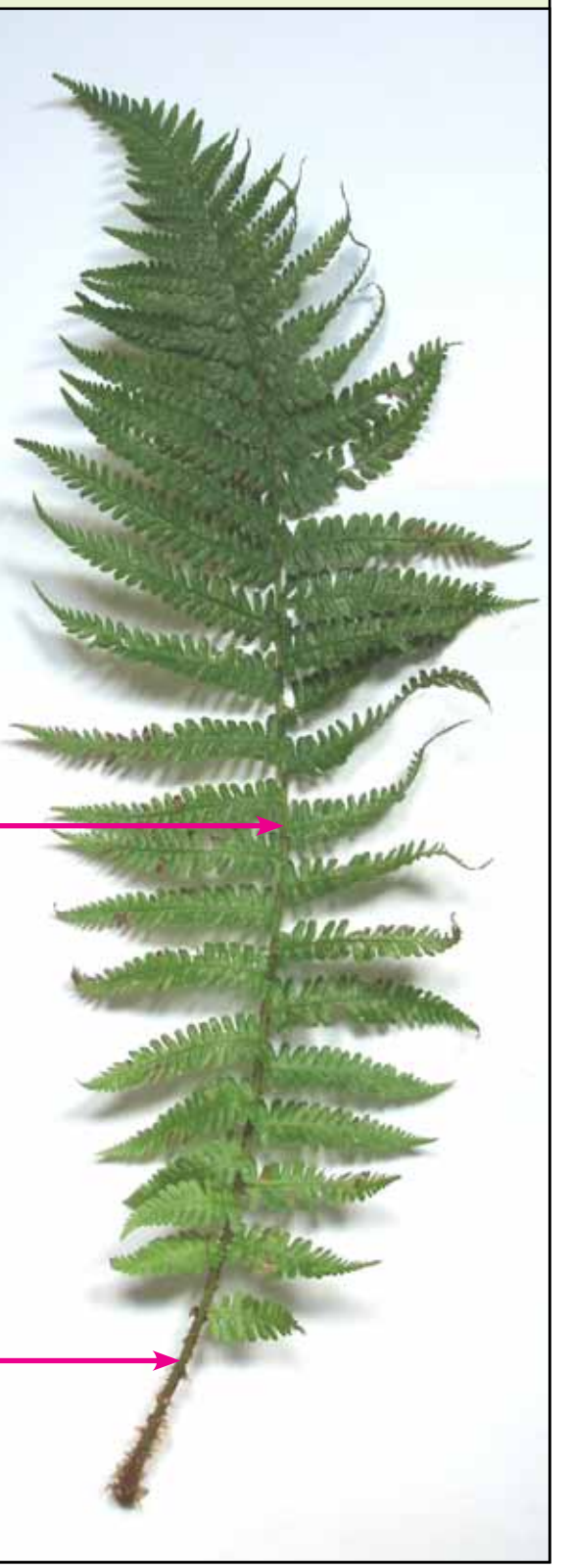
Key features:

Not robust, frond not glossy, broad, soft textured.

Pinnules lobed at sides, acute teeth at apex.

Indusia tall; some with flared out margins. Spores abortive.

Stipes fairly slender with dark brown scales.



Indusial margins may be flared

Lifting indusia, mature sporangia

Pinnules lobed with acute teeth at the apex

Dryopteris × *critica* (*D. borreri* × *D. filix-mas*)

Key features:

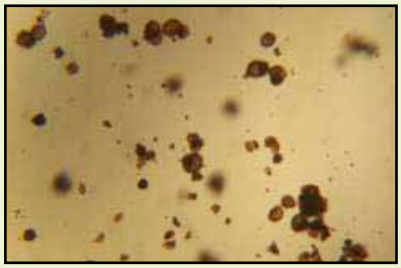
Intermediate between parents.

Stipes slender, scales sparse.

Pinnae very slightly glossy, pinnules prominently toothed.

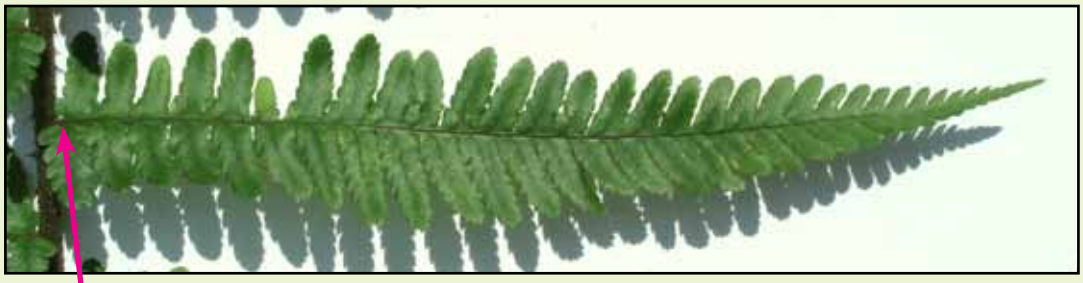
Faint dark patch at base of pinna on underside.

Spores abortive.



Abortive spores

Indusia lift to inverted cones



Pinnules prominently toothed

Dryopteris × *convoluta* nothosubspecies *occidentalis*
(*D. cambrensis* subspecies *cambrensis* × *D. filix-mas*)

Key features:

Frond narrow, lamina slightly glossy, pinnae concave.

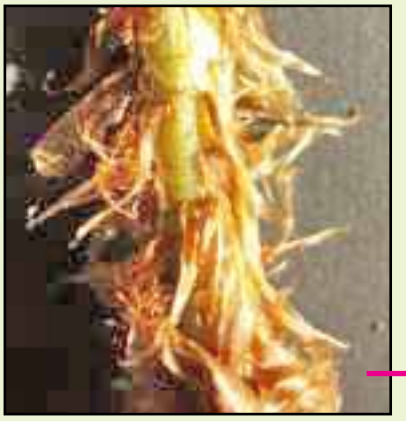
Pinnules toothed.

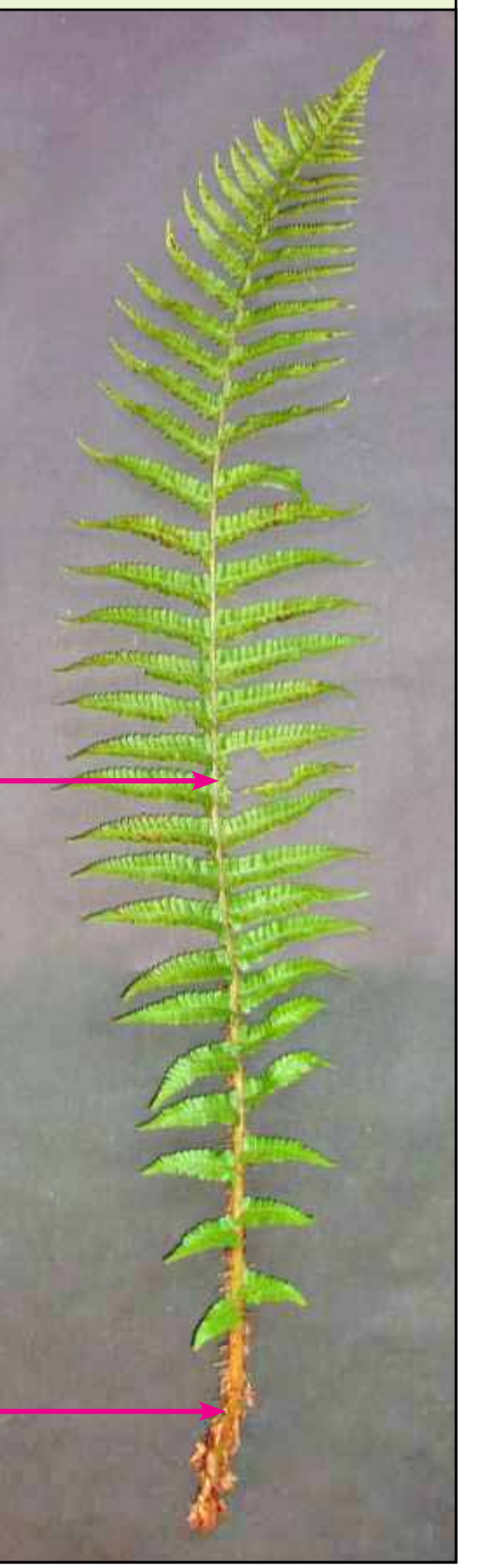
Scales narrow, brown with dark base.

Faint dark patch at base of pinna on underside.

Indusia low dome lifting to erect ear-like structure.

Spores abortive.





Indusium a low dome shape

Indusia lift to ear-like structure

Pinnae concave, pinnules toothed and slightly glossy

Dryopteris × *convoluta* nothosubspecies *inconspicua* (*D. cambrensis* subspecies *pseudocomplexa* × *D. filix-mas*)

Key features:

Frond fairly narrow, lamina slightly glossy.

Pinnules ± untoothed, margins touching, down-curved.

Scales narrow, pale brown.

Faint dark patch at base of pinna on underside.

Indusia low dome lifting to inverted cone.

Spores abortive.

Indusium low dome-shaped

Indusium shrivelling to inverted cone

Pinnule margins down-curved and touching, mostly untoothed

Dryopteris × "*protocambrensis*"
(*D. affinis* subspecies *affinis* × *D. oreades*)

Key features:

Hybrid vigour, fronds broad, tapering towards base.

Texture coriaceous, lamina glossy.

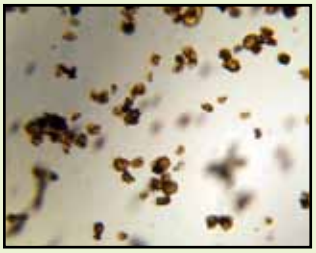
Basal pinnules prominently and bluntly lobed.

Margins of indusia tucked under.

Spores highly abortive.

Only one plant found, by Tony Church on Arran.

Indusial margins tucked under



Spores highly abortive

Lifting indusia

Basal pinnules prominently and bluntly lobed

Dryopteris × "*ogwenensis*" (*D. borreri* × *D. oreades*)

Key features:

Frond outline broad, base truncate.

Scales sparse, brown.

Frond hardly glossy, pinnae slightly concave.

Pinnules bluntly lobed, shape somewhat irregular.

Spores highly abortive.

Mature sporangia mostly brown.

Only one plant found by Clive Jermy, Nant Ffrancon.

Mature sporangia

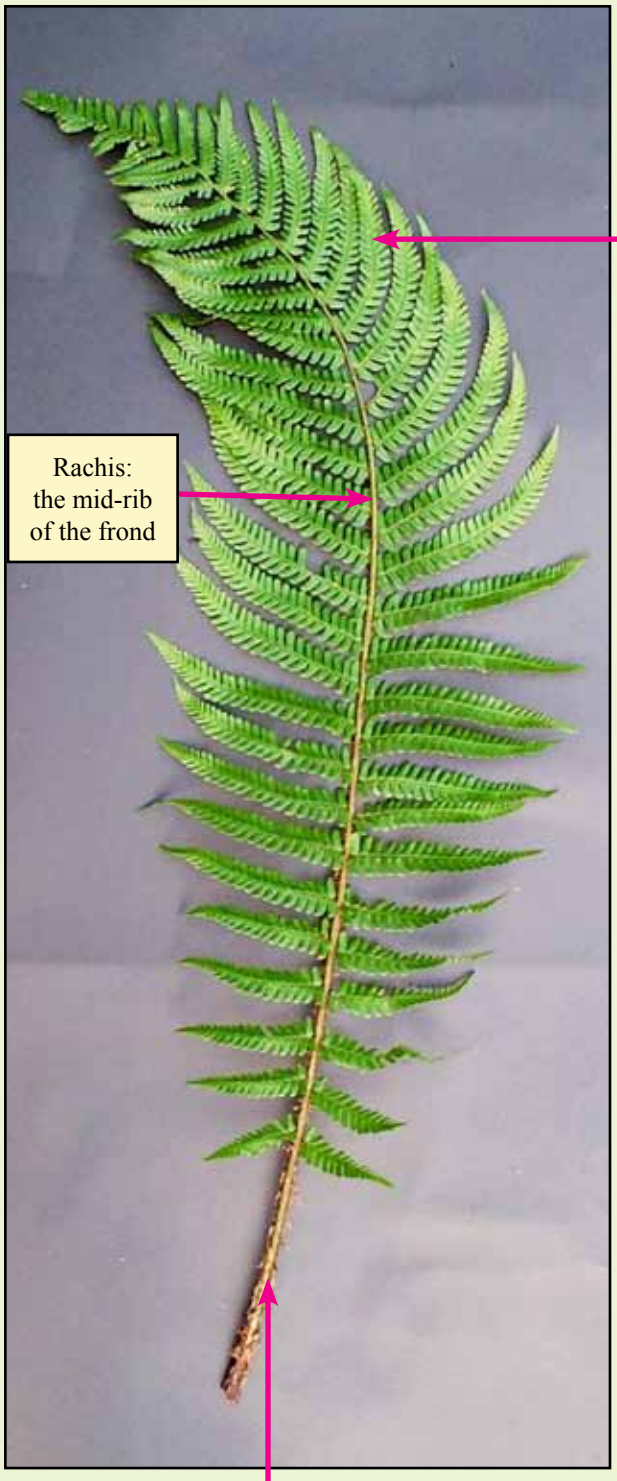
Indusia shrivelling

Pinnae slightly concave.
Irregularly shaped pinnules with blunt lobes.

Taxonomic List of *Dryopteris affinis* complex

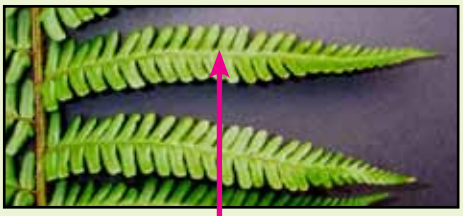
This list of the taxa covered by this guide follows the approach taken by Arthur Chater in his *Flora of Cardiganshire*, where the formal names follow Fraser-Jenkins (2007) with the morphotype names following Pigott (1997) arranged in their putative positions under the formal taxa. References are given to the corresponding text and illustrations.

Parts of a fern frond



Rachis:
the mid-rib
of the frond

Stipe: the stalk of the frond



Pinna (plural = pinnae)

Pinnules

Sorus (plural = sori):
cluster of spore cases (sporangia)

Croziers

Glossary

abortive spores	Spores that do not form properly, and cannot grow into prothalli. These infertile spores are usually produced in hybrid plants, when chromosomes are unable to pair during meiosis. The spores appear mis-shapen and irregular. N.B. All taxa in the *Dryopteris affinis* complex are apogamous and may have a proportion of abortive spores – the proportion varies between plants and between taxa.
adnate	Attached by the full width of the base e.g. of pinnules to the pinna mid-rib, as opposed to being stalked. Can also be a fraction e.g. ¼ adnate.
antherozoids	The motile male cells (sperm) produced on the prothallus.
apices	Plural of 'apex'.
apogamous	Literally 'without gametes' – a new sporophyte grows directly from the prothallus without the production of sex organs or fertilisation.
apomictic	Reproduction without fertilisation (as apogamous).
auricle	An ear-like lobe.
basal	At the base.
basiscopic	Facing or on the side toward the base.
coriaceous	Leathery and tough.
costa	The mid-rib of a pinna.
deflexed	Turned down.
dehisce	When spores are thrown out of the sporangia or spore cases, the latter are said to 'dehisce'.
diploid	Having two copies of each chromosome, so two full sets of chromosomes.
foliose	Literally 'leafy' – usually applied to plants that have curly and crowded leaves.
gametes	Sex cells – they have half the number of chromosomes of the parent, except in apogamous taxa like the *Dryopteris affinis* complex where the sex cells (antherozoids) have the same number of chromosomes as the sporophyte.
genome	The full set of genetic material of an individual, as represented by the DNA sequence.
hybrid	The product of sexual reproduction between two different taxa.
indusium	The protective cover of the sporangia, plural indusia.
lamina	Leaf blade, the leafy part of the fern frond.

meiosis	The cell division that reduces the chromosome number from diploid to haploid, giving rise to four gametes or spores in ferns.
morphotype	A recognisable taxon whose place in the taxonomic hierarchy is unknown or uncertain.
necrotic	Literally, ‘dead’; often used for an area of dead tissue in a living organism.
nothosubspecies	A hybrid involving a subspecies.
pentaploid	Having 5 sets of chromosomes.
pinna	One of the first divisions of a fern frond. Plural pinnae.
pinnule	One of the first divisions of a pinna, so a secondary division of the frond.
ploidy	The number of sets of chromosomes of an individual.
prothallus	The small plant that grows from the fern spore and produces male and female sex organs and gametes.
rachis	The mid-rib of the fern frond.
sorus	A collection of sporangia, often covered by an indusium. Plural sori.
sporangium	The structure that contains the spores. Plural sporangia.
sporeling	A small sporophyte in early stages of growth.
spore	A single-celled structure produced by the sporophyte for the purpose of dispersal and reproduction.
sporophyte	The main generation of the fern life-cycle, the plant that produces spores.
stipe	The stalk below the leafy part of the fern frond.
subspecies	A group within a species.
taxon	A category in a system of classification – for example a species, a subspecies, or a variety.
tetraploid	Having 4 sets of chromosomes.
triploid	Having 3 sets of chromosomes.
truncate	Cut off squarely, as opposed to tapering.
variety	A group within a species of lower taxonomic rank than a subspecies.

Is it a Scaly Male-fern?

Ken Trewren started his guide from the point of recognising that a fern was one of the *Dryopteris affinis* complex. This page has been added to help people distinguish our other two male ferns – *D. filix-mas*, which is common and widespread, and *D. oreades*, the mountain male fern, which is much less common and found in mountainous areas in Wales, Scotland, and north-west England.

Dryopteris filix-mas Common Male-fern

Photo: Alison Evans

A bipinnate fern, forming shuttlecocks. The pinnules taper to the apex, and are usually deeply lobed. There is no dark spot where the pinna mid-rib joins the rachis. The sori have thin indusia that often spread out at the edges, and are shed when the spores are released. The scales are pale brown or grey.

Photo: Roger Golding

Dryopteris affinis complex Scaly Male-ferns

These bipinnate ferns are usually more robust and scaly than *D. filix-mas*, and they almost always have a dark spot where the pinna mid-rib meets the rachis. The pinnules are parallel-sided, and the indusial margins do not spread out.

Photo: Alison Evans

Dryopteris oreades Mountain Male-fern

Photo: Roger Golding

Photo: Alison Evans

This fern has a branching rhizome, so the fronds appear in tufts. The sori are small and restricted to the inner half of the pinnule. The indusia have a glandular edge, and persist when the spores mature. There is no dark spot where the pinna mid-rib meets the rachis.

Ken Trewren 1944 - 2010

Photo: Alison Evans

Ken Trewren with *Dryopteris pseudodisjuncta* in Kirkbean Glen, Scotland, August 2010.

Ken Trewren joined the British Pteridological Society as a teenager in 1963. He made many significant discoveries, including a large population of *Trichomanes speciosum* (Killarney fern) in the North Yorkshire Moors. This site is now regarded as being of European significance and is protected accordingly.

He went on to learn skills in cytology in order to examine chromosomes and specialised in the scaly-male ferns, the *Dryopteris affinis* group. Having written and illustrated a guide to these ferns he led '*affinis*' workshops for members of the Society.

Ken made new discoveries in the *Dryopteris affinis* group: a new taxon in Wales and another from Kirkcudbrightshire, Scotland.

After his untimely death, the Society decided that they could best honour Ken by turning his *affinis* guide into a fully illustrated book. This is the result and it is hoped that others will continue his work and, as he so generously did, share what is learnt with others.

Taken from the obituary by Frank McGavigan published in the 2010 BPS Bulletin 7(3).

Special Publications of the British Pteridological Society

No. 1 A guide to hardy ferns
Richard Rush, 1984

No. 2 Fern names and their meanings
J.W. Dyce, 1988

No. 3 The cultivation and propagation of British ferns
J.W. Dyce, 1991

No. 4 The history of British pteridology, 1891-1991
ed. J.M. Camus, 1991

No. 5 The British Pteridological Society, Abstracts and Reports, 1894-1905
1991

No. 6 The BPS Minute book (1891-1903)
[Compact disk] ed. Barry Wright, 2002

No. 7 Polystichum cultivars – variation in the British shield ferns
ed. R.W. Sykes and M.H. Rickard, 2005

No. 8 New atlas of ferns and allied plants of Britain and Ireland
ed. A.C. Wardlaw and A. Leonard, 2005

No. 9 Fern books and related items in English published before 1900
Nigel Hall and Martin Rickard, 2006

No. 10 BPS Occasional paper No. 1; a facsimile of the 1875 issue
with notes by M. Hayward and two inserts, 2008

No. 11 The British Fern Gazette, Volumes 1-9, 1909-1967, and British ferns by E.J. Lowe, 1891
[Compact disk] ed. M. Hayward, 2013

No. 12 Who found our ferns?
John Edgington, 2013

Titles still in print are available from
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(BackNumbers@eBPS.org.uk)