

The British records of *Cystopteris alpina* (Lamarck) Desvaux; Woodsiaceae

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ABSTRACT

The Alpine Bladder Fern (*Cystopteris alpina* (Lamarck) Desvaux) is found in alpine regions of Europe and occurs from Norway to the Pyrenees and east to the Caucasus. It was found in Britain as a native species in North-west Yorkshire (v.c. 65), and in Essex (v.c. 18), where it had probably been introduced. Other British records exist for *C. alpina* and the status of some of these records, as well as the morphological characters were discussed in an earlier paper (Tennant 1995). The information is updated here, and the authenticity of further records, notably those from North Wales is discussed.

KEYWORDS: Alpine Bladder-fern, Britain, Wales, distribution, taxonomy, *Cystopteris regia*.

INTRODUCTION AND IDENTIFICATION

There is little difficulty in the recognition of typical material of *C. alpina* and in distinguishing this species from typical *C. fragilis*. *Flora Europaea* (Tutin *et al.* 1993) separates *C. alpina* by its more deeply dissected pinnae and linear-oblong ultimate pinnule segments. Classic examples are distinguished morphologically from *C. fragilis* by their more finely dissected fronds being tripinnate to almost quadripinnatifid, the pinnule segments linear-oblong, at least in the basal pair of pinnae, to linear-obdeltoid, and rather blunt, truncate or emarginate at the apex. Additionally, all or the majority of the veins of the ultimate segments usually end at the base of a distinct sinus, or in a notch between the teeth (not at the usually acute apical point of the teeth, as in typical *C. fragilis*) (Murphy & Rumsey 2005), as shown in Figure 1 by Tennant (1995: 48).

Specimens which do not conform to all of these characters, however, have caused much controversy. The variation which has been reported led to a suggestion by Stansfield (1929) that there were two distinct forms of *C. alpina*; forma *dissecta*, which corresponds to typical material, as described above, and in

which he included examples collected in North-west Yorkshire; and forma *obtusa*, which is bipinnate and has only slightly notched pinnule segments, in which he included the Essex plants and others described and illustrated on Plate 67 by E. J. Lowe (1876) as '*C. regia*'. Kestner (1930) had proposed three varieties of *C. alpina*; var. *alpina*, which more or less corresponded to Stansfield's var. *dissecta*; var. *deltoidea* Milde, which was confined to the Tyrol; and var. *regia* Milde, a lower altitude variant which he described as intermediate between typical *C. alpina* and *C. fragilis*, and which therefore, at least largely, corresponds to Stansfield's var. *obtusa*.

The epithet '*regia*' had been applied much earlier to British *Cystopteris* and the name *C. regia* auct. was considered by most 19th century authors, more recently in *Flora Europaea* (Tutin *et al.* 1993), and at present as a synonym of *C. alpina* (Lam.) Desv. A brief history of the epithet *regia* was given in more detail by Tennant (1995). Some of the specimens of *Cystopteris* which were collected in Britain and had been named as *C. regia*, or given the earlier name *Cyathea regia*, are included in the list of records given below.

BRITISH RECORDS

Cystopteris alpina certainly occurred as a native plant in Upper Teesdale (v.c. 65), where it was discovered at a single site in a limestone pavement in 1872. Details of its discovery and some of its records there were given by Tennant (1995: 46). Further records, which are almost certainly all from the same locality and correctly named, were by H. T. Mennell, 1880; A. J. Crosfield, 1880, 1884; J. Backhouse junior, 1886; C. E. Salmon, 1892; and finally by Salmon in 1911. Only three plants were reported and although the precise site is no longer known, repeated searches of the described area have failed to find the plant and it is very probably extinct there. These specimens are all in **BM**, with duplicates of some of them in **E**, **GL** and **K**.

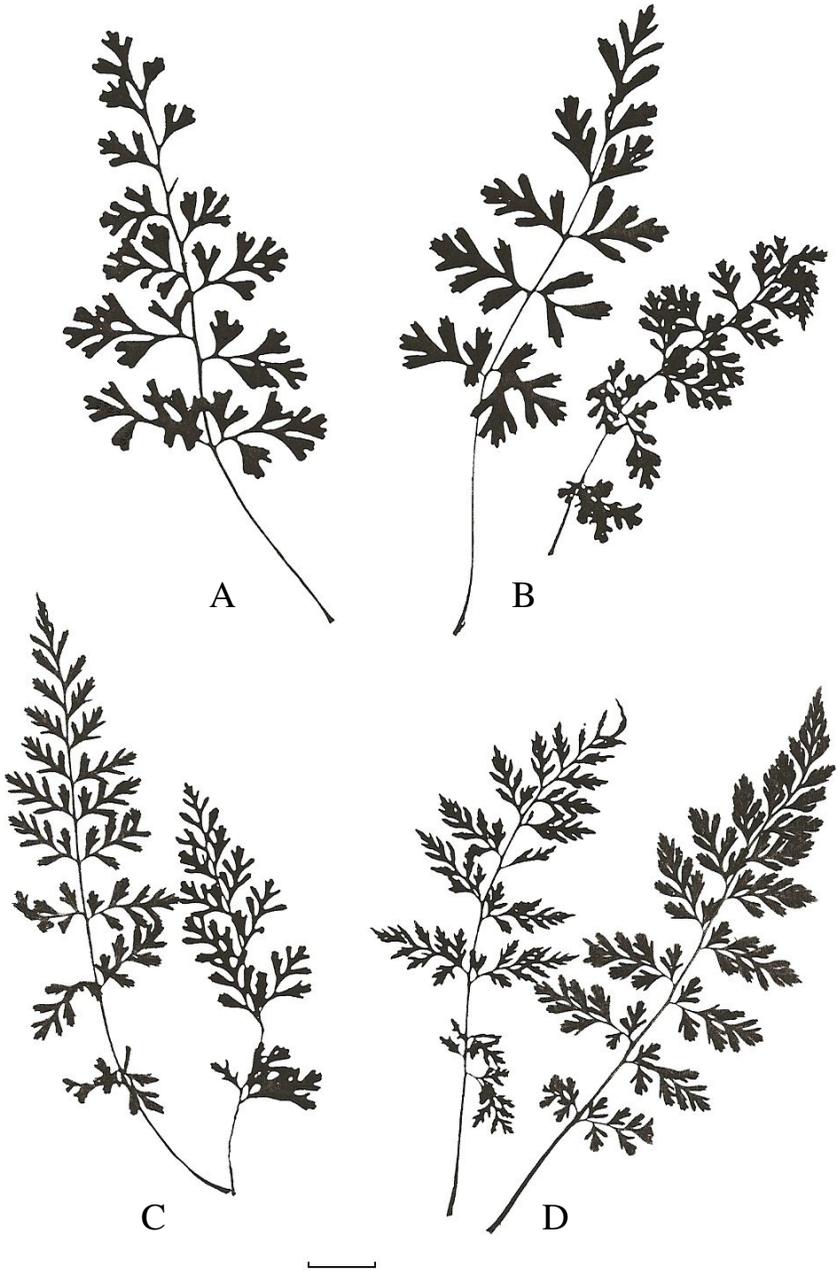


FIGURE 1. A. *Cystopteris alpina*. Illustrating the frond and pinnule morphology which develop in otherwise more typical finely dissected fronds with narrower pinnule segments; cultivated example, originally collected in Austria.

B, C, D. The *Cystopteris* taxon from North Wales. B. Illustrating fronds with pinnules very similar to those of *C. alpina* in illustration A. C. Young fronds showing linear-oblong pinnule segments, which are more typical of *C. alpina* than of *C. fragilis*. D. fully mature, fertile fronds showing morphology somewhat intermediate between these two species. Scale bar = 1 cm.

There are also specimens in the **BM**, which appear to be correctly named, collected by F. A. Lees, which are labelled 'Harwood' in Upper Teesdale, but in Durham (v.c. 66), dated 1874 and 1875. Lees also collected a specimen on the Yorkshire side of the Tees (v.c. 65) in 1874 which he labelled *C. alpina*, but the specimen is *C. fragilis*. Lees also published probable records for *C. alpina* at the head of Wharfedale, Yorkshire (v.c. 64) (Lees 1888; 1939), but no specimens from there have been traced.

J. E. Smith (1830) gives records for *C. regia* from Snowdon, collected by H. Davies and W. Wilson, and from Cwm Idwell (Idwal) by Griffith.

Griffith (1895) included two records for *C. alpina* from Snowdonia, Caernarvonshire (v.c. 49) in North Wales, and in **BM** both the *C. alpina* and the *C. fragilis* files contain several *Cystopteris* specimens collected in Wales which bear some resemblance to *C. alpina*, although none of these has apparently been confirmed recently as such with complete certainty. These specimens are as follows:

Snowdonia, 1824, collector unspecified, as *C. fragilis* (one plant of ten), in herb. W. W. Newbould (1829–1886).

A further two specimens collected in Snowdonia and labelled *C. fragilis* on the same sheet also approach *C. alpina*. These are labelled herb. H. & J. Groves (pre 1912), but could alternatively refer to another label marked Cwm Glas (Snowdon), 1874, W. R. Linton, on the same sheet.

Snowdon, 1826, William Wilson, as *C. regia* (record listed by J. E. Smith (1830)).

Snowdon, 1847, collector unspecified, as *C. fragilis* var. *angustata*, in herb. F. J. Hanbury.

Near Twll Du (Cwm Idwal), 1853, collector illegible, as *C. alpina*.

Castel Dinas, undated, Professor Hooker, as *Cyathea regia* (Assumed to be W. J. Hooker (1785–1865)), but later rejected by C. E. Salmon in 1928 (as a form of *C. fragilis*).

'Wales', period 1836–1860, Mrs Riley, in the *C. alpina* file, herb. J. Forbes Young (A further specimen in the *C. fragilis* file, as *C. regia*, is marked 'Mrs Riley, hort. ex spores', but without origin).

Cader Idris, 1875, J. Backhouse junior, as *C. fragilis* var. *angustata*.

Snowdon, 1890, J. Lloyd Williams, as *C. alpina* (later rejected by C. E. Salmon as a form of *C. fragilis*).

Cader Idris, 1928, S. P. Rowlands, as *C. fragilis* (Also in **E**).

Other records for *C. alpina* which are unsubstantiated or erroneous in Britain were given by Tennant (1995: 46). Some of the specimens in **BM** collected from Orkney (v.c. 111) in the 19th Century, however, bear a strong resemblance to *C. alpina*, and require further investigation, whereas others in **BM** which are labelled as *C. regia*, 1838, and 1872, Brecon (South Wales, v.c. 42) are clearly *C. fragilis*. Finely dissected *Cystopteris* plants are reported from Skye, v.c. 104 (A. C. Jermy in pers. comm.) which require examination.

FIELD STUDIES

Variant examples of *C. fragilis* which had been collected in Northern England, Wales, Scotland and Ireland, were re-examined and some of the localities were revisited. All of these variants, however, clearly belonged under *C. fragilis*, with some of them grading into more typical material of this species, making their taxonomic distinction difficult.

Extensive recent searches in Upper Teesdale (v.c. 65) and near Harwood (v.c. 66) did not reveal *C. alpina*. Field studies by me in Snowdonia (v.c. 49), North Wales in June and September 2008, and in 2009, however, revealed a *Cystopteris* which I had not seen elsewhere, and which is apparently confined to North Wales. *C. fragilis* and many of its variants are very abundant in Snowdonia, but the *Cystopteris* in question was very uniform, and no gradation was seen into any of the variants which occurred here or in any other British localities. Rather small populations of this plant were found in two separate locations in Snowdonia (v.c. 49), very locally in north-facing crevices or recesses on basic cliffs, in moderate shade. Other than bryophytes, there was little other vegetation in their habitats, although *Cochlearia pyrenaica* subsp. *alpina*, *Minuartia verna* and *Silene acaulis* were the most significant species seen nearby, and typical *C. fragilis* occurred not far away. These Welsh ferns, beyond any doubt, conformed exactly to the specimens in **BM** listed above (under records) from seven of the separate collections made in Snowdonia between 1824 and 1890.

All of these specimens in **BM** and the plants found in 2008 approached *C. alpina* in

morphological characters, and five of the **BM** specimens had been labelled originally as *C. regia* or as *C. alpina*, two of which had been placed in the *C. alpina* file; the status of these Welsh ferns is discussed below.

During the examination of *Cystopteris* specimens in **BM**, one sheet labelled *C. dickieana*, containing specimens collected in 1905 below Tomintoul, Banffshire (v.c. 94) by W. C. Barton confirms the prediction (Tennant 1996: 136) that it occurred there, and where it was subsequently rediscovered. Other specimens in the *C. fragilis* files in **BM**, also labelled as *C. dickieana*, were from Lanarkshire (v.c. 77), and one from Glen Clova (v.c. 90) dated 1834, and these require re-examination.

DISCUSSION AND STATUS OF RECORDS

The acceptance of *Cystopteris alpina* as a native British plant is beyond question, based on specimens from Upper Teesdale (v.c. 65), but despite several recent systematic searches it has not been seen for almost 100 years and is very probably extinct there. The Essex (v.c. 18) ferns have also been accepted as *C. alpina*, but these were almost certainly not native in that locality and are also now long extinct there. Specimens in **BM** collected by F. A. Lees dated 1874 and 1875 from Durham (v.c. 66), which are named as *C. alpina*, are possibly correctly named. Lees surprisingly, however, may not have published the records, and no other examples were collected there. Recent careful searches in the area have revealed few suitable habitats, and only *C. fragilis* was found in this area.

The ferns collected in North Wales in the 19th Century, and refound there by me in 2008, which approach *C. alpina* morphologically, are distinctive and uniform, and at present appear to be known only from North Wales. The specimens have largely gone un-noticed, or been left due to uncertainty in the *C. fragilis* files in **BM** and elsewhere, variously labelled as *C. fragilis*, *C. fragilis* var. *angustata*, *C. alpina*, *C. regia* or *Cyathea regia*. Smith (1830) had given records for *C. alpina* (as *C. regia*) from Snowdonia, and it is clear that W. J. Hooker, an expert on ferns, considered one of these, which he had collected in North Wales, was referable to *Cyathea regia*, a name which is now generally accepted as synonymous with *C. alpina*. Griffith (1895) accepted two records from Snowdonia as *C. alpina*, and although the specimens on

which these records are based were not specified, the localities given agree with at least two of the localities on the herbarium sheets in **BM** listed above and one locality in which I found plants matching the **BM** specimens; it is therefore possible that Griffith considered the **BM** specimens as one basis for his published records. All of these ferns from Snowdonia are very similar, but not identical to the Welsh specimen named by W. J. Hooker as *Cyathea regia*, and also not unlike the specimens of *C. alpina* which had been found in Essex. They do not, however, match the classic specimens from Upper Teesdale (v.c. 65) precisely, and although their characters are closer to the latter, they are also somewhat intermediate between these and *C. fragilis*. Backhouse may not have seen the Welsh specimens in **BM**, as most would have been presented there later from other private collections, but he referred one specimen which he had collected himself there to *C. fragilis* var. *angustata*. C. E. Salmon, in 1928, rejected Hooker's specimen of *Cyathea regia* as a form of *C. fragilis*, however, both Salmon, and Backhouse, may have taken this view as the specimens did not match those from v.c. 65 exactly. Hyde & Wade (1948) stated that *C. regia* Desv. records from North Wales were errors.

Stansfield (1929) and Kestner (1930) both considered that *C. alpina* was a more variable species and proposed subspecific names to distinguish its variants, although these names are not in general use now. They both considered that the epithet '*regia*' was applicable to certain variants of *C. alpina* which do not conform to the more classic material. Kestner stated that his var. *regia* was somewhat intermediate between *C. alpina* and *C. fragilis*, which also applies to the ferns of North Wales, but also suggested that the only reliable character for distinguishing the two species was the position of the vein-endings in the pinnules. Whereas the view that in *C. alpina* the veins should end in notches is generally accepted (Murphy & Rumsey 2005), it is in fact in conflict with some of the specimens which are now referred to *C. alpina*. The Essex specimens and many plants in horticulture named as *C. regia*, which, otherwise conform to *C. alpina*, do not consistently show this character, or only partially so. Additionally, Lowe (1876) described *C. alpina* as having 'veins ending in

notches or at teeth on both sides of notches', suggesting that this is a variable character, and *Flora Europaea* (1993) does not include this as a strictly diagnostic character. Similarly, the character of the veins ending in notches is sometimes seen in variants of *C. fragilis*, to a lesser or greater degree, especially in fronds which are not completely mature; it is also a character of *C. diaphana* (Bory) Blasdell (Murphy & Rumsey 2005) and often occurs in *C. dickieana* R. Sim, making the relevance of this as a constant, strictly diagnostic character in *Cystopteris* unclear. In cultivation, classic *C. alpina* from the Austrian Tyrol (which corresponds to the forma *dissecta* of Stansfield and the var. *alpina* of Kestner) develops less-dissected fronds with broader, narrowly obdeltoid (broadly wedge-shaped) pinnules (Fig. 1) and whereas such fronds are often semi-juvenile and sterile or bear fewer sporangia, they are often present, and persist in mature plants; a very similar specimen of *C. alpina* in **BM** was collected in Upper Teesdale (v.c. 65) by C. E. Salmon in 1911. This character was also noted in 2008 in the ferns growing in Snowdonia, this type of frond being virtually indistinguishable between Austrian *C. alpina* and the Welsh plants (Fig. 1). Similarly, when cultivated from spores, the very young sporophytes of *C. alpina* are distinctive and unlike those of *C. fragilis*, with well separated linear-oblong, blunt pinnule segments, but again closely approach juvenile plants seen in the populations found in Snowdonia. In the Welsh plants, the veins of the pinnules also end in shallow notches in young fronds, but unlike *C. alpina*, in the more dissected, fully mature fertile fronds of the Welsh plants the veins mainly end at the usually acute apex of the teeth of the pinnule segments.

Namings on two of the herbarium sheets in **BM** suggest that these Welsh ferns represent *C. fragilis* var. *angustata*, however there has clearly been some confusion in Britain regarding this variety. Smith (1830) stated that he had never received '*C. angustata*' from Wales (although he listed one old record for Llanberis), and considered none of the ferns which he had seen from Snowdonia were this taxon, referring the latter to *C. regia*; he also stated that the Welsh ferns which he had referred to *C. regia* are always distinct from *C. fragilis* and unquestionably distinct from every other British fern. Hooker (1842) also considered that the Welsh ferns which Smith

had named as *C. regia* were correctly named, and, as well as a fern he had collected himself in North Wales, placed these under *C. alpina* Desv., whereas he treated '*C. angustata*' separately as a variant form of *C. dentata* (Sm.) Desv. (*C. fragilis* var. *dentata* Hook.) Neither author therefore considered the specimens from North Wales which match the ferns refound there in 2008 should be referred to the taxon '*angustata*', whereas the illustration in Moore (1859–1860) of *C. fragilis* var. *angustata* shows morphology not unlike that of those ferns. Additionally, *C. fragilis* examples recorded as var. *angustata* from elsewhere in Britain, e.g. v.c. 64 (Miall & Carrington 1862; Smith 1830) and others from v.c. 65 which I have seen, do not appear to match the Welsh ferns closely, the latter possibly being a taxon confined to North Wales.

I have examined Norwegian material in the herbarium of the University of Tromsø, collected or recently determined as *C. alpina* by local experts. Some of these specimens of *C. alpina* collected near Tromsdalen, where Backhouse had also reported it, had considerably less-divided pinnae and much broader pinnule segments when compared with those collected by Backhouse in Yorkshire, and were therefore quite unlike the latter. None of the Norwegian specimens, however, corresponded to the ferns from Snowdonia which are discussed in this paper, but their morphology confirms the high degree of variation found in *C. alpina*.

The chromosome number of British examples of *C. alpina* is unknown, but in mainland Europe plants have been reported to be hexaploid ($2n = 252$), for example, Jermy & Harper (1971); Vida (1974) (both as *C. regia*), whereas *C. fragilis* is usually tetraploid ($2n = 168$), but hexaploids have been reported (Stace 1997). Vida (1974) further suggested that hybrids between these two species were frequent in Europe, were intermediate in morphology between the parents, and were pentaploid. Page (1982) stated that pentaploid examples of *C. fragilis* had been found in Britain.

CONCLUSIONS

Definite specimens of *Cystopteris alpina* have not been collected in Britain since 1911, but ferns which were found in 2008 at two localities in North Wales share several characters with this species, and bear considerable resemblance to it. The Welsh

ferns, however, do not conform to the classic British specimens of *C. alpina* from Upper Teesdale (Tennant 1995: Fig 1) in all of their characters, whereas in some characters the two are virtually indistinguishable. The most significant difference being the acute teeth of the pinnule segments and the vein-endings in mature fronds, although the latter character has not always been universally accepted in a strictly diagnostic sense for *C. alpina*. Backhouse and Salmon had both rejected some Welsh specimens as *C. alpina*, whereas earlier, Hooker and Smith had accepted others, the former perhaps as they had a narrower concept of this species than that adopted later by Stansfield, Kestner and others, although it is not known whether the Welsh plants fall within the range of *C. alpina* found in mainland Europe. If the character of the vein-endings is of paramount importance diagnostically for *C. alpina*, then the Welsh plants can not be accepted as this species. The Welsh populations are uniform and from their morphology appear to be confined to North Wales, although the specimens referred to above from Orkney and Skye require to be compared. The Welsh plants either represent a variety of *C. fragilis* which may be confined to this area, or a variant of *C. alpina*. At least two similar specimens collected in Wales in herbaria were proposed to be *C. fragilis* var. *angustata* auct., but British experts had clearly disagreed about whether the ferns from North Wales were referable to this taxon or not. If the Welsh ferns in question do represent a variety of *C. fragilis*, whether the var. *angustata*, or an undescribed variety which is confined to that area, then most, if not all of the old Welsh records for

C. alpina (e.g. Griffith 1895) would be incorrect. The Welsh ferns, however, share so many characters with the true *C. alpina* that they are likely to be affiliated with it in some way. They could represent an extreme variant of *C. alpina*, but as their morphology is somewhat intermediate between this species and *C. fragilis*, a more plausible explanation might be that the Welsh plants originated as hybrids, which arose as a cross between *C. alpina* and *C. fragilis*. In this case *C. alpina* formerly occurred in Wales, but is probably now only extant in the form of a hybrid. The chromosome number of such a hybrid would be most likely to be pentaploid (Vida 1974), and now that two localities have been rediscovered in Wales, chromosome studies are desirable as an initial step to resolve the identity of these Welsh ferns.

Additional locations for this taxon are very likely to occur in North Wales, and further British and European herbarium collections should be examined to establish whether they contain similar material, and how such specimens have been treated.

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