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# David A. Webb Memorial Issue of *Watsonia*

David Webb, the *éminence grise* (and, in later years, *éminence blanc*) of Irish botany was a colossus with one foot firmly placed in his native country but the other planted in Britain and Europe. For two generations he was not only the leading taxonomic botanist in Ireland but the best known, and respected, Irish botanist in international circles, with his major contributions to *Flora Europaea* and the genus *Saxifraga*.

When Donal Synnott, Charles Nelson and I met at the National Botanic Gardens, Glasnevin over a pint of tea in June 1993, to consider how the first Annual General Meeting of the B.S.B.I. in Ireland and the 200th anniversary of the foundation of the Gardens in 1795 might be jointly celebrated, and conceived the idea of a conference on the botany of the Irish Sea, the first name on the blank sheet was that of David Webb. We hoped that he would open the proceedings and play a prominent part, not least in the discussions where his lively contributions could be expected to combine wit, elegance and penetrating comment. His tragic death in October 1994 inevitably muted those proceedings and the prophet was not heard in his own country, teasing a speaker or drawing wisdom from his store of experience. However the A.G.M. and the conference did not become a wake: rather it was a celebration and a recollection of the life of one so much loved and so much missed. Perhaps most poignant of all was on the Saturday evening when we dined together in Trinity College, which had been his "town house" for over 40 years, and where his portrait hangs as a remarkable reminder of the man in action.

The wish by so many to extend that feeling of celebration to a wider audience inspired the editors of *Watsonia* to suggest that papers given at the conference should be published together with papers by friends and colleagues in a single part and dedicated to the memory of David Allardice Webb. By persistence and sheer hard work they have converted suggestion into reality and the first section of this Part contains those papers together with David Webb's Obituary and extensive Bibliography. They deserve our gratitude for providing, so speedily, this lasting tribute to one of the most illustrious members of the B.S.B.I. from either side of the Irish Sea in the 20th century.

Franklyn H. Perring
*Oundle, August 1995*

# Obituary

## DAVID ALLARDICE WEBB
## (1912—1994)

David Webb, Fellow and former Professor of Systematic Botany at Trinity College, Dublin, died in a car accident near Oxford on 26 September 1994. He was born on 12 August 1912; his father, G. R. Webb, was a Fellow of Trinity College, Dublin (a mathematician, philosopher and administrator) and his mother was a medical doctor.

He lived for most of his life in Dublin and devoted his career to research and teaching as a Fellow of Trinity College, first as a zoologist and ultimately as Professor of Botany. The B.S.B.I. will remember him especially as the doyen of the Irish botanical community, but his reputation was international and all Europe was his domain.

He grew up during exciting times in Dublin. As a child he witnessed the sounds of skirmishing in Dublin during The Troubles and he recalled a diffident young I.R.A. man coming to his parents' house to seek out any arms that might be available! He attended Castle Park Prep. School in Dalkey, one of Dublin's attractive coastal suburbs. From there he went on to Charterhouse in Godalming, Surrey, where he became a Foundation and Senior Scholar and was awarded a leaving exhibition. Then, as for many years, Charterhouse was in the forefront of biology teaching; one of his teachers was the late Percy 'Cheese' Chapman (who later taught J.R.A.). Percy had an enthusiastic love of the taxonomy and biology of marine invertebrates. The young David Webb took up this interest and, having graduated in Natural Sciences at Trinity College, Dublin, in 1935, with first class honours, he carried out research on the chemical composition of seawater and marine invertebrates, especially vanadium in the blood-pigments of tunicates or sea squirts. After graduation, he worked with W. R. Fearon at the Biochemical Laboratory at Trinity and published several papers, mainly on marine biology; and he produced one on the nitro-chromic reaction and its application in detecting alcohol in expired air – the "breathalyser" test! In 1937 he obtained a Ph.D. from Trinity, by which time he had transferred to the Department of Zoology, Cambridge, as the holder of an Overseas Scholarship of the Royal Commission of 1851. His work took him to the Stazione Zoologica at Naples to work on the biochemistry of the blood of tunicates. In 1939 he gained a Ph.D. from the University of Cambridge for his thesis on the biochemistry of marine invertebrates.

World War II found him back in Ireland, in 1939. His conversion to botany is said to have occurred near the beginning of that difficult period known in neutral Ireland as The Emergency. By his own account he was travelling across the Irish Midlands when he stayed overnight in a seedy and unhygienic hotel. There he contracted diphtheria, which lead to a long convalescence in Dublin. As he was recovering, a message came from his Alma Mater that the Professor of Botany, H. H. Dixon, required an Assistant to deliver a course of lectures.

David took to the botanical life with zest and soon joined the staff of Trinity as a full-time Assistant Lecturer in Botany. Shortly afterwards he introduced regular field trips for his students, now a tradition but something unusual at that time. Never one to dodge a challenge, by 1943 he had put together a first edition of his handbook on Irish plants, *An Irish Flora*, to provide a pocket reference book for his students to identify Irish plants. The idea came to him in his bath, where he said he found some of his best ideas. He also told P.W.J. that the preparation of this book helped him greatly to learn the Irish flora as each species had to be examined critically. For over 50 years, through six editions, this has been the standard and much loved field reference book on Irish plants for Irish botanists, naturalists, school and university students. In 1950, he was appointed Professor of Plant Biology, and, four years later, University Professor of Botany in succession to Dixon. He held these chairs until 1965 when W. A. Watts succeeded him. He was Professor of Systematic Botany from 1966 until his retirement in 1979, after which he held an honorary chair of the same name until his death.

After he had worked on invertebrate physiology, David Webb's initial botanical research concentrated on physiological ecology, notably the problem of the distribution of calcicole and calcifuge plants in the Irish flora. Both groups of plants appear to have wider tolerance in Ireland than other parts of Europe, perhaps due to the preponderance of leached and peaty soils that have, on the one hand, low levels of $Al^{+++}$ ions and, on the other, upper horizons leached of $Ca^{++}$ and other bases. This interest led on to studies of Irish vegetation, including straight descriptions of plant communities, as in his account of Carrowkeel, a limestone hill in Co. Sligo.

In 1949, with Frank Mitchell, who also became a distinguished T.C.D. professor, David Webb led the participants of the International Phytogeographical Excursion to Ireland. His great interest in Irish plant geography grew during this time and he contributed much time and energy to studies of Irish plant distribution, producing papers on such species as *Hypericum canadense*, *Erica ciliaris*, *Arbutus unedo* and making major contributions to the *Atlas* of the flora of the British Isles.

In 1951, David began to study the Dactyloid and Robertsonian groups of saxifrages. His interest was stimulated when he brought a group of students to climb Galtymore mountain in Co. Tipperary and was puzzled by the dactyloid saxifrages he found there. The taxonomic problems of the genus developed into a lifelong interest in *Saxifraga*, especially those from the mountains of southern and central Europe. In 1959 he undertook what he called his "Grand Tour" of Europe to study and collect saxifrages, which culminated thirty years later in a handsome and scholarly monograph with Richard Gornall published in 1989. Many of the specimens he gathered on that and subsequent trips are still cultivated at the Trinity College and Cambridge University Botanic Gardens.

The XIV International Botanical Congress in Paris in 1954 represented a critical point in his career and the future development of plant taxonomy in Europe. During a quiet interlude of the Congress, David and a group of like-minded British colleagues met in a Left Bank café for discussion and, as he himself admitted, "a little too much Calvados". There they resolved to write a comprehensive Flora of Europe. A few weeks later, having recruited other interested parties in Britain, this caucus of young and able botanists established a *Flora Europaea* Editorial Committee. The rest, as they say, is history.

David Webb made an astonishing contribution to *Flora Europaea*. His massive intellect, covering a wide knowledge of botany, related sciences, geography and history, his critical editing and his working knowledge of some 15 European languages made him a major driving force of the Committee. From Volume 1 onwards he was given special responsibility for checking the geographical distribution of each plant included in the *Flora*.

When J.R.A. was revising *Flora Europaea* Vol. 1 at Reading during the 1980s, David and he would work systematically through the geography of each genus. Not only distribution, but taxonomy, morphology, cytology, horticultural and culinary potential, and even the character of the author of a monograph or Flora came under his scrutiny. He and J.R.A. often reminisced on those sessions, held both in Reading and Dublin, with enormous affection. They bantered, they discussed, they poked fun at each other and at fellow botanists; above all they laughed. Jokes, stories and observations flew back and forth. David took an anarchic delight in the foibles of more pompous colleagues and possessed a fund of hilarious anecdotes. Often Stephen Jury and other Reading botanists would come running to catch the fun, as hysterical cackles and an occasional quite uncontrollable fit of coughing disrupted the staid ambience of the University Herbarium.

Despite the levity, or probably because of it, much valuable work was done. The revised Volume 1 of *Flora Europaea* (1993) owes more to D.A.W. (all were known in memos and minutes by initials) than to any other individual.

*Flora Europaea* completed in 1980, he turned his undivided attention back to Ireland, to finish *Trinity College Dublin, 1592–1952; an academic history* which he wrote with R. B. McDowell. It was published in 1982. Throughout David's life, he was quite prepared to turn his scholarship to any discipline to which he felt he could contribute. In the foreword to that book, the noted historian and Provost of T.C.D., F. S. L. Lyons, wrote that David Webb possessed "the most incisive mind of his generation in [Trinity] College" and that he displayed an easy versatility that was a hallmark of older Trinity traditions. During the last few years of his life David also put much energy into a revision of the Trinity College statutes and, with Anne Crookshank, he published a book on the history of art in the College.

In 1982 he was awarded the Boyle Medal of the Royal Dublin Society (R.D.S.). In 1983 he published the classic *Flora of Connemara and the Burren* (with M. J. P. Scannell), bringing together

his lifetime's work, knowledge and love of those regions. David devoted much energy to teaching. Both of us learned so much from him, and his teaching and friendship were a pleasure and a privilege that we shall always cherish. His insistence on an ever-questioning mind, his attention to detail and accuracy and his unerring good common sense approach to scientific problems has had a lasting influence on so many of his students. P. W. J. was fortunate enough to attend some of his last undergraduate courses. He was a fine lecturer; clear, well prepared, conscientious and sometimes very amusing. The basic principles of plant taxonomy were demonstrated by his students' attempts to classify the cutlery from his College rooms in various ways, spoons versus forks and kitchen versus dining room cutlery. His Presidential Address to the B.S.B.I. in 1990 was a memorable lecture, entitled "Genera, Hollow Curves and Boojums". In it he described characters from Lewis Carroll's *The hunting of the snark* as symbols of the taxonomic approaches he had encountered when editing *Flora Europaea*: the Beaver, the Butcher, the Barrister, the Bellman and the Banker. Two other lessons he taught all his students: the value of field work – he brought several generations of botany students to explore the floras of Connemara, the Burren, Kerry and Wicklow. He also taught us the importance of keeping an eye on the broader picture, for example, to consider always the Irish flora in its European context.

After retirement he remained in the Botany School as Honorary Professor, keeping an active eye on proceedings from his book-lined lair in the herbarium where he worked every day. He was not as distant and formidable a figure as some would suppose, particularly in his later years, joining in bridge sessions with students, organizing herbarium jumble sales, judging a marmalade making contest and providing displays of virtuoso wit and erudition at tea and coffee. He would invite students and others to his cottage near Lough Corrib in Connemara and later to Derrywater, a purpose-built retreat near Aughrim in the Wicklow Mountains. Here we helped him to plant trees, chop firewood and carve out a garden from thickets of bramble and furze, being rewarded by a good table, his legendary conversation and trips to explore the plants and habitats of Wicklow. He was a fine cook, producing foods the like of which most of the students had never seen before, albeit from a rather grimy kitchen. Afterwards, washing up would be enlivened by the studies he led on the taxonomy of kitchen rubbish (divided into compostable, combustible and unspeakable)!

David had an enormous appetite for travel. Amongst his papers P.W.J. came across a list of the dozens of trips he made over a period of over 60 years, often with students or friends, to most parts of Europe. In 1981, P.W.J. accompanied him on a trip through France to the Cevennes and Pyrenees where they enjoyed botany, church architecture, good food, wines and restaurants, though not necessarily in that order. J.R.A. once came upon him quite by chance on a park bench on the shore of Italy's Lake Maggiore, smartly dressed in his tropical suit and reading *The Times* – Euro-man at large. Armed with several languages and Irish charm, he was an ideal ambassador to all Europe for the *Flora Europaea* Committee, a group of youngish men regarded with some suspicion by the entrenched Teutonic elite of Mitteleuropa. He recalled giving a paper in Florence, when Italian ladies approached him afterwards, thrilled to hear an "Englishman" speak their native tongue: "We are all thinking that you must be very nice man!" one said.

One of his tasks was to "open up" distant, Marxist Bulgaria to the project. This meant gaining the confidence of Profs Stojanov and Stefanov ("Stoj. 'n Stef."), stern men of the old guard, distrustful of a new, brighter world of youth and *Modern methods in plant taxonomy*. As David walked along a cold Sofia street with the large, gruff, heavily overcoated figure of Stoj., he enquired cautiously: "Professor Stojanov, do you think that Bogdan Kuzmanov would make a suitable Regional Representative for *Flora Europaea* in Bulgaria". "No", said Stoj., slowly, in heavily accented English: "He is a *young* man. He knows only the genus *Euphorbia*". Nevertheless, all became friends and the genial and able anglophile Bogdan, who sadly died soon after Bulgaria threw off its totalitarian shackles, became one of *Flora Europaea*'s greatest champions.

David's physical appearance was striking. He was tall and, for most of his life slim, and as a young man he had red hair. He adopted denim jeans and jackets as a uniform some time during the late 1960s, combined with trainers and more often than not a sweater or teeshirt emblazoned with the logo and trade-name of his jeans supplier. These he wore simply because they were comfortable. He favoured tweed on more formal occasions, often with brightly coloured shirts, waistcoats and ties. An unruly halo of bushy shoulder-length white hair complemented this perhaps slightly louche image. When asked by J.R.A. about his garb and why he was never a real hippie, he replied somewhat crossly: "I like to keep clean, I hate rock music and I don't take drugs".

FIGURE 1. David Allardice Webb, 1912–1994.

He never married but compensated for the companionship that marriage might have brought him by maintaining a wide circle of friends, spanning several generations, whom he would visit or entertain regularly. Homemade scones and jam (often made from the blackberries he had picked himself) for afternoon tea at the Wyse Jackson house in Ranelagh was a regular pleasure for him. Every summer, during his latter years, he would visit the Wyse Jackson family cottage on Kerry's Dingle Peninsula, enjoying a daily excursion in search of natterjack toads or to help record the plants of a 10-km square. He somewhat grudgingly accepted the noisy family life going on around him, since some good books, regular meals and a good afternoon tea were available. David Webb's apparent misogyny – actually it was more a case of not suffering fools gladly, of either sex – was a front for the most part. He had several close women friends, of whom he spoke warmly. But ultimately his was a man's world, of an earlier Oxbridge and clubman's age.

J.R.A. last saw the great man in June 1994 over dinner at the Athenaeum Club, his favourite London base. A characteristically bachelor group, with Arthur Chater and Hugh Synge, they discussed botany and other matters over sea bass and sumptuous wines. This was a true Webb World – a refined, Anglo-Irish, academic milieu, amidst the trappings of an older and more civilised era. P.W.J. and his brother Michael, another of David's close friends and companions, accompanied him a few weeks later in the field in Co. Kerry for a B.S.B.I. excursion, where he was intellectually active but finding physical effort tiring. We shall miss that soft, educated voice, the loud laughter, the stream of oft-repeated anecdotes, the sheer enjoyment of scholarship and plants. Your man could be cussed, grumpy, pompous and self-centred, but he was a kind and generous friend and a wonderful companion and colleague.

Irish botany will never be quite the same again. The new generation of excellent Irish field botanists that has emerged over the last 15–20 years will be unable, though, to forget the man who was their greatest inspiration.

J. R. AKEROYD & P. S. WYSE JACKSON

### DAVID WEBB'S CONTRIBUTION TO THE DISTRIBUTION MAPS SCHEME

David Webb's contribution to the Distribution Maps Scheme of the B.S.B.I. was of crucial importance in the early days of planning. Quoting the Introduction to the published *Atlas of the British Flora* (ed. Perring, F.H. & Walters, S.M., 1962, p. xi): "The problem of producing gridded maps for [the whole of] Ireland was presented to Professor Webb, who solved it elegantly and published the skeleton of his agony in a short paper in 1955".

Essentially, the problem arose from the fact that the Irish O.S. maps (on a $\frac{1}{2}$ inch to the mile scale) used in field recording did not carry the British National Grid. In such a delicate situation, the mediating role was admirably played by David, who was in a position to see both sides of the affair. But David did much more to further the Maps Scheme, setting up a small regional office in Dublin to assemble the field data for the Republic of Ireland and transmit them to the Maps Office in Cambridge. His enthusiasm for field botany was shared and passed on to many of his circle of students and amateurs, and undoubtedly ensured that the coverage of Ireland as a whole in the published *Atlas*, though inevitably imperfect, was very substantially better than it could ever have been without his help.

S. M. Walters

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M. B. Wyse Jackson

# A bridge too far – the non-Irish element in the British flora

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ABSTRACT

Native British vascular plants which do not occur in Ireland were assessed by examining all those which occur in eight selected areas: St David's, Lleyn, West Anglesey, Isle of Man, Mull of Galloway, Mull of Kintyre, Arran and Islay. The 58 candidate species which emerged were analysed in relation to their distribution in Britain and Europe and their biogeographical elements, their habitats, Quaternary history and ability to become established in Ireland or elsewhere beyond their native range. This analysis reduced the list to 22 species which fell into two distinct groups: 17 of woodlands and woodland margins, and five of dry, open grassland or cliffs. It is argued that these species, nearly all of which are thermophilous and belong to Continental or Continental Southern elements in the British flora, did not arrive in Britain until the climatic amelioration of the Boreal period of the Flandrian post-glacial, about 9,000 BP, by which time the land bridge to Ireland had already gone, or would have gone, before these slow-moving forest species reached the coast. The small number of the candidate species is compared with other similar situations in Britain.

KEYWORDS: biogeography, floral history, plant distribution.

## INTRODUCTION

The first extensive use of the maps being produced by the Distribution Maps Scheme of the B.S.B.I. was by David Webb in an account of the vegetation and flora of Ireland which he wrote for the British Association in preparation for their visit to Dublin in 1957 (Meenan & Webb 1957), in which he discussed the possible explanation of the fact that there are 460 species which are native to Britain which are not found in Ireland. Whilst acknowledging that for the majority no special explanation is needed – Ireland is outside the geographical range of the higher Scottish mountain plants, the steppe species of East Anglia, the Mediterranean element of the Lizard Peninsula, or that large number of species more or less confined to the area south-east of a line joining the Severn to the Humber such as *Cirsium acaule** and *Viburnum lantana* – he drew attention to species like *Genista anglica*, *Helictotrichon pratense* and *Chrysosplenium alternifolium* for which this explanation is inadequate. He suggested that there were both historical and ecological reasons for these absences: *Genista anglica* is an Oceanic West European species according to Matthews (1955) which, on biogeographical grounds, ought to be in Ireland, the most Atlantic country of all, where the acid habitats it grows on are abundant, but it was probably a late arrival in Britain and, by the time it arrived in Wales and south-west Scotland, the land bridges which formerly connected Britain and Ireland had already gone. *Helictotrichon pratense*, in contrast (see Fig. 1), belongs to the Continental element in our flora (Perring 1985), and was probably established early in post-glacial times in eastern England and the midlands but advanced so slowly along the restricted routes open to this base demanding species that it was never common on the west coast area and was not able to cross to Ireland before the waters inundated the bridge. He pointed out that *Chrysosplenium alternifolium* had a distribution showing the same feature (Fig. 2).

Webb was not the first to address this subject. Praeger (1934) suggested nine species which failed to reach Ireland: *Genista anglica*, *Ononis spinosa*, *Astragalus glycyphyllos*, *Lathyrus sylvestris*, *Chrysosplenium alternifolium*, *Scabiosa columbaria*, *Paris quadrifolia*, *Convallaria majalis* and *Helictotrichon pratense*. Godwin (1975) included the same list when discussing the impoverished nature of the Irish flora and fauna. It will be noted that all three species selected for discussion by Webb are in this list. However he did not at that time have the access to the completed maps of the

* Nomenclature follows Kent (1992).

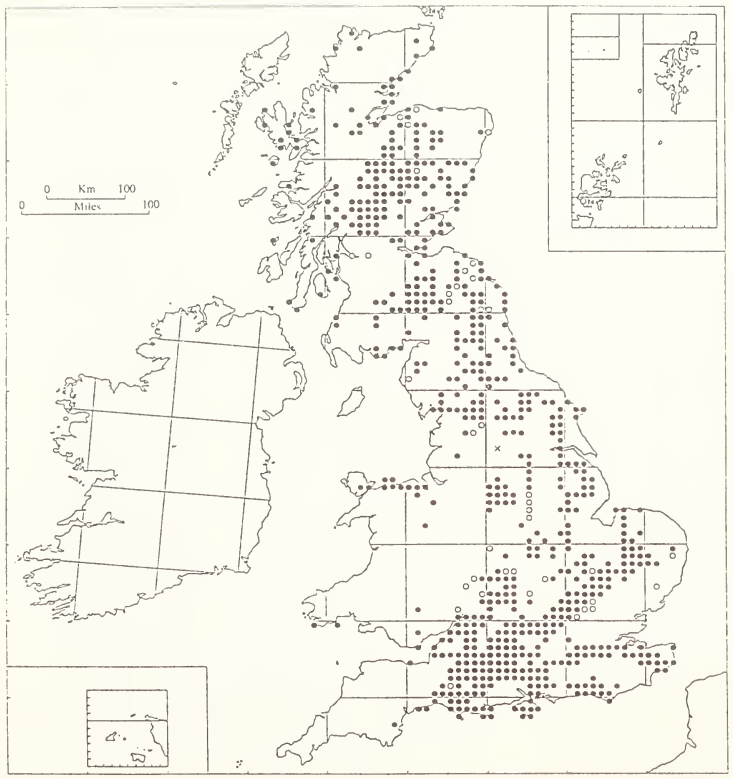


FIGURE 1. The distribution of *Helictotrichon pratense* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

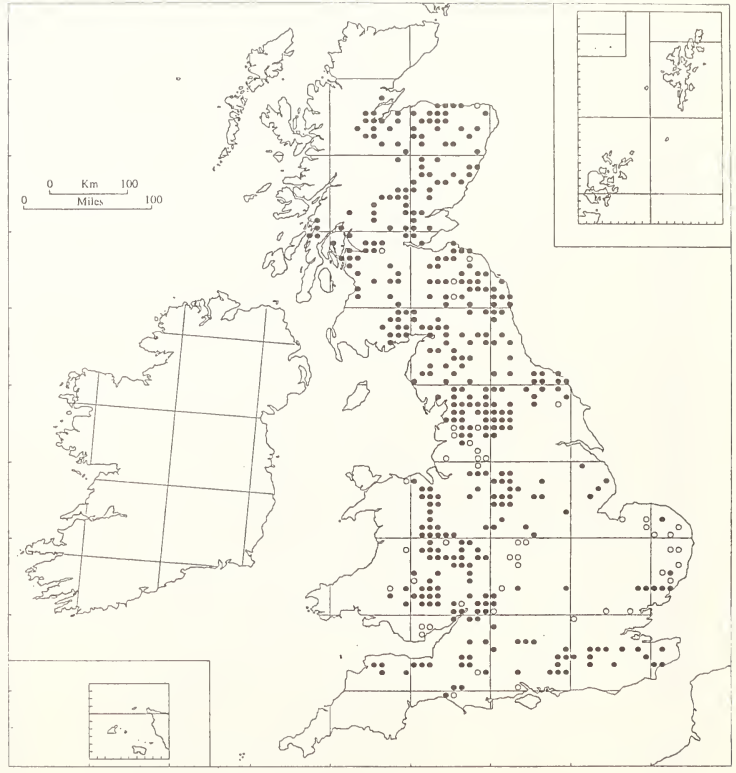


FIGURE 2. The distribution of *Chrysosplenium alternifolium* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

*Atlas of the British flora* (Perring & Walters 1962) or the other sources of information which have followed it including many local floras. In a later paper (Webb 1983) he did return to the subject and concluded that there are 186 species "of which it may be said with reasonable confidence that their absence from Ireland is due, principally if not entirely, to the opening of the Irish Sea before they had completed their north-westward migration". However he did not consider the distribution of these species in detail or publish a list, though he implied that they all occur in Britain close to the bridge-heads from which an invasion of Ireland must have started.

It therefore seems timely to assess the list of species in the flora of Great Britain which are absent from Ireland and review them in the light of up-to-date information on their present and, where it is known, past distribution, and recent evidence on the existence of land bridges between Britain and Ireland and the time when they ceased to exist.

To do this all the native species of Britain which are not recorded as native in Ireland but which grow or have grown recently in the areas of the British coast closest to Ireland have been considered. Critical species in the *Critical Supplement* (Perring & Sell 1968) and the brambles covered by Edees & Newton (1988) were also considered but narrow endemics were excluded on the grounds that the majority will have evolved in situ in habitats like cliffs from which they are unable to spread or that they are so local that even if they do occur in Ireland they have not yet been detected.

The areas selected were: St David's Peninsula, Lleyn, West Anglesey, Isle of Man, Mull of Galloway, Mull of Kintyre, Arran and Islay. These are defined by the 10-km squares shown on the map (Fig. 3).

## THE LAND BRIDGES

Godwin (1975) placed the separation of Ireland from Great Britain in the Boreal period about 8,500 BP when the bridges were flooded by a major eustatic rise in the sea level. More recently Synge (1985) has postulated a much earlier date suggesting that the last land bridge, the Bardsey Ridge between Wicklow and Lleyn, was breached during the Allerød about 12,000 BP.

This large difference of date is critical for, as Godwin remarked, during the earlier stages of the retreat of the ice, in the Allerød for example, the conditions favoured species of open habitats but the later stages were within a period of rapidly intensifying forest dominance. A bridge in the Boreal would have allowed many forest species to cross: a bridge in the Allerød would have been available only for species of open vegetation.

Both authors agreed that the separation of Ireland from Britain was earlier than the separation of England from northern France which was placed by Pennington (1969) at about 7,500 BP. The separation of the Isle of Man from Britain appears to have been later than the separation from Ireland but earlier than the separation from France and is placed by Allen (1984) at 9,000 BP.

## NATIVE WEST COAST SPECIES OF BRITAIN ABSENT FROM IRELAND

The native British species which occur in these eight areas on the west coast but which do not occur as natives in Ireland are listed in Table 1. They may be regarded as candidate species. A few general points are noteworthy:

1. The small number of candidates – 52 macro and six critical species – this represents only about 28% of the 186 macrospecies absent from Ireland suggested by Webb (1983).
2. The absence of any pteridophytes or member of the Ericaceae and the presence of only two orchids in the list – light-propaguled species can cross the sea without bridges.
3. That the largest number of species which may have failed to cross is in St David's (31) with Anglesey (28) a close second whilst the smallest numbers are in Arran (3) and on the Mull of Kintyre (5) but there are no species in Islay which do not occur in Ireland.
4. That these numbers tend to be correlated with the present distance between these areas and the nearest Irish coast (Fig. 4). However, though there is a general correlation there are two major discrepancies:
   i) All four islands fall well below the line, suggesting that they too have impoverished floras because of early separation from the mainland of Britain.

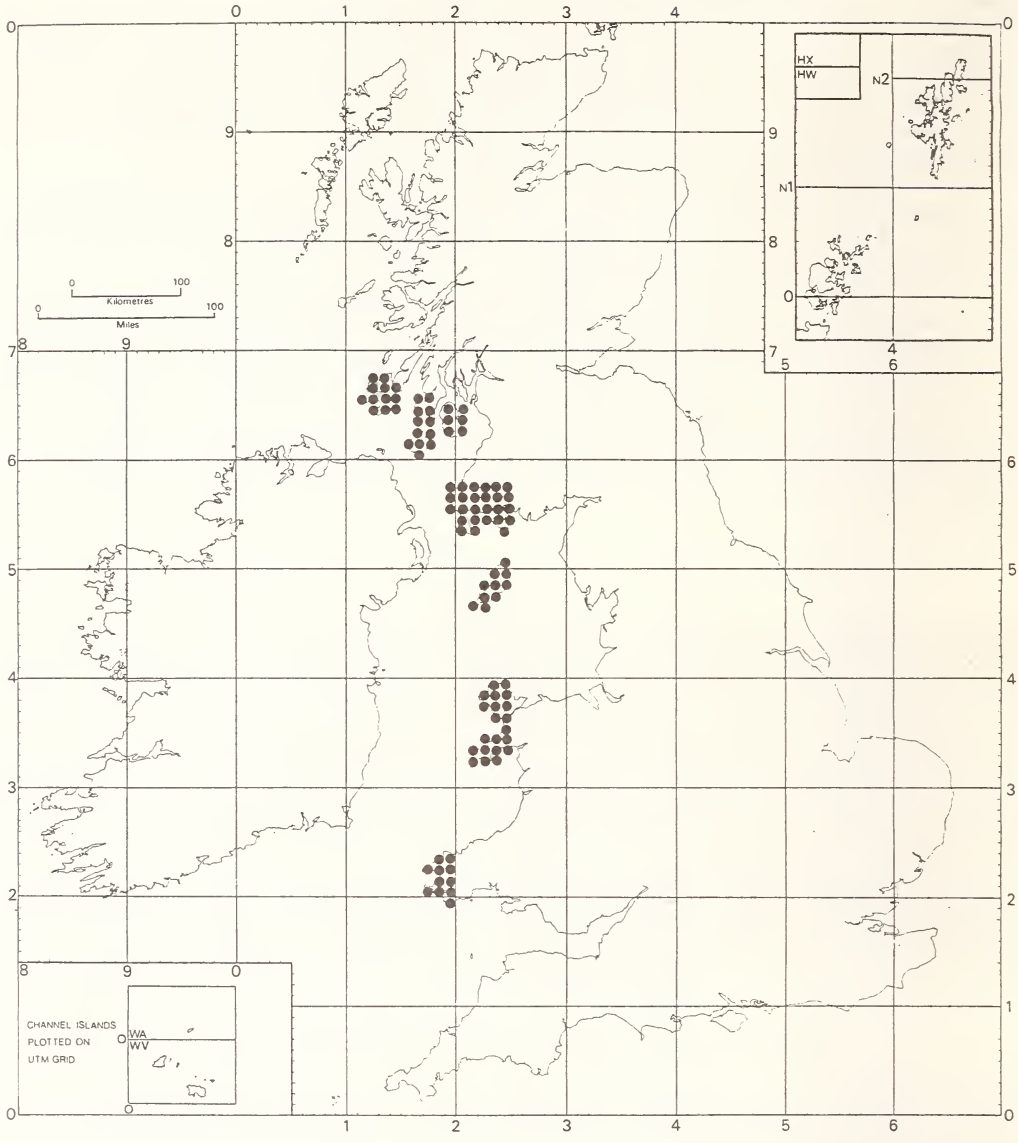


FIGURE 3. Map showing selected areas by 10-km squares used in the study.

ii) Lleyn has many fewer absent taxa than St David's or Anglesey which may be correlated with the location of the last land bridge being between Lleyn and Wicklow (Synge 1985) but may also be related to the scarcity of base-rich habitats there compared to these other two areas.

5. Most of the taxa (49) occur in only one or two of the eight areas, six occur in three areas, whilst there is only one in four and two in five areas and none in more than that.
6. Whilst of the nine species which failed to reach Ireland suggested by Praeger (1934) *Lathyrus sylvestris* (5), *Helictotrichon pratense* (4) and *Genista anglica* are in the top nine here, *Astragalus glycyphyllos*, *Paris quadrifolia* and *Scabiosa columbaria* occur in only one area whilst *Chrysosplenium alternifolium*, *Convallaria majalis* and *Ononis spinosa* do not occur in any.

TABLE 1. SPECIES WHICH OCCUR IN BRITAIN AS NATIVES IN EIGHT GEOGRAPHICAL AREAS BUT WHICH DO NOT OCCUR AS NATIVES IN IRELAND

S = St David's; L = Lleyn; An = W. Anglesey; M = Isle of Man; G = Mull of Galloway; K = Mull of Kintyre; Ar = Arran; I = Islay; (+) = extinct or no records from 1930 onwards.

| Species | Geographical area | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | S | L | An | M | G | K | Ar | I | |
| *Acer campestre* | + | | | | | | | | 1 |
| *Allium schoenoprasum* | + | | | | | | | | 1 |
| *Astragalus glycyphyllos* | | | | | (+) | | | | 1 |
| *Campanula latifolia* | | | | | + | + | | | 2 |
| *Clematis vitalba* | + | | + | | | | | | 2 |
| *Coincya monensis* | | | | + | | | + | | 2 |
| *Cruciata laevipes* | | | | | + | + | | | 2 |
| *Cyperus longus* | (+) | + | | | | | | | 2 |
| *Dactylorhiza praetermissa* | + | + | | | | | | | 2 |
| *Daphne laureola* | + | + | + | | | | | | 3 |
| *Epipactis leptochila* | | | + | | | | | | 1 |
| *Genista anglica* | + | + | + | | | | | | 3 |
| *G. pilosa* | + | | | | | | | | 1 |
| *G. tinctoria* | | | (+) | + | + | | | | 3 |
| subsp. *littoralis* | + | | | | | | | | 1 |
| *Gentiana pneumonanthe* | | | + | | | | | | 1 |
| *Helictotrichon pratense* | + | | + | | | + | + | | 4 |
| *Hornungia petraea* | + | + | | | | | | | 2 |
| *Hottonia palustris* | | | + | | | | | | 1 |
| *Hypericum linarifolium* | | + | (+) | | | | | | 2 |
| *H. montanum* | + | | | | | | | | 1 |
| *H. undulatum* | + | | | | | | | | 1 |
| *Inula conyzae* | + | + | + | | | | | | 3 |
| *Iris foetidissima* | + | | + | | | | | | 2 |
| *Juncus capitatus* | | | + | | | | | | 1 |
| *Lathyrus sylvestris* | + | + | (+) | | + | | (+) | | 5 |
| *Limonium vulgare* | | | + | + | | | | | 2 |
| *Luronium natans* | + | | + | | | | | | 2 |
| *Meum athamanticum* | | | | | + | | | | 1 |
| *Mibora minima* | | | + | | | | | | 1 |
| *Moenchia erecta* | + | | + | | | | | | 2 |
| *Nepeta cataria* | | + | | | | | | | 1 |
| *Ononis reclinata* | + | | | | + | | | | 2 |
| *Oxytropis campestris* | | | | | | + | | | 1 |
| *O. halleri* | | | | | + | | | | 1 |
| *Paris quadrifolia* | | | + | | | | | | 1 |
| *Petroselinum segetum* | + | | | | | | | | 1 |
| *Potamogeton trichoides* | | | + | | | | | | 1 |
| *Puccinellia rupestris* | + | | | | | | | | 1 |
| *Ranunculus sardous* | + | | | | (+) | | | | 2 |
| *Rhinanthus angustifolius* | | | (+) | | | | | | 1 |
| *Ruscus aculeatus* | + | | | | | | | | 1 |
| *Scabiosa columbaria* | + | | | | | | | | 1 |
| *Sedum telephium* subsp. *fabaria* | + | + | + | | + | + | | | 5 |
| *Sison amomum* | + | | (+) | | | | | | 2 |
| *Tamus communis* | + | + | + | | | | | | 3 |
| *Tephroseris integrifolia* subsp. *maritima* | | | + | | | | | | 1 |
| *Trifolium strictum* | | | (+) | | | | | | 1 |
| *Valeriana dioica* | | | (+) | (+) | | | | | 2 |
| *Veronica spicata* subsp. *hybrida* | + | | | | | | | | 1 |
| *Vicia lutea* | | | | (+) | + | | | | 2 |
| *V. tetrasperma* | + | (+) | | | | | | | 2 |
| Totals | 29 | 12 | 26 | 5 | 11 | 5 | 3 | 0 | |

TABLE 1. *continued*

| Species | Geographical area | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | S | L | An | M | G | K | Ar | I | |
| Critical genera – excluding narrow endemics | | | | | | | | | |
| *Hieracium caesiomurorum* | | | | | | + | | | 1 |
| *H. sarcophylloides* | | | | | | + | | | 1 |
| *H. vagum* | | + | + | | | | | | 2 |
| *Rubus bertramii* | + | | | | | | | | 1 |
| *R. lindebergii* | | | | + | + | | | | 2 |
| *R. silurum* | + | + | + | | | | | | 3 |
| Grand totals | 31 | 14 | 28 | 6 | 12 | 7 | 3 | 0 | |

Notes:
The following species were omitted on the grounds that all the evidence suggests that they were never more than colonists in west Britain: *Medicago arabica*, *Rumex pulcher*, *Verbascum nigrum*, *Kickxia spuria*. *Brassica oleracea* has been omitted because recent opinion suggests that it was introduced by the Romans long after the bridge to Ireland was flooded (Stewart *et al.* 1994).
Sources:
The data presented in this table have been taken from the following:
General
*Atlas of the British flora* (Perring & Walters 1982). *Critical supplement to the atlas of the British flora* (Perring & Sell 1968). *British red data books*: 1 – *Vascular plants* (Perring & Farrell 1983). *Scarce plants in Britain* (Stewart *et al.* 1994). *Brambles of the British Isles* (Edees & Newton 1988). *Flowering plants of Wales* (Ellis 1983). *Census Catalogue of the flora of Ireland* (Scannell & Synnott 1987). *Flora of North-east Ireland* (Hackney 1992).
Specific
St David's: *Plants of Pembrokeshire* (Davis 1970). Anglesey: *The flowering plants and ferns of Anglesey* (Roberts 1982). Isle of Man: *Flora of the Isle of Man* (Allen 1984). Mull of Kintyre: *The flora of Kintyre* (Cunningham & Kenneth 1979). *Additions to the Flora of Kintyre* (Kenneth 1985). Arran: *Arran's flora* (Church & Smith 1991). Islay: *The wild flowers of Islay* (Ogilvie 1995).

Clearly further analysis is required to distinguish between those species for which the absence of a bridge explains their absence from Ireland and those species which, even if there were a bridge, would not find the climatic or edaphic conditions in Ireland suitable.

To make this analysis the following features of each species have been examined:

1. Distribution inside Britain; 2. Distribution outside Britain; 3. Habitat; 4. Any known glacial and post-glacial record in Britain or Ireland; and 5. Behaviour if introduced to Ireland.

## DETAILED ANALYSIS

### RELICT SPECIES

Firstly there is a group of 14 species (Table 2) which can be dismissed as candidates because they are clearly not taxa which have been prevented from moving westwards into Ireland. All occur in only one of the selected areas, with the exception of *Luronium natans* and *Vicia lutea* which are recorded in two, though the latter was probably introduced to the Isle of Man by gulls and did not persist (Allen 1984). They are Continental or Northern Continental in distribution outside Britain and are at the extreme edge of their range here. They are rare or scarce plants, according to the list in Stewart, Pearman & Preston (1994), which have disjunct distributions suggesting they are relicts which have declined but were more widespread when climatic and habitat conditions were more suitable. They include such taxa as *Veronica spicata* subsp. *hybrida* (Fig. 5) regarded by Pigott & Walters (1954) as having survived in their present scattered refuge sites since the late-glacial period about 10,000 BP.

Material of three of these species has been found in Quaternary deposits (Godwin 1975). *Potamogeton trichoides* has records from interglacials and the post-glacial and the overall record

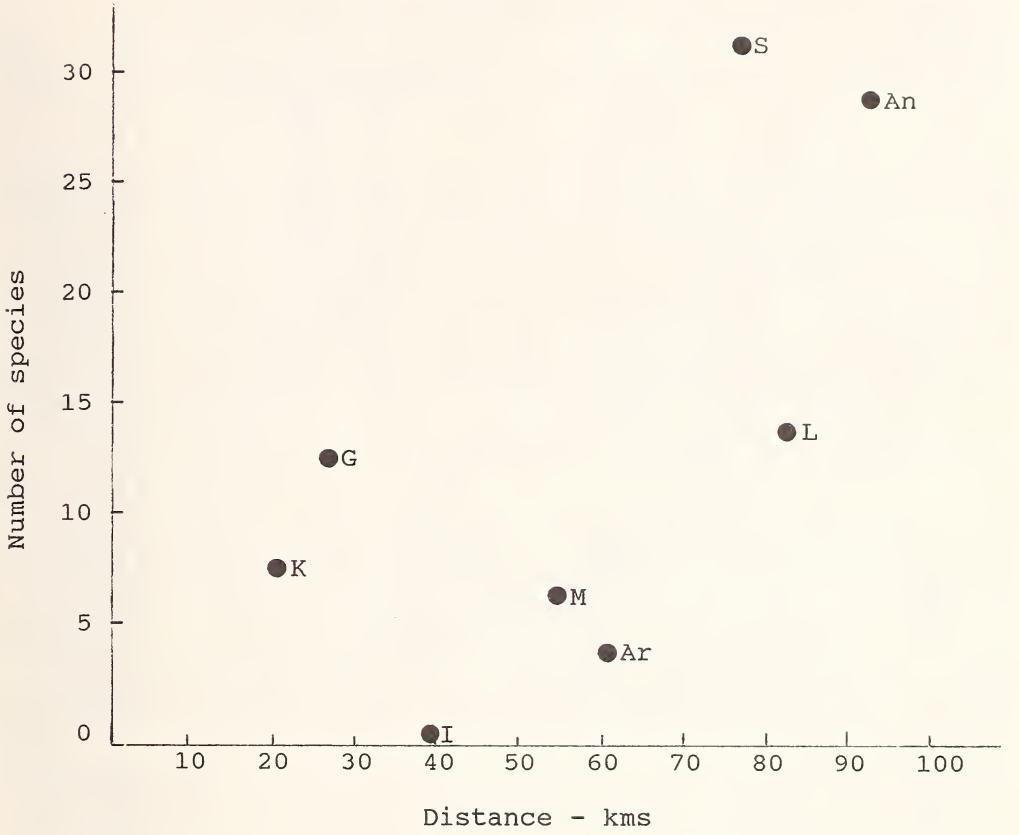


FIGURE 4. Correlation between numbers of species in each coastal area absent from Ireland and distance to the nearest part of Ireland. An = W. Anglesey, Ar = Arran, G = Mull of Galloway, I = Islay, K = Mull of Kintyre, L = Lleyn, M = Isle of Man, S = St David's.

suggests permanent occupation of the British Isles. *Allium schoenoprasum* has been found in the Middle Weichselian about 15,000 BP, long before Ireland was separated from Britain, whilst *Gentiana pneumonanthe* was found in Boreal remains from Cheshire, about the time the land bridge was breached if we accept the later date of Godwin (1975) of 8,500 BP.

*Gentiana pneumonanthe* and *Potamogeton trichoides* are species of wet habitats, and *Allium schoenoprasum* often grows close to such habitats in its upland sites: they are more likely to have material preserved than some of the others in this group, especially dry heath, cliff or grassland species like *Genista pilosa*, *Hieracium* sp., *Meum athamanticum*, *Oxytropis* sp., *Tephroseris integrifolia*, *Veronica spicata* and *Vicia lutea* which may, nevertheless have had a similar history.

TABLE 2. RELICT SPECIES — SPECIES WHICH HAVE DECLINED IN BRITAIN BUT WHICH WERE FORMERLY MORE WIDESPREAD

| | |
|---|---|
| *Allium schoenoprasum* | *Meum athamanticum* |
| *Genista pilosa* | *Oxytropis campestris* |
| *Gentiana pneumonanthe* | *O. halleri* |
| *Hieracium caesiomurorum* | *Potamogeton trichoides* |
| *H. sarcophylloides* | *Tephroseris integrifolia* subsp. *maritima* |
| *Juncus capitatus* | *Veronica spicata* subsp. *hybrida* |
| *Luronium natans* | *Vicia lutea* |

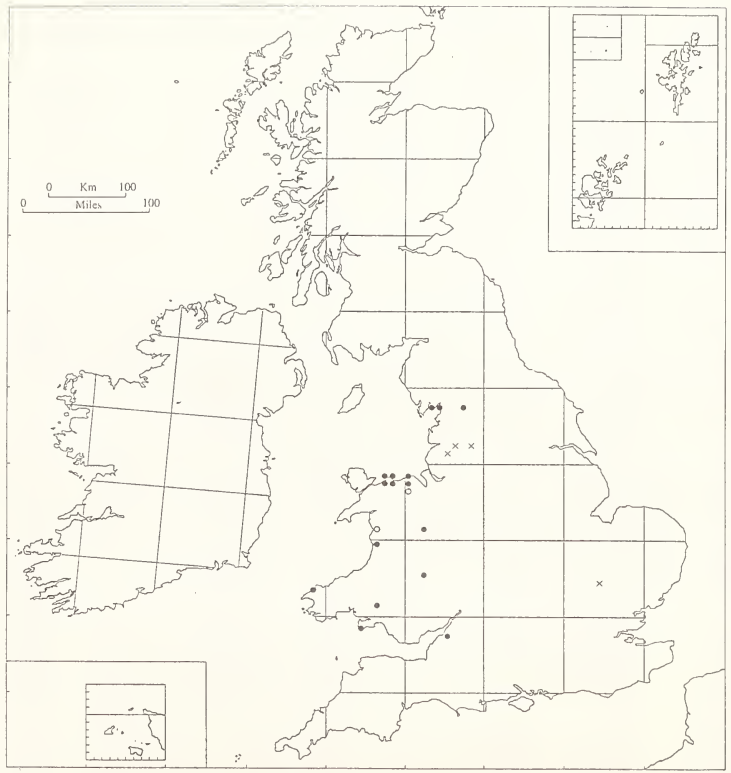


FIGURE 5. The distribution of *Veronica spicata* subsp. *hybrida* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1970 onwards record, ○ = pre-1970 record, × = introduction. Based on Stewart, Pearman & Preston (1994) and prepared by the Biological Records Centre, Institute of Terrestrial Ecology.

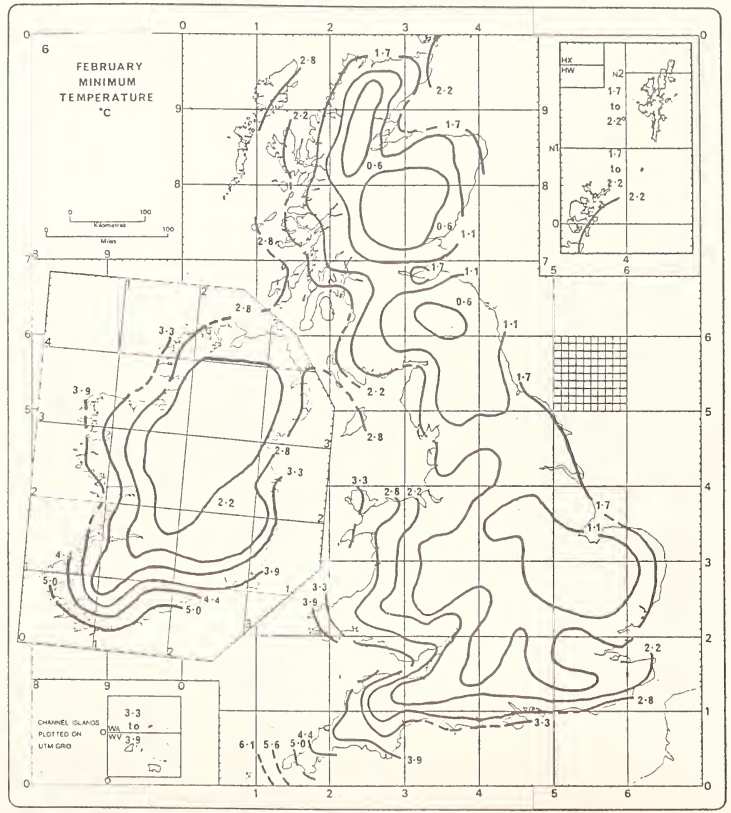


FIGURE 6. February minimum temperature. Isotherms show the mean minimum temperature in °C based on 1941–70 average for Britain and the 1931–60 average for Ireland. From Institute of Terrestrial Ecology (1978).

In order to consider taxa with similar distribution patterns and climatic relationships together the 44 remaining taxa have been grouped according to their biogeographical elements following Matthews (1955), Perring (1985) or other information. Wide and Eurasian taxa which do not fall within one of the 'European' elements have been placed in the element which most conforms with their distribution within Europe – these are marked (W) in Tables 3–7.

CONTINENTAL ELEMENT

Details of the 14 members of the Continental element which occur in the selected areas are given in Table 3. They all have a similar distribution in Europe and in Britain. In Europe they generally reach southern Scandinavia in the north and extend as far south as central Italy and the Balkans but are usually confined to the mountains there. They are absent from most of the Mediterranean islands and tend to be scarce or absent from Spain or Portugal, and western France.

In Britain they are mainly eastern in distribution and are rare or absent from Devon and Cornwall and most of Wales though, if they are calcicoles, they occur on the limestones of North and South Wales. If they reach the west coast it is usually only in the north – the Lake District and western Scotland. *Helictotrichon pratense* (Fig. 1) is a typical example.

This distribution pattern correlates with the mean February minimum temperature isotherm of 2.2°C (Fig. 6) and is characteristic of species which require low winter temperatures to complete their life cycles. Being 'Continental' species they also require warm summers and their northern limits may be an indication of the level of that requirement.

*Valeriana dioica* (Fig. 7) only reaches southern Scotland in the area with a July mean of 15.5°C (see Fig. 8) whereas *Helictotrichon pratense* (Fig. 1) reaches Orkney with a July mean of 12.5°C.

The most 'Continental' part of Ireland is in the north-east which has the lowest winter temperatures of under 2.2°C which are similar to those of the Lake District and south-west Scotland whilst the summer temperatures are comparable with those of southern Scotland.

Of the 14 taxa *Rhinanthus angustifolius* has the slenderest claim for recognition and has been omitted on the grounds that the single record by Druce from Anglesey, which has not been seen since, may have been another error for a species much over-recorded in the past (Perring & Farrell 1983).

*Nepeta cataria* can be excluded because it was almost certainly introduced to Britain as a herb after the land bridge was severed. The first record is from a Roman site in Nottinghamshire.

*Epipactis leptochila* is an orchid which has the ability to spread westwards, as its recent discovery in the Glasgow area demonstrates and, if climatic and other conditions had been suitable, it would no doubt have spread to Ireland without the presence of a land bridge.

Two other species which can be omitted on the basis that they had the opportunity to reach Ireland are *Scabiosa columbaria* and *Valeriana dioica* (Fig. 7). They both have extensive interglacial and post-glacial Quaternary material and were widely distributed in Britain when it was connected to Ireland. They either existed in Ireland but have since died out because the climate and other conditions have become unsuitable, or failed to cross the bridge because the conditions never were suitable for these two generally base demanding species which do not go far north in Scotland and may need warmer summer temperatures than have prevailed in Ireland.

A species with a similar distribution to *Scabiosa columbaria* and *Valeriana dioica*, though much more restricted, is *Hypericum montanum* (Fig. 9). It has only qualified for consideration because of two 10-km square records on the east side of St David's and, with its northern limit well south of the Scottish border, is probably too warmth demanding to extend its range to Ireland and is therefore omitted.

The same argument might be applied to *Hottonia palustris*. Like *Hypericum maculatum* it too reaches its northern limit near the Tyne and it is even more restricted in the west and is in only one of the eight areas, Anglesey. It too could be omitted from the list of candidates were it not recorded from Northern Ireland where it has been established and persisted since 1810. However the absence of any Quaternary records for this aquatic species, where preservation might have been expected had the species been here (cf. *Potamogeton trichoides* above) strongly suggest that it was a late arrival in the British Isles and not a good candidate.

Too high a temperature in winter is the most likely explanation for the absence of *Astragalus glycyphyllos* and *Paris quadrifolia* from Ireland. The former only qualified because of a single old record on the Isle of Whithorn well east of the Mull of Galloway, whilst the latter relies on a

TABLE 3. CONTINENTAL SPECIES

1 = distribution inside Britain; 2 = distribution outside Britain; 3 = habitat; 4 = glacial/post-glacial records; and 5 = behaviour if introduced into Ireland or other part of the selected areas. W = widespread taxa placed in the element which most conforms with their distribution in Europe.

*Astragalus glycyphyllos*
1. A species of central and eastern Britain almost absent from Devon and Cornwall, Wales and the western half of Scotland. Only in one area (Galloway) and that a pre-1930 record.
2. Continental (Matthews 1955). Most of Europe but only in southern Scandinavia and the mountains in the south. Absent from north-west France.
3. Rough grassland and bushy places on basic to neutral soils.
4. –
5. –

*Campanula latifolia*
1. A somewhat northern species absent from most of Wales but reaching the west coast of Scotland on Mulls of Galloway and Kintyre.
2. Continental element (Perring 1985). Although widespread in Europe absent from parts of the north, much of the south-west (in Spain but not in Portugal), and from most of the Mediterranean.
3. Woodland rides and glades, shady hedgebanks and river sides on moderately acid soils.
4. –
5. Very well established in numerous localities in north-east Ireland (Hackney 1992); also an established introduction in Anglesey (Roberts 1982), Islay (Ogilvie 1995) and Man (Allen 1984).

*Epipactis leptochila*
1. Mainly a southern and eastern species but with scattered localities on the north-west coast of England and in Anglesey where it occurs in two 10-km squares. Has recently spread westwards to the Glasgow area (Richards 1989).
2. Continental (Stewart *et al.* 1994). From Belgium and central France through the Alps to Hungary and northern Greece.
3. Beechwoods on calcareous soil in deep shade; under birch on lead and zinc rich soils, old runways and coal spoil; edges of dune slacks and stabilised sides of sandhills (Richards & Swann 1976).
4. –
5. Though not introduced by man has recently spread westwards to new, man-made, habitats in northern England and Scotland.

*Genista tinctoria*
1. Throughout England and Wales and southern Scotland reaching the west coast in many places. Subsp. *littoralis* grows on St David's. Subsp. *tinctoria* was in Anglesey but is thought to be extinct there; it is common in a small area of the Isle of Man but there is doubt about its status there (Allen 1984) where it was not recorded until 1888; it grows on the cliffs of Wigtownshire where it is clearly native.
2. Continental (Matthews 1955). Most of Europe north to Denmark but absent from Portugal.
3. Old pastures, heath and open scrub on acid to base rich soils.
4. –
5. –

*Helictotrichon pratense*
1. Nearing its western limit on west coast of Britain: absent from almost all Devon and Cornwall but occurs in four of the eight areas including St David's (Ellis 1983). (See Fig. 1)
2. Continental (Perring 1985). West and central Europe from western and southern Fennoscandia to north-east Spain, but not in Portugal.
3. Base rich grasslands and cliff-top turf; up to 825 m on Scottish mountains (Wilson 1956).
4. –
5. –

*Hieracium vagum*
1. Frequent in central and northern England and North Wales but absent from South Wales, Devon and Cornwall and most of Scotland though it does reach the west coast just north of the Mull of Galloway.
2. Continental (Perring & Sell 1968). Absent from Scandinavia and Portugal but extending east to Poland, Hungary and Romania.
3. Open woodland and hedgebanks.
4. –
5. Established in the Isle of Man since c. 1899 or before. "Abundant round Laxey, recurring S to Baldrine, on railway banks and adjacent roadsides and cliffs" (Allen 1984).

TABLE 3. *continued*

*Hottonia palustris*
1. Almost confined to central and eastern England but reaching the west coast in Lancashire and North Wales where it still occurs in Anglesey.
2. Continental (Perring 1985). Central Sweden southwards to central Italy and Romania; absent from most of the west of France and from Spain and Portugal.
3. Ponds, wide ditches in standing, fairly shallow, waters.
4. –
5. Established introduction in Co. Down (v.c. H38) where it has been known since 1810 and was thought by Praeger to be native there (Hackney 1992). Also reported from S. Tipperary (v.c. H7), Meath (v.c. H22), Fermanagh (v.c. H3), and other parts of Down but rarely persistent.

*Hypericum montanum*
1. Confined to lowland England and Wales just reaching the west coast on limestone in North Wales and the Morecambe Bay area and only qualifying because it occurs in two 10-km squares on the east side of St David's. (See Fig. 9).
2. Continental (Matthews 1933). Southern Scandinavia, south to central Spain, Italy and northern Balkans and east to the Ukraine.
3. Tall herb community on dry base rich soils.
4. –
5. –

*Nepeta cataria*
1. Only in one selected area, Lleyn, though it also occurs in east Anglesey. Confined to lowland England and Wales but reaching the west coast on the limestone in North and South Wales and in Devon and Cornwall. Doubtfully native (Clapham, Tutin & Moore 1987) and probably introduced as a herb.
2. Continental (Perring 1985). South, east and east central Europe but regarded as naturalised in Belgium and Holland.
3. Roadside verges and hedgebanks usually on lime-rich soils.
4. Material found at a Roman site in Nottinghamshire (Godwin 1975).
5. Widespread as a garden escape in Ireland and persisted in the Magilligan – Benone – Downhill area of Co. Londonderry (v.c. H40) from 1830s to 1940s (Hackney 1992).

*Paris quadrifolia*
1. Generally an eastern species in Britain only reaching the west coast in the Lake District, Anglesey and in south-west Scotland. Only occurs in one of the selected areas, Anglesey.
2. Continental (W). Throughout most of Europe but not in north-west France or Portugal and rare in the Mediterranean. Extends eastwards to Caucasus and Siberia.
3. Ancient broad-leaved woodlands on moderately acid to calcareous damp clays.
4. –
5. –

*Rhinanthus angustifolius*
1. Only in one of the selected areas, Anglesey, where it was recorded by Druce but has not been seen since. Otherwise absent from the whole of Britain west of a line from the Outer Hebrides to the Isle of Wight.
2. Most of Europe (W) but absent from the Mediterranean region, the south-west and most of the islands.
3. Cornfields, meadows and sand dunes.
4. –
5. –

*Scabiosa columbaria*
1. Mainly absent from Devon, Cornwall, Scotland and Wales but extending westwards on limestone of North and South Wales and occurring in one 10-km square on east side of St David's.
2. Continental (Perring 1985). Scattered in Scandinavia to 60°N and southwards to the Mediterranean but absent from most of the islands and from north-west France.
3. Base rich grassland, open scrub and rocks.
4. Quaternary deposits show that it was present during the Cromerian, Hoxnian, Ipswichian and Weichselian interglacials and in the post-glacial in Kirkudbrightshire about 9,000 BP. No doubt persisted in Britain throughout the period (Godwin 1975).
5. –

*Sedum telephium* subsp. *fabaria*
1. One of only two taxa to occur in five of the eight areas. Commoner in the west of Britain than the east and only absent from north-west Scotland. (Fig. 11, but not native in Arran, see (5) below).

TABLE 3. *continued*

2. Though the species occurs throughout Europe, North America and temperate Asia this subspecies appears to be Continental. It occurs throughout western and central Europe including western France, Spain and Portugal but is absent from most Mediterranean islands and is only in southern Scandinavia.
3. Shady roadsides, open woods and scrub on moderately acid to basic soils.
4. –
5. Successful introduction in several parts of Ireland, e.g. "naturalised in the woods by L Neagh nr Shane's castle . . . – first reported here c. 1878" (Hackney 1992). Also reported as naturalised in all other three selected areas in which it is not native (Allen 1984; Church & Smith 1991; Ogilvie 1995).

*Valeriana dioica*

1. Throughout England, Wales and southern Scotland but absent or not recorded since 1930 from any of the western peninsulas. Occurred in two of the selected areas but now extinct in both. Two 19th century records in Anglesey (Roberts 1982) and one in the Isle of Man where it was last seen about 1909 (Allen 1984).
2. Continental (Perring 1985). From south-east Norway and Sweden east to Macedonia and the western borders of Russia. Absent from western France and most Mediterranean islands but in Spain and Portugal.
3. Fens, marshes and flushes on moderately acid to base rich soils.
4. Quaternary records throughout the period from Hoxnian, Ipswichian and Weichselian interglacials to post-glacial (Godwin 1975) all point to the long persistence of this species in Britain and its presence before the land bridges were severed.
5. –

woodland site in Anglesey (Fig. 10) apart from which there is no other record within 30-km of a former land bridge. *P. quadrifolia* is a species confined to ancient woodlands, usually on base-rich soils which, even today, has not penetrated far west in Britain and may never have reached a bridge-head.

There are, however, three woodland and woodland margin species which have a strong claim to be considered as candidates: *Campanula latifolia*, *Hieracium vagum* and *Sedum telephium*.

*Sedum telephium* is outstanding in being one of the only two species which occurs in five of the eight areas (Fig. 11). It is also an established introduction in the other three areas – the islands of Arran, Islay and Man – as well as being naturalised in several parts of Ireland. It occurs widely along the western seaboard of Britain and, of all the species considered, is probably the strongest candidate for inclusion in a list of species which would be in Ireland as a native today if there were a land bridge.

*Campanula latifolia* and *Hieracium vagum* both occur in two areas and, unlike most other species considered, but like *Sedum telephium*, are very abundant on the west coast, *C. latifolia* in south-west Scotland and the Lake District, *H. vagum* in North Wales. Both species have become established further west: *C. latifolia* in numerous localities in north-east Ireland as well as in Anglesey, Islay and Man, whilst *H. vagum* has been established for about 100 years in Man. Both species would surely have been in Ireland, especially the north, if there had been an opportunity to cross when they reached the coast.

Two other species of more open habitats including grassland near the sea, are also strong candidates for species which reached the coast too late – *Genista tinctoria* and *Helictotrichon pratense*. *G. tinctoria* including the subsp. *littoralis* has occurred or occurs in four of the eight areas and it reaches the coast in many places around the northern half of the Irish Sea. It is also common in a small area of the Isle of Man and, though there is some doubt about its status, it has long survived there and is clearly a species well adapted to growing in that area which could have colonised Ireland had a land bridge been available. *H. pratense* has been referred to above: it is in four of the eight areas and with its wide range of grassland habitats, especially in Scotland, and altitude range, could surely have found a niche in Ireland had the way been open for it to cross the gap.

It is interesting to compare these species with two species which do occur in Ireland as natives, one of woodland and the other of grassland. *Adoxa moschatellina*, which is native to Ireland, still occurs in a single locality in Co. Antrim though lost from another over a century ago. However *A. moschatellina* occurs in six of the eight selected areas (Fig. 12), more than any of the candidate species, being absent only from the Isle of Man and Islay, though it is on Jura (Ogilvie 1995). Like *Sedum telephium* it is also frequent throughout the west of Britain. It is a Europe-wide but

TABLE 4. CONTINENTAL SOUTHERN SPECIES

1 = distribution inside Britain; 2 = distribution outside Britain; 3 = habitat; 4 = glacial/post-glacial records; and 5 = behaviour if introduced into Ireland or other part of the selected areas. W = widespread taxa placed in the element which most conforms with their distribution in Europe.

*Acer campestre*
1. Throughout lowland England and Wales north to Northumberland and the Lake District; probably not native in Scotland. Rarer in the west reaching the coast in St David's and north Cornwall but not native in Anglesey (Roberts 1982) and west Cornwall (Margetts & David 1981). (See Fig. 14).
2. Southern Continental (Matthews 1955). Denmark and southern tip of Sweden south to the Mediterranean but absent from north-west France and Portugal.
3. Woods, hedge and scrub on well-drained moderately acid to base-rich soils.
4. First Quaternary records from the Neolithic about 4,500 BP (Godwin 1975).
5. Widely established as an introduction outside its native area in the British Isles. "Occasionally run wild" in Ireland (Webb 1977).

*Clematis vitalba*
1. Lowland England and Wales northwards to the Humber and North Wales and reaching the west coast in Cornwall and two of the selected areas, St David's and Anglesey.
2. Continental Southern (Matthews 1955). From southern Denmark southwards to the Mediterranean, including many of the islands, and south-eastwards to Greece and the Balkans. (See Fig. 13, upper map).
3. Woods, hedges and scrub on well-drained, moderately acid to base-rich soils.
4. First Quaternary records from warm periods in interglacials but then a long gap until wood and pollen dated c. 6,300 BP was found in Hampshire (Godwin 1975).
5. Widely naturalised outside its native area. "Hedges and thickets, mainly in S. half" [of Ireland] (Webb 1977), and in Man (Allen 1984).

*Cruciata laevipes*
1. Somewhat eastern and not on west coast of Wales, but reaching the west coast of Scotland on the Mulls of Galloway and Kintyre, and recently from Jura (Ogilvie 1995). (See Fig. 16). The Isle of Man record in Perring & Walters (1982) was an error (Allen 1984).
2. Continental Southern (W) (Perring 1985). Absent from Scandinavia but in Spain and Portugal and several Mediterranean islands and extending eastwards to Poland and Russia and western Asia.
3. In rough grassland, hedge bottoms and woodland margins on moderately acid to base rich soils.
4. –
5. Established at one locality at Downpatrick, Co. Down (v.c. H38) since at least 1744 (Hackney 1992).

*Cyperus longus*
1. Only found as a native near the coast in the south and west north to Lleyn. Extinct near St David's for over 100 years (Davis 1970).
2. Continental Southern (W) (Matthews 1955). Widespread throughout west, central and southern Europe east to central Asia, north and east Africa: at its northern limit in Britain.
3. Wet pastures near the coast and base-rich flushes on cliffs.
4. One doubtful record from the Anglian interstadial of the glacial period (Godwin 1975).
5. Introduced in many sites in England, especially in the south, and also in a few places in Wales. Not reported as an introduction to Ireland.

*Daphne laureola*
1. Throughout lowland England and Wales north to the Lake District and Durham and west to Devon and Cornwall though thought to be mainly bird-sown in the former (Margetts & David 1981). Occurs in all three Welsh selected areas.
2. Continental Southern (Matthews 1955). South, south central and western Europe: at its northern limit in England and Hungary.
3. Woodland margins and clearings on dry, neutral to calcareous soils.
4. –
5. Recently established in Cos Down (v.c. H38) and Antrim (v.c. H39) in N. Ireland (Hackney 1992). Also widely naturalised in the Isle of Man where "Solitary bird-sown bushes are usual, but on the steep bank of the Ballaglass stream near Rhenab it occurs in profusion." (Allen 1984).

*Hornungia petraea*
1. Scattered in west and central England and Wales from sea level in South Wales to c. 490 m in North Yorkshire. (See Fig. 20).

TABLE 4. *continued*

2. Continental Southern (Matthews 1955). Although placed in this element by Matthews it is a more continental species than others reaching southern Scandinavia and the Baltic as well as occurring in western, central and southern Europe. It has a very disjunct distribution suggesting a species in retreat: absence from west Brittany and north-west Spain may be significant.
3. "South and south-west facing slopes on carboniferous limestone and calcareous sand dunes . . . . . open vegetation on bare soil which is dry in summer but moist in winter." (Stewart *et al.* 1994).
4. –
5. –

*Inula conyzae*
1. Throughout lowland England and Wales north to the Lake District and Durham; widespread in Devon and Cornwall and in all three Welsh selected areas.
2. Continental. Although placed in this element by Matthews (1955) and accepted by Perring (1985) its distribution in Europe fits more closely with members of the Continental Southern element. It only just reaches Sweden, is absent from the northern quarter of Germany and reaches north-west Ukraine but is mainly in western, central and southern Europe including many of the Mediterranean islands.
3. Open scrub and grassy banks, old pastures and rock ledges on moderately acid to calcareous soils.
4. –
5. –

*Lathyrus sylvestris*
1. Scattered through the southern half of lowland England and along the coasts of Wales and south-west Scotland. More frequent in the selected areas than shown by Perring & Walters (1982) and occurring now in three: St David's, Lleyn and Galloway, and in the past in Anglesey and Arran. There is also a recent (1959) record from Jura (Ogilvie 1995).
2. Continental Southern (W). Throughout most of Europe from southern Scandinavia southwards to the Mediterranean including Spain and Portugal and some of the islands. Also in the Caucasus and north-west Africa.
3. Scrubby vegetation, overgrown hedgerows and damp places on sea cliffs.
4. No authenticated Quaternary records (Godwin 1975).
5. –

*Ranunculus sardous*
1. Scattered through lowland England, most frequent near the east coast, but also on the south and west coasts of Wales, the Lake District and Scotland north to the Outer Hebrides where a single record dates from 1949 (see Fig. 19). Only present now in one selected area, St David's, but there is a pre-1930 record from Galloway. Often only a casual on the western fringe (Wade *et al.* 1994).
2. Continental Southern. Although not placed in this, or any other, element by Matthews (1955) or Perring (1985) the recently published map of its distribution in Europe (see Fig. 13, lower map, from Jalas & Suominen 1989) is so similar to that of *Clematis vitalba* (Fig. 13, upper map) that it clearly belongs to this element, though it does extend slightly out of Europe into North Africa and western Asia.
3. Damp meadows, salt meadows by the sea and cornfields.
4. Quaternary records from the Early and Middle Weichselian interglacials, 20,000–70,000 BP and then not again until Roman times, 2,000 BP, when found as a weed of four Romano-British occupation sites in England and South Wales (Godwin 1975).
5. Only once recorded in Ireland, as a probable casual in Belfast Docks in 1986 (Hackney 1992).

*Ruscus aculeatus*
1. Native only in the southern third of England and on the limestones of North and South Wales where it occurs within the St David's area but just outside the West Anglesey area.
2. Continental Southern (Matthews 1955). From France eastwards to central Hungary and the Balkans, and southwards to the Mediterranean, where it is widespread and on most of the islands.
3. Dry woodland and rocky cliffs on moderately acid to base-rich soils.
4. –
5. ". . . extremely rare as a 'wild' plant" [in Cos Down (v.c. H38) and Antrim (v.c. H39)] (Hackney 1992) and first recorded about 1974. In the Isle of Man "naturalised in old plantations and in one or two hedgebanks." (Allen 1984).

*Tamus communis*
1. Almost throughout lowland England and Wales north to Northumberland and the Lake District (see Fig. 15). In all three of the selected areas in Wales.

TABLE 4. *continued*

2. Continental Southern (Matthews 1955). From Belgium and west Germany south to Spain and Portugal and the Mediterranean including all the larger islands.
3. Hedgerows and woodland margins on moderately acid to calcareous soils.
4. –
5. Listed in Scannell & Synnott (1987) as an introduction in Co. Clare (v.c. H9), Co. Sligo (v.c. H28), Co. Leitrim (v.c. H29), Tyrone (v.c. H36) and Co. Armagh (v.c. H37) and recorded in Webb & Scannell (1983) as "from 1971 to 1979 in a hedge 4 km S.S.W. of Ballyvaughan, and, as it is a difficult weed to eradicate from gardens, it is likely to remain there for some time."

*Vicia tetrasperma*

1. Lowland England and Wales northwards to Northumberland and the Lake District and reaching the west coast there, in Cornwall and in two of the selected areas in Wales, St David's and Lleyn, and formerly in east Anglesey (see Fig. 17).
2. Continental Southern (W). Throughout Europe north to southern Scandinavia and south to the Mediterranean including most of the larger islands and N. Africa. Extending eastwards to W. Asia and Japan and westwards to Macaronesia.
3. Coarse grassland, hedgebanks on dry to damp moderately acid to calcareous soils.
4. First recorded from the late Bronze Age in Sussex about 2,500 BP (Godwin 1975).
5. Webb (1977) did not include it in the flora of Ireland but it is included, as probably introduced, in Scannell & Synnott (1987) for W. & Mid Cork (v.cc. H3 & H4), Co. Dublin (v.c. H21), Meath (v.c. H22), West Meath (v.c. H23), Co. Down (v.c. H38), Co. Antrim (v.c. H39) and Co. Londonderry (v.c. H40) and as a native in *Flora Europaea*. Recorded in 1967 as a native or colonist in the Isle of Man (Allen 1984).

somewhat continental species absent from N.W. France, Spain and Portugal. It grows in open woodland and shady hedgebanks on moderately acid to neutral soils. There are no glacial or post-glacial records.

The other grassland species which has a similar distribution to *A. moschatellina* and to others in this group and which, like *A. moschatellina*, just gets into the northern half of Ireland, is *Helianthemum chamaecistus*. It is absent from the south-west of England and Wales but it does occur in Anglesey and Arran and is extremely abundant on the coast of Galloway – clearly 'population pressure' may have been important in determining its success in crossing the water.

It is surely not without significance that both these species are found in the north of Ireland, in the part of the country which has the most continental climate.

### CONTINENTAL SOUTHERN ELEMENT

Details of the twelve members of the Continental Southern element which occur in the selected areas are given in Table 4. They all have similar distributions in Britain and Europe. The distribution in Europe of two of the species, *Clematis vitalba* and *Ranunculus sardous*, which are typical, are shown in Fig. 13. Taxa in this element only just reach Scandinavia but go southwards to the Mediterranean where they occur in most of the larger islands and occasionally reach N. Africa.

In Britain they are essentially southern in distribution, occurring throughout the lowlands of England and Wales and extending northwards to a more or less horizontal limit in Durham/ Northumberland across to the Lake District. They are more frequent on the west coast than species of the Continental Element and are often widespread in Devon and Cornwall and in Wales. *Acer campestre* (Fig. 14) and *Tamus communis* (Fig. 15) are good examples.

The northern limits of these species correlate with the July average means of daily mean temperature isotherm of 15–15·5°C (Fig. 8) and are characteristic of those which require warm summer temperatures to complete their life cycles. Even *Cyperus longus* and *Ruscus aculeatus*, which reach their northern limit in North Wales, are there in an area on the coast where the July mean is the same as that inland further north.

The warmest part of Ireland, with a July mean of over 15·5°C falls south and east of a line from Kerry to Dublin, and provides a summer climate which should be suitable for all the species in this group.

Nine of the twelve species in this group are either trees or shrubs or woodland or woodland margin species and all have a strong claim to be considered as candidates. The four trees/shrubs plants are *Acer campestre*, *Clematis vitalba*, *Daphne laureola* and *Ruscus aculeatus*. All reach the

TABLE 5. OCEANIC WEST EUROPEAN AND OCEANIC SOUTHERN SPECIES

1 = distribution inside Britain; 2 = distribution outside Britain; 3 = habitat; 4 = glacial/post-glacial records; and 5 = behaviour if introduced into Ireland or other part of the selected areas.

*Dactylorhiza praetermissa*
1. Throughout most of lowland England and Wales as far north as Northumberland in the east but absent from the Lake District. Very rare in north-west Wales but is recorded from one 10-km square in Lleyn: extremely abundant in St David's and in every 10-km square there (Ellis 1983).
2. Oceanic West European (Matthews 1955). Britain is at the centre of its distribution. Known elsewhere from Denmark, Holland, Belgium and northern France.
3. Meadows, wet hollows, flushes, valley mires and quarry floors on moderately acid to calcareous soils.
4. –
5. –

*Genista anglica*
1. Throughout Britain north to Ross but absent from all of western Scotland and the north though reaching 700 m in Atholl (Wilson 1956). Occurs abundantly in all three selected areas in Wales.
2. Oceanic West European (Matthews 1955). Western Europe extending north east to the southern tip of Sweden and north-east Germany and south to Spain and Portugal and south-west Italy.
3. Heaths, dry mosses and infertile pastures on moist to dry often peaty soils.
4. –
5. –

*Hypericum linarifolium*
1. Restricted to one locality in Cornwall, two in Devon and one in Lleyn. Formerly in the selected area of Anglesey, but not seen there for 80 years (Roberts 1982), and apparently no longer in Radnor or Merioneth where it has not been seen for over 50 years (Ellis 1983).
2. Oceanic West European (Matthews 1955). Western Britain, western France southwards to Spain and Portugal.
3. Steep, dry rocky acid banks in open vegetation on acid soils.
4. –
5. –

*Hypericum undulatum*
1. Confined to Devon and Cornwall and west Wales where it is abundant in the St David's area occurring in eight post-1970 and one pre-1970 10-km squares and 17 tetrads (Stewart *et al.* 1994).
2. Oceanic West European (Matthews 1955). From Wales southwards through western France to Spain, Portugal and the Azores.
3. Rushy pastures and damp heaths on acid soils which are seasonally or permanently waterlogged with lateral movements.
4. –
5. –

*Iris foetidissima*
1. Britain north to a line joining the Humber to the Dee estuaries but much commoner south of the River Thames. In two 10-km squares in both St David's and Anglesey (Ellis 1983).
2. Oceanic Southern (Matthews 1955). South and west Europe from Britain southwards through France to north-east Italy and the western Mediterranean including the larger islands.
3. Open woodland and scrub, roadside banks and field margins on dry, moderately acid to calcareous soils.
4. –
5. Although through most of Ireland considered only to be a garden escape (Webb 1977; Webb & Scannell 1983; Hackney 1992). Praeger (1934) suggests that, on Ireland's Eye, an islet, and on Lambay Island, both to the north of Howth in Co. Dublin (v.c. H21), it might be native as it is well established on sands and cliffs remote from houses or former cultivation. Naturalised on the Isle of Man (Allen 1984).

*Limonium vulgare*
1. Coasts of Britain north to the Firths of Forth and Solway. Abundant on the east coast, less common on the west. Though it occurs in Anglesey of the selected areas, and to the east of Lleyn, it is replaced in St David's by *L. humile*.
2. Oceanic Southern (Matthews 1955). From southern Sweden along the coasts of western and southern Europe as far east as Turkey and on most of the larger Mediterranean islands. N. Africa.
3. Muddy salt-marshes.
4. Tentatively recorded from the post-glacial about 2,500 BP in south Devon.
5. Thought to be extinct in the Isle of Man but found in two new localities in 1971 and 1972 (Allen 1984).

TABLE 5. *continued*

*Mibora minima*
1. One of Britain's rarest plants known only from Wales as a native: on the coasts of Glamorgan and Anglesey where it occurs in three 10-km squares in the selected area.
2. Oceanic Southern (Matthews 1955). From western Germany, Holland, Belgium and France southwards through Spain and Portugal to north-west Africa; Greece.
3. Sandy and other light soils, damp in winter.
4. –
5. Not recorded as an introduction in Ireland but has spread and become established in sand dunes in East Lothian, where it has been introduced and re-introduced since 1800 (Silverside & Jackson 1988). Also established in Dorset, Suffolk and Bedfordshire and as a casual elsewhere.

*Moenchia erecta*
1. Scattered throughout England and Wales north almost to the Scottish border in the east but now only to North Wales in the west where it occurs in Anglesey: also recorded from St David's of the selected areas. (See Fig. 23).
2. Oceanic Southern. Although placed by Perring (1985) in the Continental Southern element the map published by Jalas & Suominen (1983) (Fig. 21, upper map) shows that the main centre of distribution lies to the south of Britain conforming very closely to the criteria for the Oceanic Southern element as defined by Matthews (1955). Matthews, curiously, did not include *Moenchia* in his list of Continental Southern species even though its distribution is very similar to that of *Ranunculus parviflorus* (Fig. 21, lower map) which he does include.
3. Bare patches in dry open grassland, rock outcrops, cliff-tops, path-sides and dunes.
4. –
5. –

*Ononis reclinata*
1. Confined in Britain to the coasts of Devon and Glamorgan, and to two of the selected areas, St David's where it occurs in one locality, and the Mull of Galloway in a recently rediscovered site where it had not been seen since 1835.
2. Oceanic Southern (Matthews 1955). West coast of Europe from Galloway southwards and then throughout the Mediterranean east to Iran including all the larger islands.
3. Coastal cliffs.
4. –
5. –

*Petroselinum segetum*
1. Almost entirely confined to the area of England south and east of a line joining the Humber and Severn estuaries but with a Western extension along the coast of South Wales to St David's where it is recorded from four 10-km squares.
2. Oceanic West European (Matthews 1955). From Holland and western France southwards to Spain and Portugal and east to central Italy.
3. Dry hedgebanks and rocky places in the west, perhaps more often arable fields in the east.
4. Recorded from at least three interglacials, Hoxnian, Ipswichian and Late Weichselian and from the post-glacial about 2,000 BP in Cumbria.
5. –

*Puccinellia rupestris*
1. Coasts of Britain; formerly as far north as Northumberland in the east and to the Solway Firth in the west but now only to south Durham in the east and to St David's in the west. Now in two 10-km squares in the selected area of St David's; formerly in four. Appears to be retreating southwards (Stewart *et al.* 1994).
2. Oceanic West European (Matthews 1955). Western Europe from Holland and Britain southwards to Spain. Mainly coastal but inland on damp sands in central Spain.
3. Edges of brackish pools and ditches and in open, ephemeral vegetation behind sea-walls; also on muddy shingle and in rock crevices.
4. –
5. Found in Larne and Belfast in Northern Ireland in 19th century and persisted for several years in Belfast until site was paved (Hackney 1992).

*Rubus bertramii*
1. England and Wales north to the Lake District but much commoner in the west than the east. Widespread in central and west Wales extending to St David's where it is recorded from one 10-km square (Edees & Newton 1988). A small patch in the Isle of Man may have been this but only inadequate panicles present (Allen 1984).

TABLE 5. *continued*

2. Oceanic West European. Widespread in north-western Europe from Denmark to France and east to Germany.
3. Damp woods and heath margins.
4. –
5. –

*Rubus lindebergii*
1. Almost absent from south and east England, west Wales and Scotland north of Perthshire. Occurs in two of the selected areas, Man and Galloway, and on the eastern edge of Lleyn (Edees & Newton 1988).
2. Oceanic West European. From southern Sweden, Norway and Denmark as well as Britain.
3. "Wood and moor margins particularly in upland areas" (Edees & Newton 1988).
4. –
5. –

*Sison amomum*
1. Almost entirely confined to the south and east of a line joining the Humber and Severn estuaries with a small concentration in North Wales where it formerly occurred in Anglesey but has not been seen for over 100 years. The record in Perring & Walters (1982) requires confirmation.
2. Oceanic Southern (Matthews 1955). From Britain southwards through France and Spain to the Mediterranean east to Turkey, including most of the larger islands. W. Asia; N. Africa.
3. Hedge-bottoms and roadsides.
4. –
5. Not reported from Ireland; a rare casual in northern England.

*Trifolium strictum*
1. Recorded since 1970 in Cornwall, Radnorshire and the Channel Isles. The only record from a selected area, Anglesey, dates from 1837.
2. Oceanic Southern (Matthews 1955). Britain southwards through western France to Spain and Portugal and the Mediterranean east to Turkey, including some of the larger islands; also in Hungary and other parts of south-central Europe.
3. Short, dry grassland.
4. –
5. Not reported from Ireland; a rare casual in Sussex and Midlothian.

TABLE 6. ENDEMIC SPECIES

1 = distribution inside Britain; 2 = distribution outside Britain; 3 = habitat; 4 = glacial/post-glacial records; and 5 = behaviour if introduced into Ireland or other part of the selected areas.

*Coincya monensis*
1. Centred on the coast of north-west England and south-west Scotland and extending to both Arran and the Isle of Man and in four 10-km squares in each. Also in South Wales.
2. Endemic.
3. Sand dunes, sandy ground and sometimes on cliffs by or near the sea.
4. –
5. Not recorded as an introduction in Ireland but has occurred recently in ruderal communities in central Scotland (Stewart *et al.* 1994).

*Rubus silurum*
1. Widespread throughout central Wales and recorded from single 10-km squares in St David's, Lleyn and Anglesey. Also in North Devon.
2. Endemic.
3. "Hedgebanks, thickets and margins of woods and moors to 1000ft" (Edees & Newton 1988).
4. –
5. –

TABLE 7. SPECIES LISTED BY PRAEGER (1934) AS EXCLUDED FROM IRELAND WHICH ARE NOT IN THE SELECTED AREAS IN BRITAIN

1 = distribution inside Britain; 2 = distribution outside Britain; 3 = habitat; 4 = glacial/post-glacial records; and 5 = behaviour if introduced into Ireland or other part of the selected areas. W = widespread taxa placed in the element which most conforms with their distribution in Europe.

*Chrysosplenium alternifolium*
1. Scattered through England, east Wales and Scotland north to the Moray Firth. Almost absent from Devon and Cornwall and only reaching the west coast of Britain in a few localities and some distance from the selected areas (Fig. 2).
2. Continental Northern (Matthews 1955). From 65° N in Scandinavia southwards through continental Europe and absent from western France, Spain and Portugal and the whole of the Mediterranean including Greece.
3. Stream banks and valley woods on basic to acid soils.
4. Seed was found in a Hoxnian interglacial site near Birmingham (Godwin 1975).
5. –

*Convallaria majalis*
1. Distribution similar to that of *Chrysosplenium alternifolium* hardly reaching the west coast. Also doubtfully native and not known today in Cornwall (Margetts & David 1981) and not regarded as a native in Devon (Ivimey-Cook 1984) or Anglesey (Roberts 1982).
2. Continental (W). Most of Europe from the Arctic Circle in Scandinavia to the mountains of the Mediterranean but absent from the islands, and also absent from Brittany and Portugal.
3. Open patches in old woodland on damp to dry acid to basic soils.
4. –
5. Not included in the Irish flora as an introduction by Webb (1977) or by Scannell & Synnott (1987) but recorded from four scattered localities in Perring & Walters (1982) and as "established in the Umbra woodland [Derry] from at least 1953, still there 1989" by Hackney (1992).

*Ononis spinosa*
1. Predominantly a species of lowland England which is much more abundant in the east than the west. Not known as a native in Devon and Cornwall except in the extreme east of Devon (Ivimey-Cook 1984). Although reported from one of the selected areas, St David's, the record is unsubstantiated by specimens and was not included by Davis (1970). It is frequently mistaken for *O. repens*.
2. Continental (W). From southern Norway and north-west Ukraine southwards and westwards to southern Italy and north-east Portugal but absent from Brittany.
3. Roadsides and rough pastures especially on heavy, basic clays.
4. There is a Late Weichselian record, about 10,000 BP, from Cornwall (Godwin 1975).
5. –

west coast of Wales. *A. campestre* and *C. vitalba* are particularly abundant there and both have become extensively naturalised in Ireland, especially in the south and east; *A. campestre* is described by Webb (1977) as "occasionally running wild". *D. laureola* and *R. aculeatus* are also established introductions in Ireland though in the north in Down and Antrim, where they have appeared in the last 25 years (Hackney 1992). However both these species also have a longer history of introduction in the Isle of Man; in one locality *Daphne laureola* "occurs in profusion" (Allen 1984).

*A. campestre* and *C. vitalba* have been recorded in Quaternary deposits but *A. campestre* not until the Neolithic about 4,500 BP, whilst *C. vitalba*, although reported from warm periods in interglacials, has not been reported from the post-glacial until c. 6,300 BP suggesting that it died out before returning after the last glaciation. There are no Quaternary records for *D. laureola* or *R. aculeatus*.

The five woodland or woodland margin species are *Cruciata laevipes*, *Inula conyzae*, *Lathyrus sylvestris*, *Tamus communis* and *Vicia tetrasperma*. Of these *C. laevipes* has an anomalous distribution in Britain (Fig. 16). Although it is absent from Scandinavia and reaches the Mediterranean, so that it occurs in similar area to that covered by *Clematis vitalba* (Fig. 13, upper map), its distribution in Britain is much closer to that of Continental species such as *Helictotrichon pratense* (Fig. 1) than to a Continental Southern species such as *Tamus communis* (Fig. 15). It therefore occurs on the west coast, in the selected areas, in Scotland rather than in Wales and it is

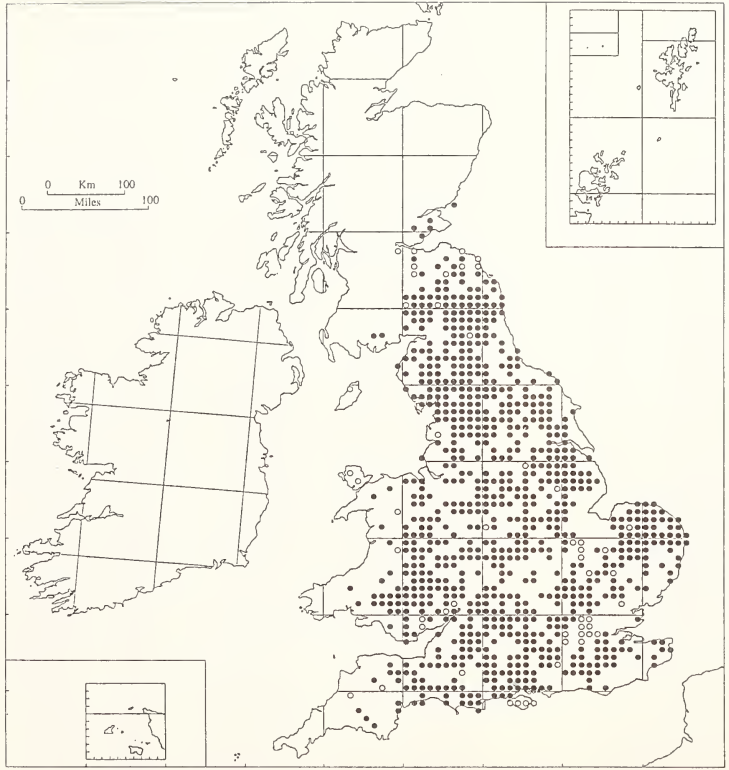


FIGURE 7. The distribution of *Valeriana dioica* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

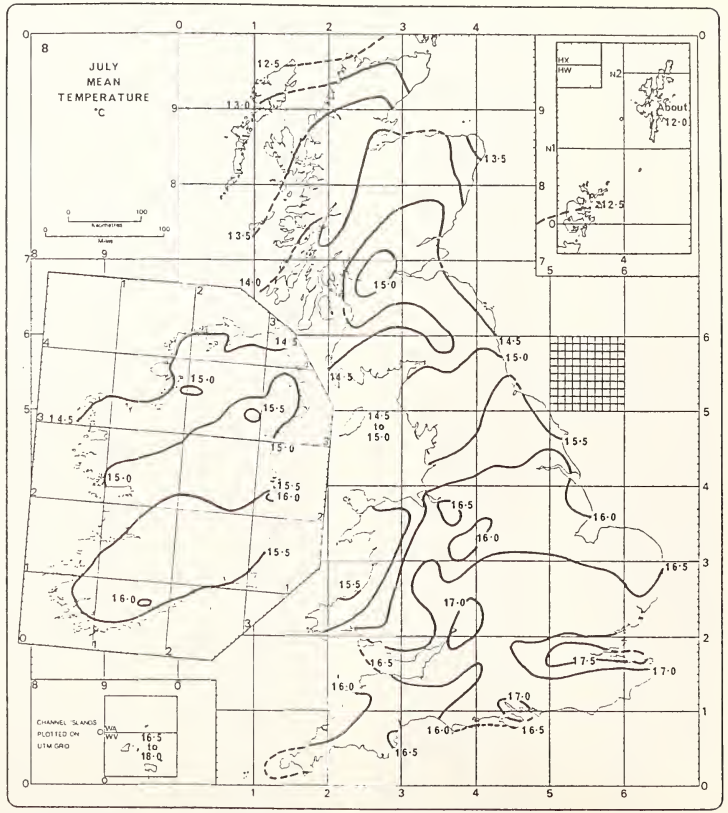


FIGURE 8. July mean temperature. Isotherms show the mean temperatures in °C based on 1941–70 average for Britain and the 1931–60 average for Ireland. From Institute of Terrestrial Ecology (1978).

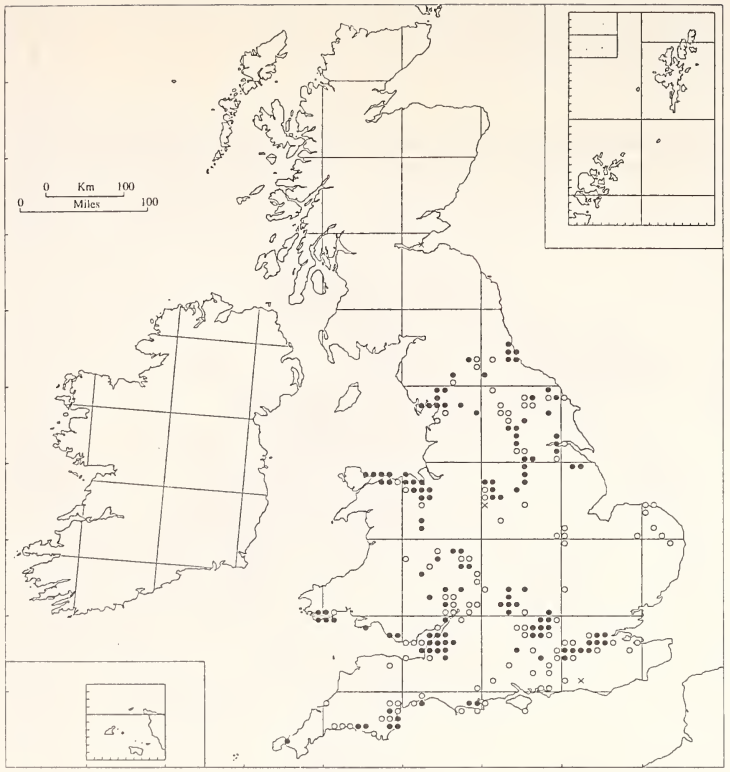


FIGURE 9. The distribution of *Hypericum montanum* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1970 onwards record, ○ = pre-1970 record, × = introduction. Based on Stewart, Pearman & Preston (1994) and prepared by the Biological Records Centre, Institute of Terrestrial Ecology.

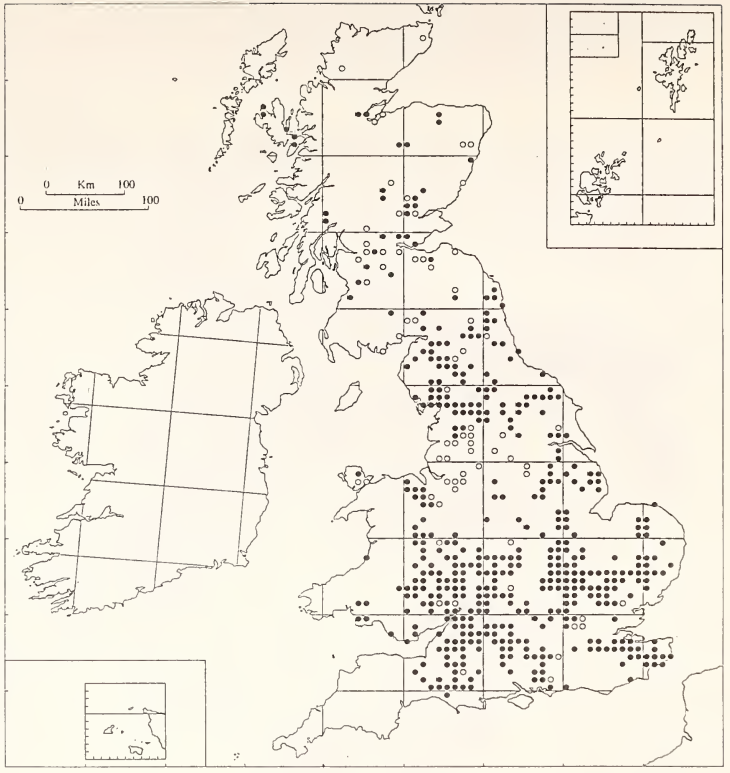


FIGURE 10. The distribution of *Paris quadrifolia* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

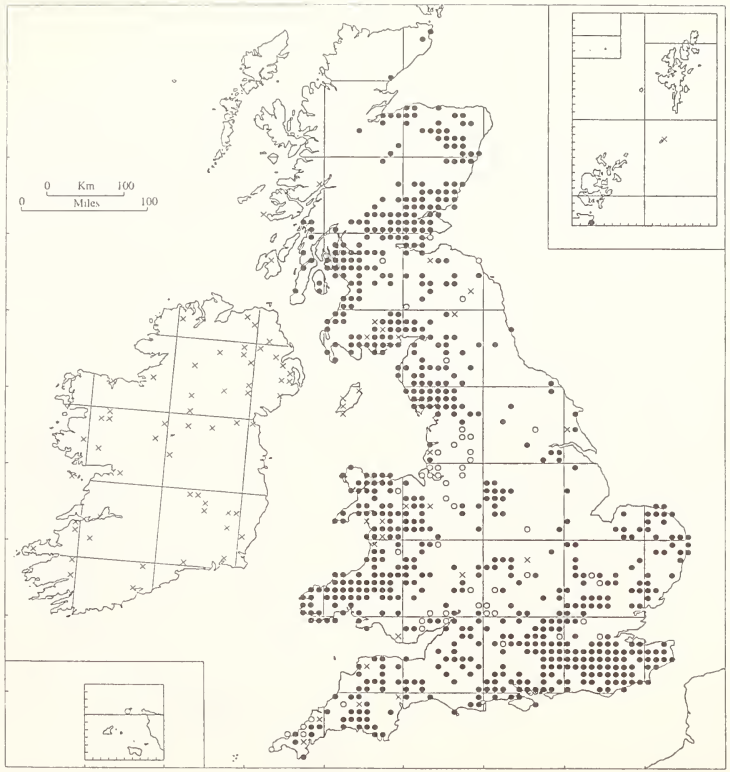


FIGURE 11. The distribution of *Sedum telephium* subsp. *fabaria* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

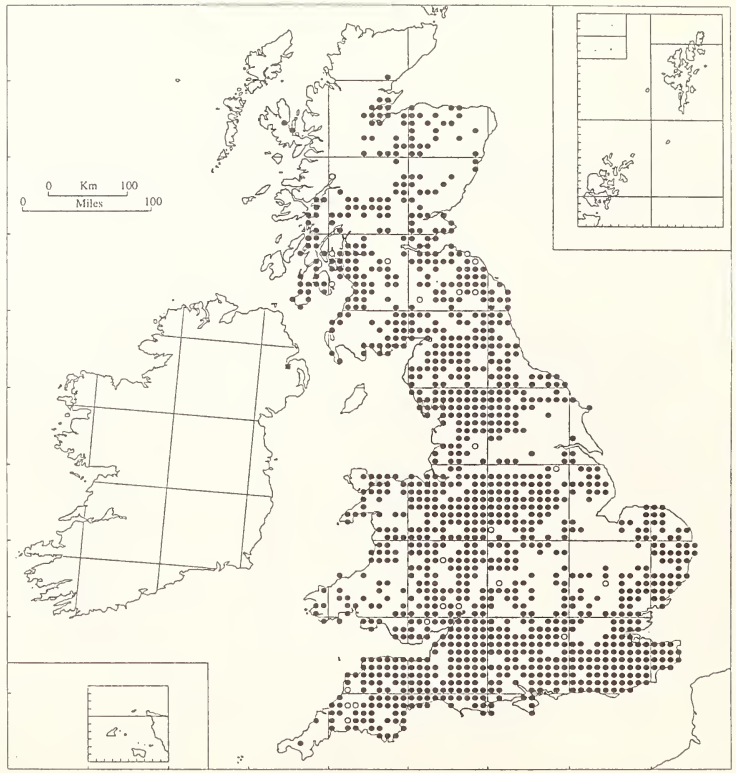


FIGURE 12. The distribution of *Adoxa moschatellina* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

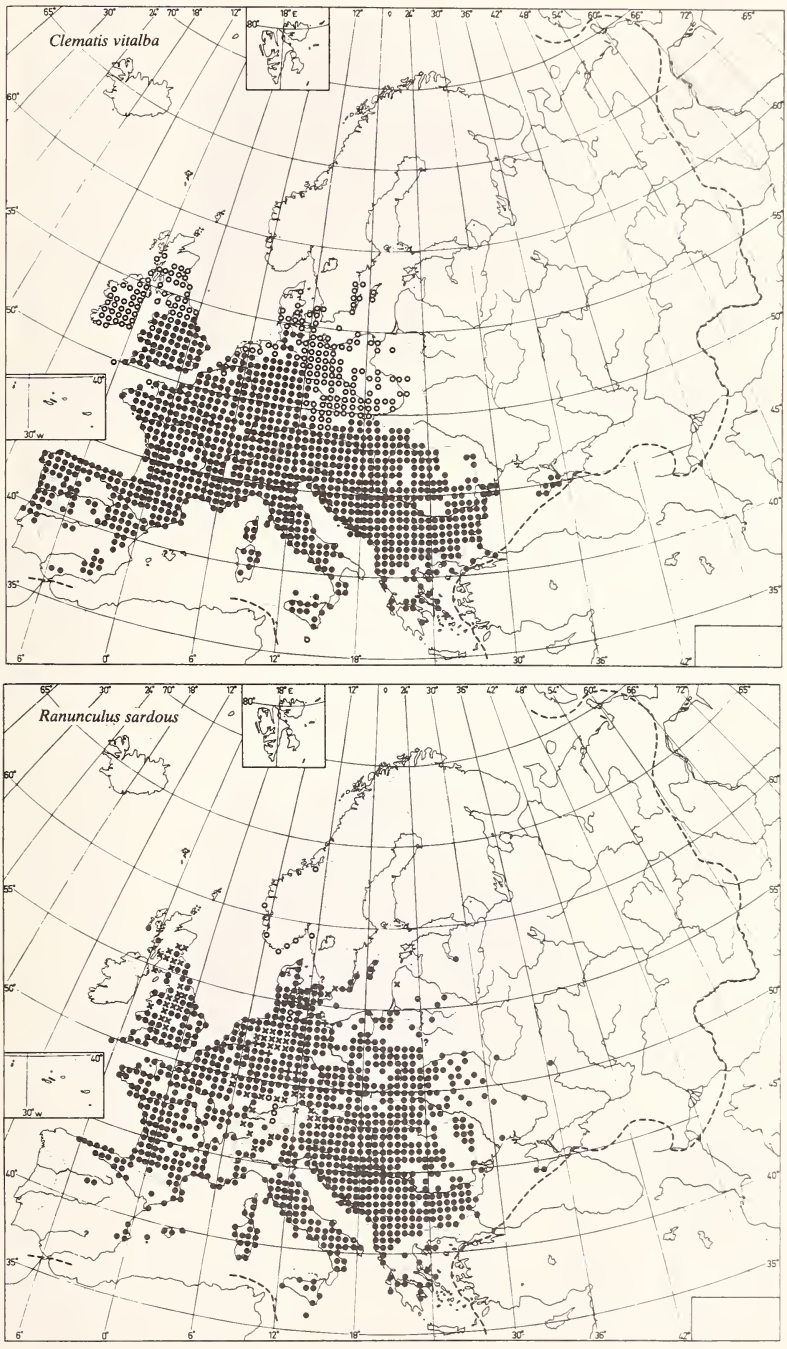


FIGURE 13. European distribution maps. Each dot represents at least one record in a 50-km square of the U.T.M. grid. ● = native occurrence, × = probably extinct or not recorded since 1930, ○ = introduction. Upper map *Clematis vitalba*; lower map *Ranunculus sardous*. From Jalas & Suominen (1989).

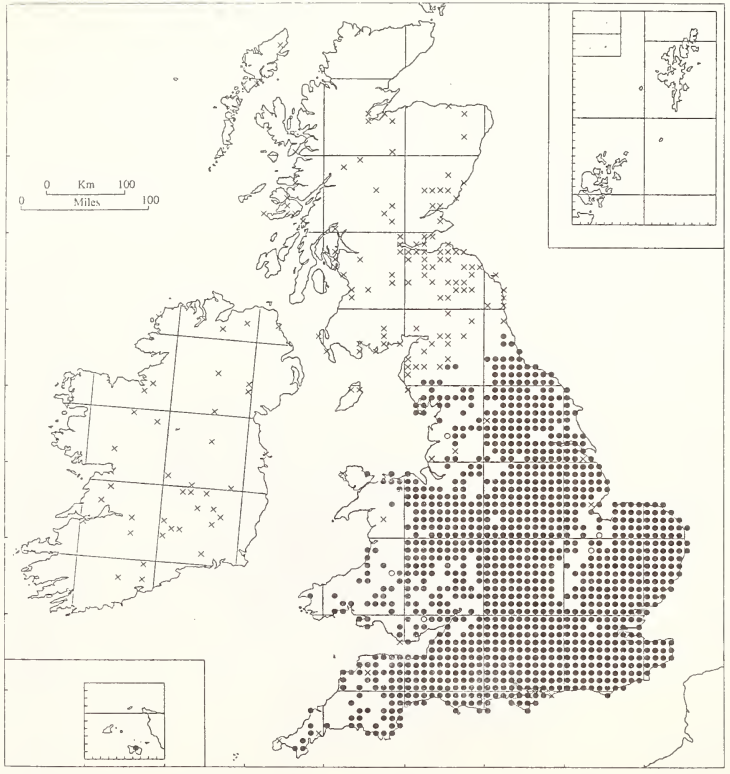


FIGURE 14. The distribution of *Acer campestre* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

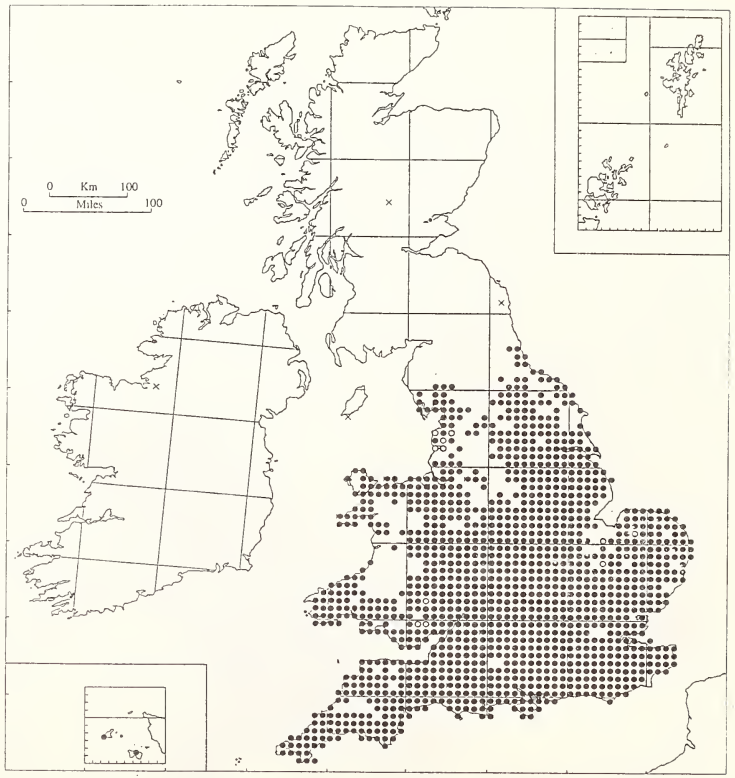


FIGURE 15. The distribution of *Tamus communis* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

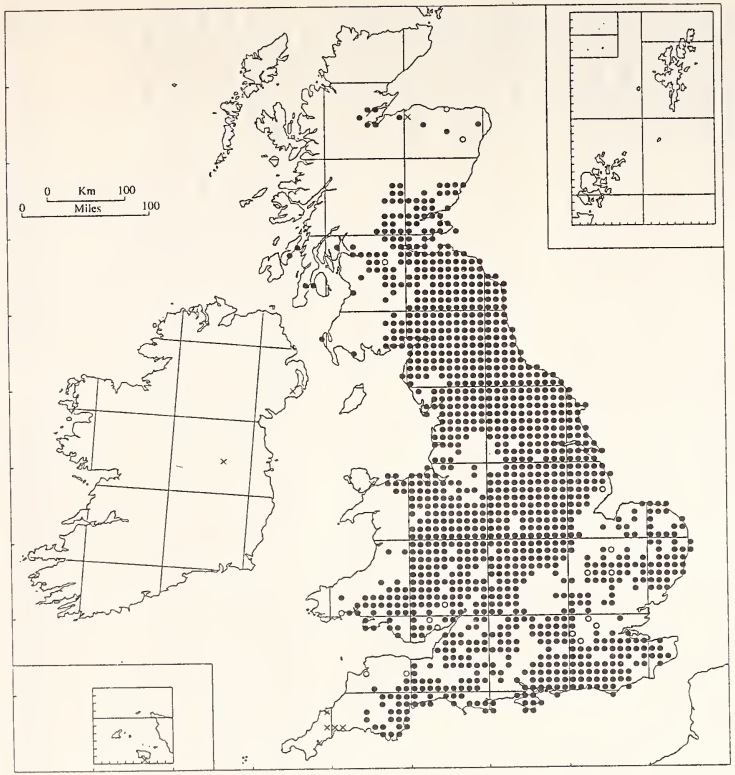


FIGURE 16. The distribution of *Cruciata laevipes* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

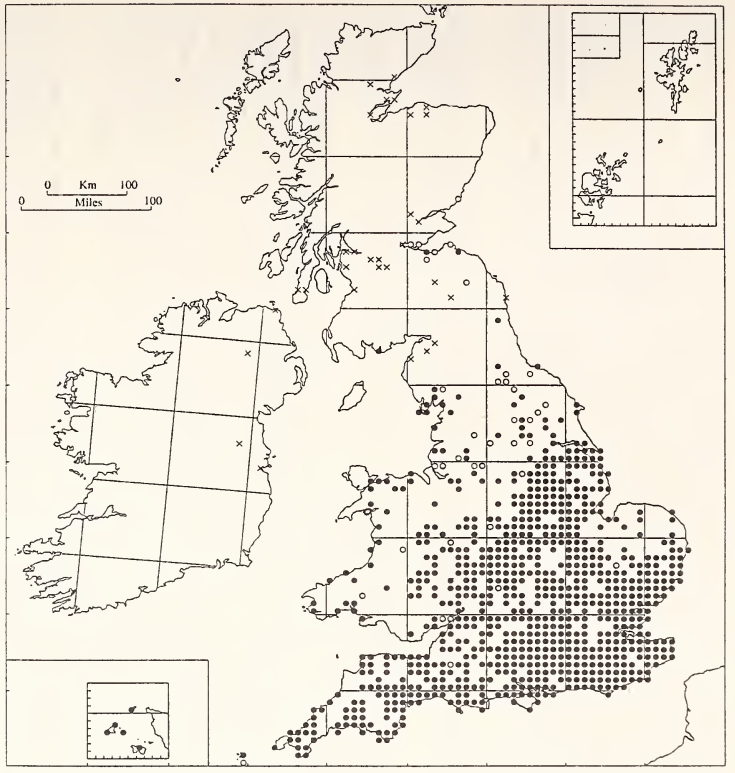


FIGURE 17. The distribution of *Vicia tetrasperma* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

not surprising that, as an established introduction in Ireland, it occurs in north-east Ireland, where it has been known for over 250 years, rather than in the south-east.

The other four woodland species have much more intelligible British distributions. *Tamus communis* (Fig. 15) is perhaps the most outstanding candidate of the species in this group. Not only is it extremely abundant on the west coast of England and Wales but it has recently demonstrated its ability to persist for a decade as an introduction in the west of Ireland, though a similar introduction to the Isle of Man did not persist (Allen 1984). *Vicia tetrasperma* (Fig. 17) has also been reported as an introduction in Ireland though the reports are confused and it is not clear whether it has ever become established there. A record from the Isle of Man in 1967 is also enigmatic: "native or colonist" (Allen 1984).

*Lathyrus sylvestris* is also a strong candidate, being one of only two species, along with *Sedum telephium*, to have been recorded from five of the selected areas as well as from Jura, so close to a sixth, Islay.

*Vicia tetrasperma* is the only one of these five species to have been found in Quaternary deposits, but these were not until the Bronze Age c. 2,500 BP.

It is evident that within this Continental Southern element there is a group of woodland species including small trees, shrubs or lianes, or herbs of shade and woodland margins for which there are either no glacial or post-glacial records or which, as in the cases of *Acer campestre*, *Clematis vitalba* and *Vicia tetrasperma*, are of dates after the land bridge was broken. They are all thermophilous species which arrived in Britain from the south across the land bridge to the Continent which was broken later there (about 7,500 BP) and despite some such as *Acer campestre*, *Clematis vitalba* and *Inula conyzae* having wind dispersed seeds and *Daphne laureola* being distributed by birds, could not reach the west coast in time. However most of them, *Acer campestre*, *Clematis vitalba*, *Cruciata laevipes*, *Daphne laureola*, *Ruscus aculeatus*, *Tamus communis* and possibly *Vicia tetrasperma*, are successfully established in the wild in Ireland today.

Chance no doubt plays a significant part in determining whether or not a species has crossed the gap. A woodland species with similar distribution in Britain (although it only just reached east Anglesey outside the selected area) which did reach Ireland is *Campanula trachelium* (Fig. 18). It is a somewhat more continental species than some of the eight discussed above though similar to *Acer campestre*, *Inula conyzae* and *Lathyrus sylvestris* but it has the same clear horizontal northern limit in Britain and, significantly, occurs in the area of Ireland with the highest summer temperatures.

Two of the remaining three species, *Cyperus longus* and *Ranunculus sardous*, occur in wet habitats near the sea. *C. longus* is at its northern limit in Britain and, though widely established as a deliberate introduction or as an escape from cultivation, there is a suggestion that it does not produce ripe seed in Britain (Stewart *et al.* 1994). It has not escaped from cultivation in Ireland, so the climate may be even less suitable for it there.

*Ranunculus sardous* is present now only in one selected area, St David's (Fig. 19), and often appears to be only a casual at the western fringe of its distribution in Britain (Wade, Kay & Ellis 1994) whilst it has only been recorded once from Ireland, and then as a casual. Though it has a considerable fossil record during the last glacial period and there is a possibility that it was in the British Isles throughout, the long gap between its Late and Middle Weichselian records and its records as a weed from Romano-British occupation sites, suggests that it is likely that this thermophilous Continental Southern species died out and only returned long after the land bridge had gone.

There is no evidence which suggests that *C. longus* or *R. sardous* are species which would have become established in Ireland had there been a bridge in the later stages of the post-glacial period.

The last species of this group, *Hornungia petraea*, has an unusual, mainly western distribution in Britain (Fig. 20). It is a species of dry habitats which thrives best in areas with mild, damp winters (Ratcliffe 1959).This suggests that the climate of south-east Ireland would have been as suitable as west Wales and that a species of sand dunes, like so many other coastal species, would have had no difficulty in spreading, even without a land bridge. *H. petraea* perhaps remains as a candidate, though a doubtful one.

### OCEANIC WEST EUROPEAN AND OCEANIC SOUTHERN ELEMENTS

It is convenient to consider these two biogeographical elements together because species in both

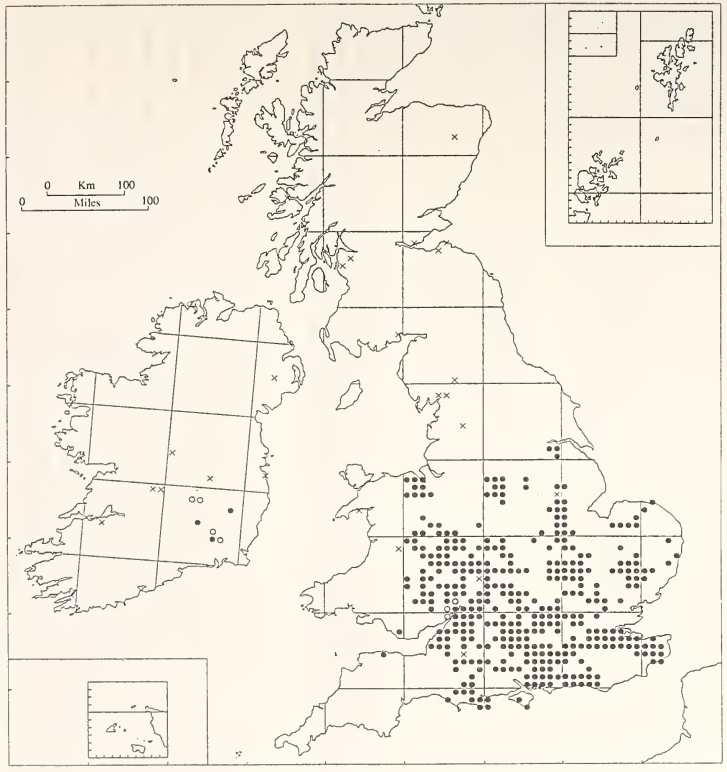


FIGURE 18. The distribution of *Campanula trachelium* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

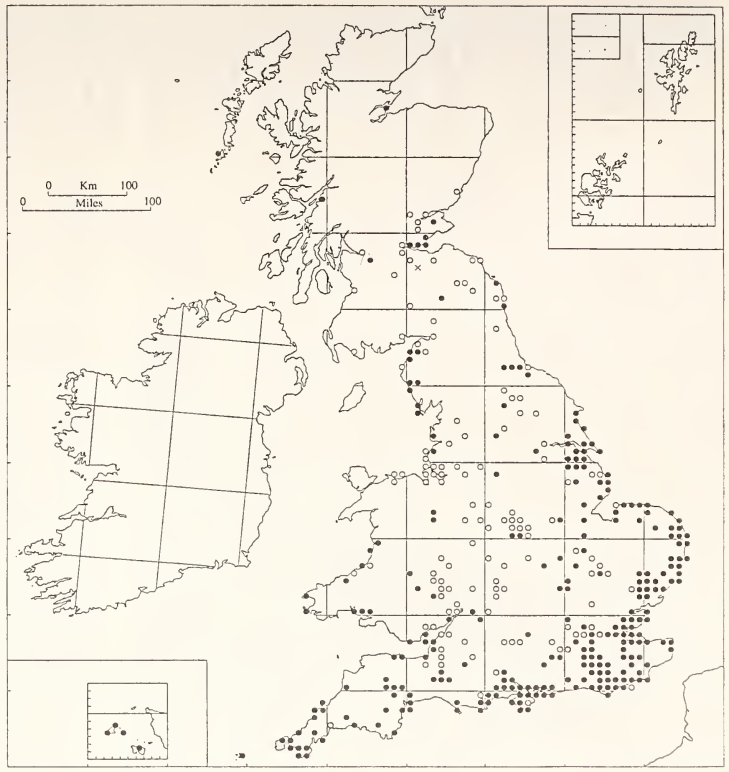


FIGURE 19. The distribution of *Ranunculus sardous* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1930 onwards record, ○ = pre-1930 record, × = introduction. Based on Perring & Walters (1982) and updated by the Biological Records Centre, Institute of Terrestrial Ecology.

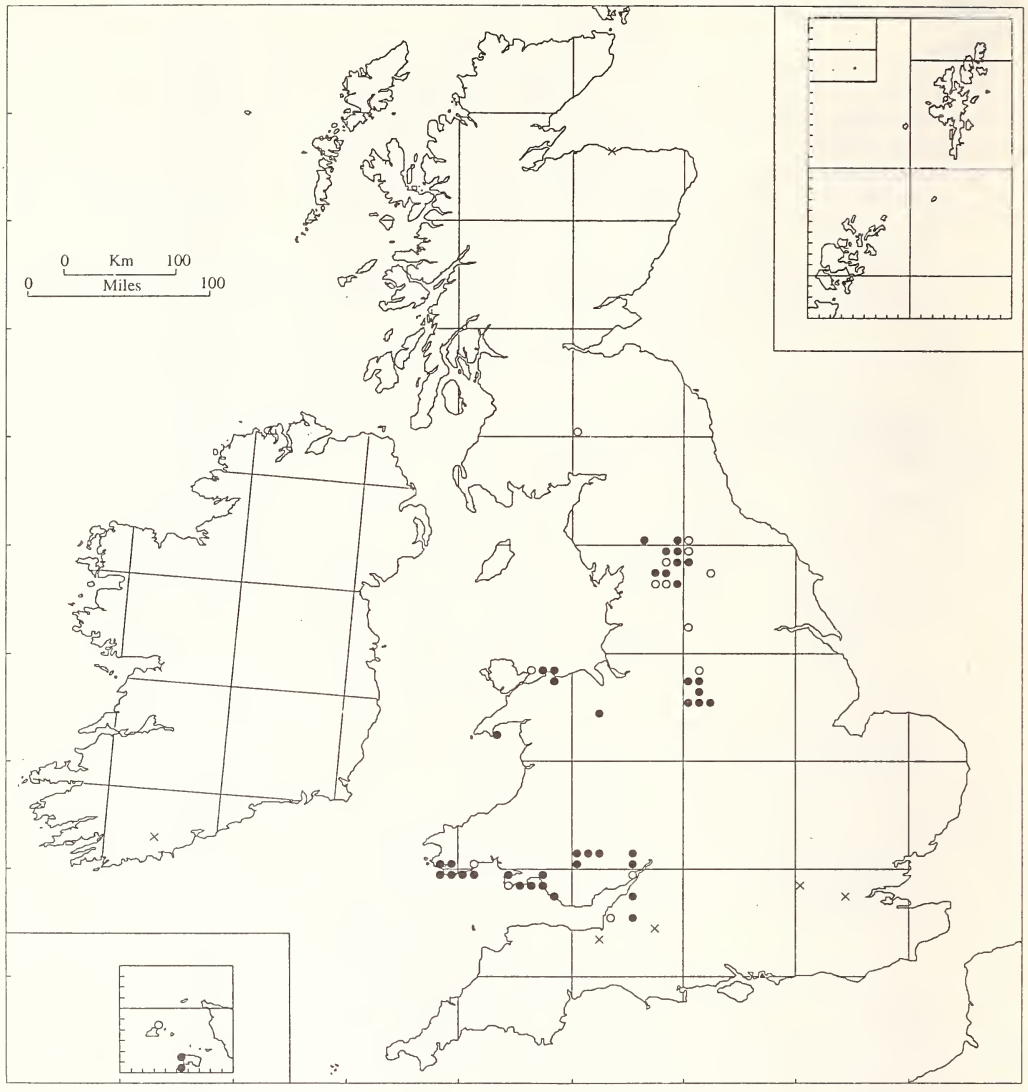


FIGURE 20. The distribution of *Hornungia petraea* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1970 onwards record, ○ = pre-1970 record, × = introduction. Based on Stewart, Pearman & Preston (1994) and prepared by the Biological Records Centre, Institute of Terrestrial Ecology.

have broadly similar distributions in Britain and north-west Europe, which is the main area of interest. They have been allocated as follows:

a. Oceanic West European. *Dactylorhiza praetermissa*, *Genista anglica*, *Hypericum linarifolium*, *H. undulatum*, *Petroselinum segetum*, *Puccinellia rupestris*, *Rubus bertramii*, *R. lindebergii*.
b. Oceanic Southern. *Iris foetidissima*, *Limonium vulgare*, *Mibora minima*, *Moenchia erecta*, *Ononis reclinata*, *Sison amomum*, *Trifolium strictum*.

The difference between these two elements is that whereas Oceanic West European species are restricted to an area from southern Sweden or Denmark through north-west Germany, Holland,

Belgium and western France to Spain and Portugal, Oceanic Southern species 'add on' the Mediterranean and often extend eastwards and southwards to south-west Asia and North Africa. There is also an overlap between the two elements, the decision as to which a particular species belongs to depending on how far they penetrate the Mediterranean. *Moenchia erecta* (Fig. 21, upper map) is a good example. The main part of its range is characteristic of an Oceanic West European species, but the thin scatter of records eastwards to Greece places it into the Oceanic Southern.

Details of the 15 members of these two elements which occur in the selected areas are given in Table 5. Whilst they do form a group of species which are not found in 'Continental' Europe their distribution in Britain does not have the same degree of uniformity of pattern which was discernible with the Continental and the Continental Southern elements where winter and summer temperatures seemed to be the dominant factors. They vary from rare species confined to a few localities in the west, e.g. *Hypericum undulatum* (Fig. 22), to species which are widespread in the south and east with a few relict localities in the west, e.g. *Petroselinum segetum*. Two are littoral species: one, *Limonium vulgare* reaching well into Scotland, the other, *Puccinellia rupestris* almost confined to the southern half of England and Wales. History and habitat appear to have been more important in determining the present distribution in Britain of species in these elements than isotherms. They are therefore considered in the following habitat groupings:

a. Dry, often open, habitats. *Hypericum linarifolium*, *Moenchia erecta*, *Petroselinum segetum*, *Trifolium strictum*.
b. Wetland habitats. *Dactylorhiza praetermissa*, *Genista anglica*, *Hypericum undulatum*.
c. Woodland margins. *Iris foetidissima*, *Rubus bertramii*, *R. lindebergii*, *Sison amomum*.
d. Coastal habitats. *Limonium vulgare*, *Mibora minima*, *Ononis reclinata*, *Puccinellia rupestris*.

a. *Dry habitats.*

*Hypericum linarifolium* is at its northern limit in Europe in Britain. It has a very restricted distribution here and appears to have been lost from three of its four Welsh localities this century. It is a species of steep, open, dry acid rocks and this coupled with its decline, suggests a retreating species, a relict of a warmer period of the post-glacial maximum, which could have been included with the relict species discussed on p. 20 had it not been an Oceanic West European species rather than a 'Continental' one.

*Moenchia erecta* in contrast is widely distributed along the western seaboard of Wales, is frequent in Cornwall and Devon and is probably still under-recorded (Fig. 23). It has a distribution in Britain and Europe (Fig. 21, upper map) which is remarkably similar to that of *Ranunculus parviflorus* (Fig. 21, lower map). The latter, however, is a species which does occur in Ireland – in the south-east which, as we have seen, is where the highest summer temperatures are enjoyed and is just the area in which *M. erecta* might have been expected to have grown had it been able to cross the gap on dry land.

*Petroselinum segetum* has a very long glacial and post-glacial history and was recorded from the Flandrian c. 2,000 BP in Cumbria. So perhaps it was more widespread during the post-glacial climatic optimum about 7,000 BP, when it could have been in Ireland, but has retreated since and is now only a relict in dry, open habitats on the Welsh coast. It has a typical 'Continental' distribution in Britain today.

*Trifolium strictum* is included on the slender basis of one record from Anglesey where it has not been seen for over 150 years. It is another rare, relict, species which, like *Hypericum linarifolium*, is at its northern limit in Britain and hangs on in a small number of dry, short grassland localities.

b. *Wetland habitats.*

*Dactylorhiza praetermissa* has a distribution in Britain which would suggest it ought to occur in south-eastern Ireland. However it appears to have general difficulty in spreading and, despite its abundance in Britain and in the St David's area, it is otherwise very restricted and only occurs in northern France, northern Denmark, Belgium and Holland. Perhaps it is a 'young' taxon with very special mycorrhizal requirements which, like other light-seeded orchids, will become established in Ireland when the conditions are right there; lack of a bridge has not been its problem.

*Genista anglica* was one of the species listed both by Praeger (1934) and by Webb (Meenan & Webb 1957) as being excluded from Ireland because of the absence of land bridges to Britain. It has already been discussed (p. 15) and is clearly a very strong candidate: one of only nine species in three or more selected areas (all three Welsh ones); a species of moist to dry peaty habitats which are

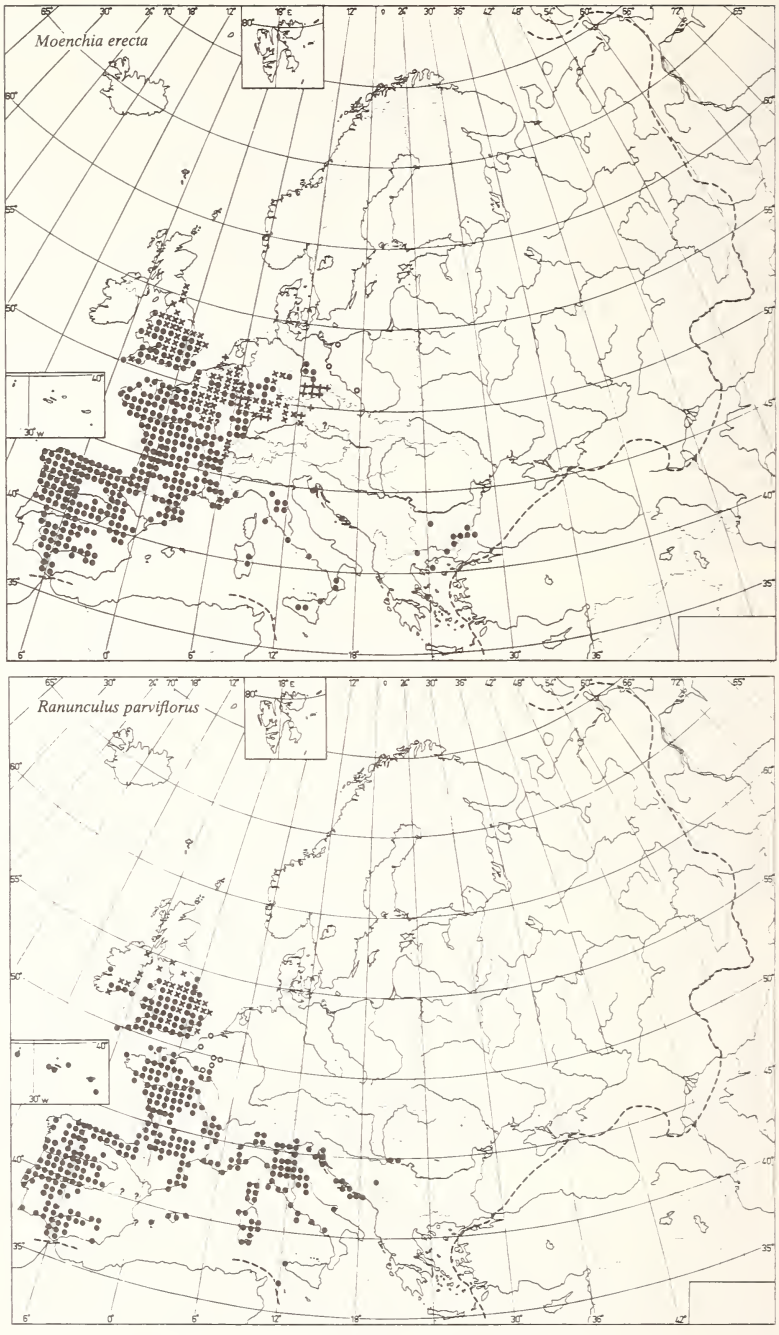


FIGURE 21. European distribution maps. Each dot represents at least one record in a 50-km square of the U.T.M. grid. ● = native occurrence, × = probably extinct or not recorded since 1930, ○ = introduction. Upper map *Moenchia erecta* from Jalas & Suominen (1983); lower map *Ranunculus parviflorus* from Jalas & Suominen (1989).

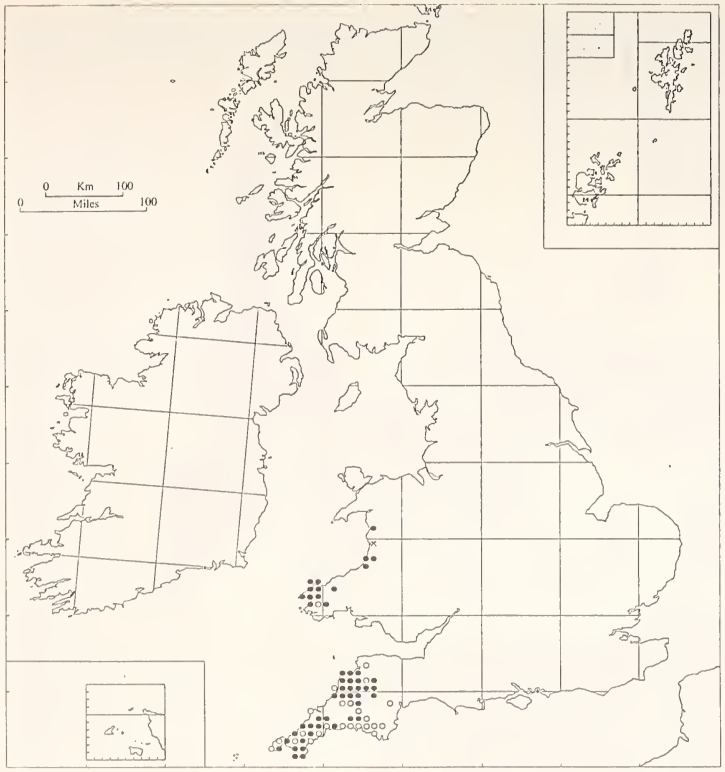


FIGURE 22. The distribution of *Hypericum undulatum* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1970 onwards record, ○ = pre-1970 record, × = introduction. Based on Stewart, Pearman & Preston (1994) and prepared by the Biological Records Centre, Institute of Terrestrial Ecology.

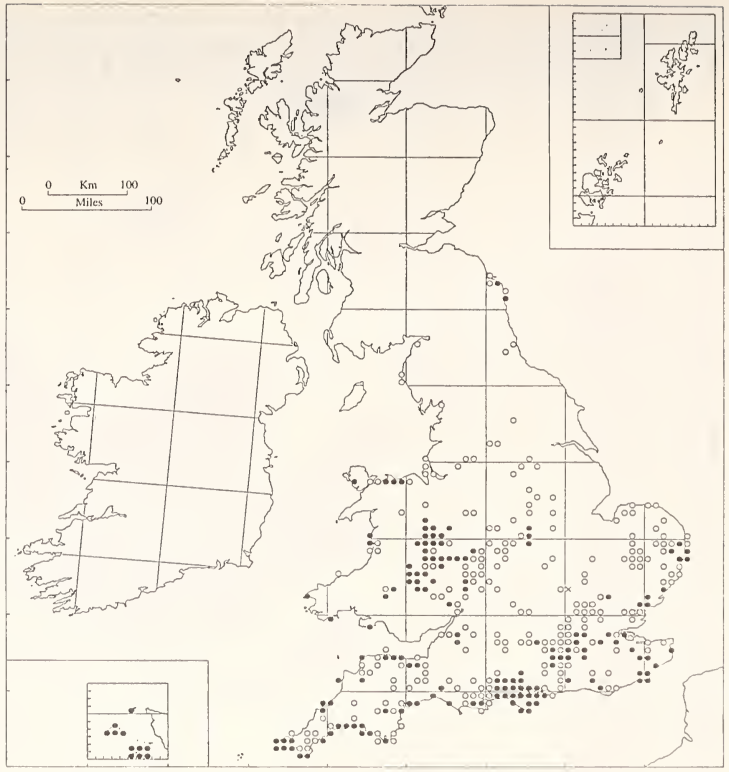


FIGURE 23. The distribution of *Moenchia erecta* in the British Isles. Each dot represents at least one record in a 10-km square of the National Grid. ● = 1970 onwards record, ○ = pre-1970 record, × = introduction. Based on Stewart, Pearman & Preston (1994) and prepared by the Biological Records Centre, Institute of Terrestrial Ecology.

abundant in Ireland and, despite this habitat, where Quaternary remains might have been expected to be preserved if it had been in Britain during that period, there are none.

*Hypericum undulatum* is a species requiring warm summers and a higher water-table throughout the year. Though the summers in south-east Ireland across the sea from St David's, where it is abundant (Fig. 22), are as warm (Fig. 8). The rainfall is lower on this more sheltered side of the Irish Sea (Fig. 24) and it may have been excluded by absence of suitable climate/habitat conditions when this

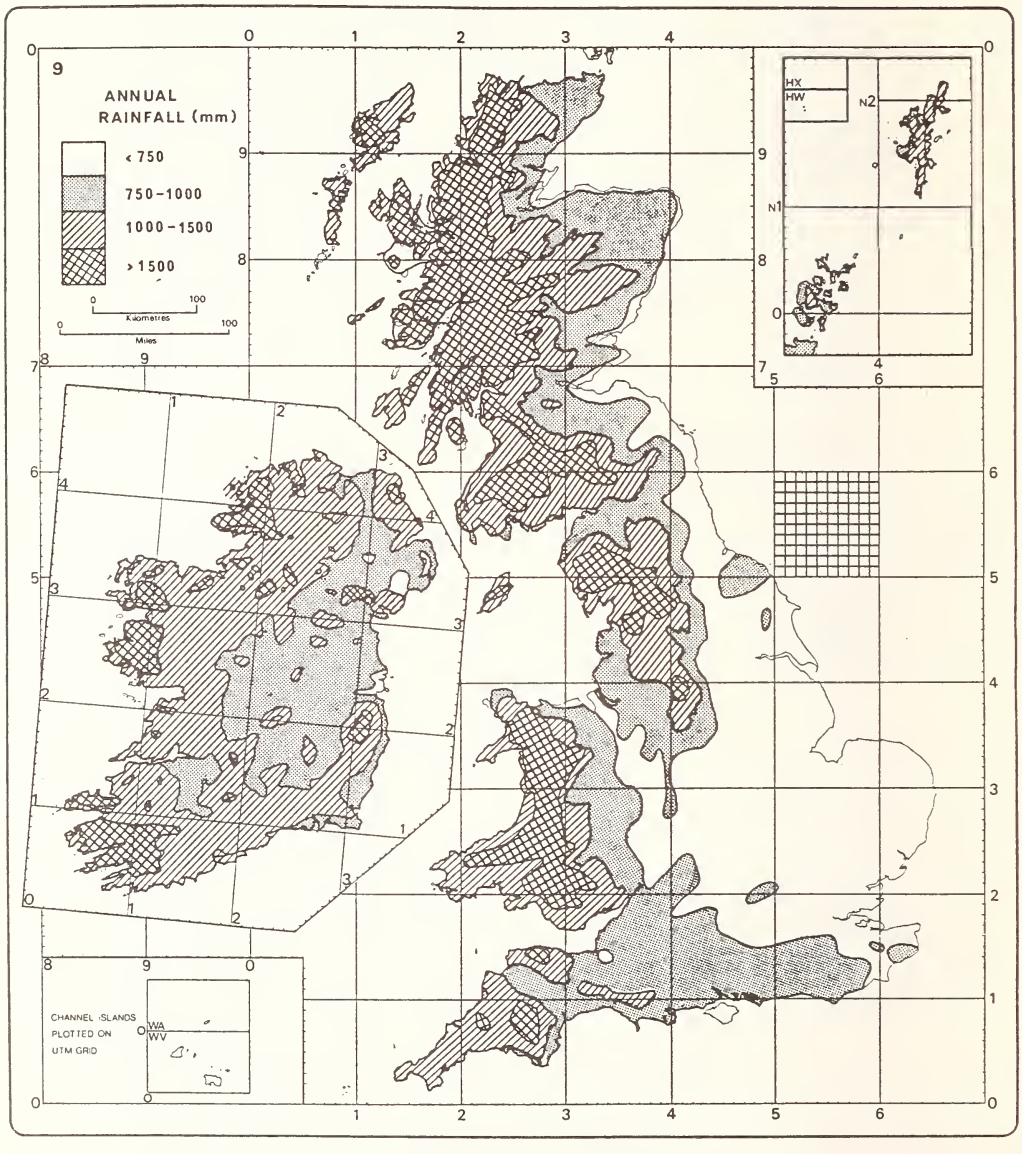


FIGURE 24. Annual rainfall. Isohyets show the rainfall in mm based on the 1941–70 average for Britain and the 1931–60 average for Ireland. From Institute of Terrestrial Ecology (1978).

thermophilous species was spreading during the post-glacial. However it is a possible, though not a very strong, candidate for inclusion in the list.

c. *Woodland margins.*
*Iris foetidissima* is a thermophilous species, well-established as a native on the west coast of Wales and behaving as if it were a native on islands off the Irish coast just across the sea. If it is not native in Ireland it has clearly demonstrated its ability to become established in natural habitats there, and in the Isle of Man, and must consequently be a prime candidate for inclusion. Absence of Quaternary records supports the view that it was a late arrival in Britain.
*Rubus bertramii* and *R. lindebergii* are both woodland margin species with distributions centred on north-west Europe and Britain. They are both conspicuously western in Britain: *R. bertramii* is more southern with the greatest number of records in Wales and the west Midlands but stretching from Devon and Cornwall to Cumbria; *R. lindebergii* is more northern extending from South Wales to Perthshire but with the greatest concentration in northern England. Perhaps significantly there are records for both species from the Isle of Man (though there is some doubt about that for *R. bertramii*). This demonstrates an ability to spread westwards to Man whilst the bridge remained but that the arrival was too late for the next step. They join other woodland margin species as strong candidates for the final list.

d. *Coastal habitats.*
*Limonium vulgare* is a curious absentee from Ireland. The similar *L. humile* does occur there even though it is the less frequent of the two in Europe, not reaching Spain or Portugal, going slightly further north in Scandinavia and getting into Norway. When they grow together in the north-west of Britain *L. humile* seems more successful (Stewart *et al.* 1994) so the absence of *L. vulgare* from Ireland may be due to competition from a closely related species which grows in almost the same habitat. *L. vulgare* has recently been found in two new localities in the Isle of Man after being thought extinct there. Though this may only demonstrate "the usual floristic fluctuation to which tide dispersed communities are subject" (Allen 1984), it could also indicate that this species could cross the Irish Sea without a bridge if the conditions (e.g. lack of competition) were suitable.
*Mibora minima* grows in sand dunes at the north of its range in Anglesey and on the Dutch coast: it appears to be a relict like *Trifolium strictum* discussed above (p. 43). It does however have the ability to spread and has persisted, with assistance, for nearly 200 years in East Lothian, 350 km north of its natural northern limit in Anglesey.
*Ononis reclinata* has an extremely disjunct distribution. It is an annual found throughout the Mediterranean which could have been in the British Isles (including Ireland?) for a very long time, being more widespread when the climate was warmer but now retreating.
*Puccinellia rupestris* also appears to be a species retreating and the St David's records may be relicts of a period in the post-glacial climatic maximum when this southern species (which reaches Syria) was more widespread and may even have been in Ireland. It is self compatible and reproduces by seed which can germinate after many years in the ground (Stewart *et al.* 1994) so it might reappear in some of its former northern localities after a particularly hot summer (1995). It was once found in Northern Ireland and persisted for several years until the site was paved.

On this evidence it is difficult to conclude with confidence that any of these four species would be native in Ireland today if there were a land bridge. *Limonium vulgare* may be kept out by competition whilst the other three are in retreat. Moreover coastal species, especially those of salt marshes and sand dunes are usually mobile with ability to spread across the sea to new areas or return to old ones e.g. *Atriplex pedunculata* to eastern England or *Limonium vulgare* to the Isle of Man cited above.

ENDEMIC ELEMENT

There are only two endemic species which occur in the selected areas but are absent from Ireland: *Coincya monensis* and *Rubus silurum*. Details are given in Table 6. Both are species of western Britain with distributions overlapping in Lancashire.

It is surprising that *Coincya monensis*, which is of recent origin and is a coastal species which has demonstrated its ability to cross water by reaching Arran and the Isle of Man or has spread from an island origin to the mainland, should not have reached the north of Ireland. Perhaps it will, given more time.

*Rubus silurum* is one of only nine species which occur in three or more of the selected areas – St David's, Lleyn and Anglesey. It is another woodland margin species and fits well with those other woodland margin species which have already been accepted as strong candidates such as *Sedum telephium* and *Hieracium vagum*. It may be significant that the closely related endemic, *Rubus robii*, which is widespread in hedgebanks and wood borders on the west side of the Pennines and along the coast of Lancashire and the southern Lake District, does occur, in a single locality, in Armagh in Northern Ireland (Edees & Newton 1988).

### OTHER EXCLUDED SPECIES

As indicated earlier (p. 18) three species included by Praeger (1934) in the list of species which failed to reach Ireland, do not occur in any of the selected areas. However it would be unreasonable not to give them the same analysis as has been afforded to the 58 taxa which do occur in these areas. The details of these three species, *Chrysosplenium alternifolium*, *Convallaria majalis* and *Ononis spinosa* are given in Table 7.

The last named is perhaps the easiest to dismiss. It is predominantly eastern in Britain today with scattered localities in the west, with the suspicion that some at least are errors through confusion with *O. repens* (Margetts & David 1981). As well as being absent from Cornwall and Devon except the extreme east, and most of Wales, it does not occur in Brittany. Moreover there is a pollen record from Cornwall in the early post-glacial c.10,000 BP suggesting that this Continental species was more widespread at that time and could have spread to Ireland over a land bridge and become established there had soil and climate been suitable.

A stronger case might be made for *Chrysosplenium alternifolium* (Fig. 2) and *Convallaria majalis* because of the similarity of their distributions to that of *Helictotrichon pratense* (Fig. 1). However closer analysis discloses that they hardly reach the west coast, and seem to have their western limit to the east of Ireland similar to *Paris quadrifolia* (Fig. 10), already rejected as a candidate, and in no way comparable with another woodland species *Sedum telephium* (Fig. 11), a strong candidate. Both are also distinctly eastern in Europe. *C. alternifolium* is absent from W. France, Spain and Portugal whilst *C. majalis* is absent from Brittany and Portugal.

Of the two only *C. majalis* has been reported as an established introduction in Ireland, though only in one place (H40, Co. Londonderry). Whilst this is in the north, where a Continental species would be most likely to become established, the rarity of such establishment for such an attractive species so commonly grown in gardens suggests it is not well adapted to Irish soils and climate. It may be significant that there are no reports of establishment from the Isle of Man.

The record of *C. alternifolium* from the Hoxnian interglacial is an indication that this species was in Britain and could have crossed the Irish Sea long before the land bridge was broken.

## DISCUSSION

The taxa which have been identified as candidates are listed in Table 8 according to their biogeographical elements and with their habitats.

It is noteworthy that the majority (15 out of 22) are in the Continental or Continental Southern elements which, as a whole, have an eastern tendency in Britain. Equally noteworthy is the absence of any species from any of the Northern elements in our flora i.e. Continental Northern, Oceanic Northern or Northern Montane (sensu Matthews 1955), the first two of which include species which embrace all the selected areas within their overall distribution patterns whilst the third embraces the non-Welsh ones. Matthews pointed out, and this is substantiated by Godwin (1975), that many of these 'northern' species "have been identified from plant material of full-glacial and late-glacial age in Britain and Ireland. It seems probable, therefore, that a large proportion if not all the species having a northern facies, survived the last glaciation . . .". This contrasts vividly with the candidate species in Table 8. 19 out of the 22 have no full-glacial or post-glacial records and two of the other three for which material has been found have their first records in the late post-glacial after any land bridges had been severed: *Acer campestre* in the Neolithic, 4,500 BP, and *Vicia tetrasperma* in the Bronze Age, 2,500 BP. Only the third, *Clematis vitalba*, has a considerable Quaternary history having been reported from one or two warm periods before 70,000 BP but then not again until c.

TABLE 8. CANDIDATE SPECIES (NATIVE BRITISH VASCULAR PLANTS ABSENT FROM IRELAND – SEE TEXT) BY BIOGEOGRAPHICAL ELEMENTS WITH HABITATS

| | |
|---|---|
| Continental | |
| *Campanula latifolia* | woodland |
| *Genista tinctoria* | open scrub and rough grassland |
| *Helictotrichon pratense* | grassland and cliff-tops |
| *Hieracium vagum* | woodland margins |
| *Sedum telephium* subsp. *fabaria* | woodland margins |
| Continental Southern | |
| *Acer campestre* | woodland |
| *Clematis vitalba* | woodland |
| *Cruciata laevipes* | woodland margins and rough grassland |
| *Daphne laureola* | woodland margins |
| *Hornungia petraea*? | sand dunes and rocks |
| *Lathyrus sylvestris* | scrub and cliffs |
| *Ruscus aculeatus* | woodland and cliffs |
| *Tamus communis* | woodland margins |
| *Vicia tetrasperma* | hedgebanks and rough grassland |
| Oceanic West European and Oceanic Southern | |
| *Genista anglica* | heaths and dry mosses |
| *Iris foetidissima* | woodland, scrub and field margins |
| *Moenchia erecta* | dry open grassland and cliff-tops |
| *Rubus bertramii* | damp woods and heath margins |
| *R. lindebergii* | wood and moor margins |
| Endemics | |
| *Coincya monensis* | sand dunes and cliffs |
| *Rubus silurum* | wood margins and moors |

6,300 BP suggesting that it died out after one warm glacial period ended and returned after another had begun, though still too late to cross to Ireland.

Another noteworthy feature of the list is perhaps its small size – far smaller than the 186 suggested by Webb (1983). This small number is however supported by the analysis made by Rose (1972) who examined the floristic connections between south-east England and northern France and found only about twelve native species in the coastal zone of northern France which are absent from the British flora and wrote "that the Channel has not proved an important barrier to plant migration in the post-glacial period. In addition some of the species may well have formerly existed in S.E. England and become extinct before recording began". This view is reflected by Allen (1984) when considering the Manx and Irish floras and the fact that there are only four vascular plants in the former not in the latter (the present analysis has six but he omitted *Limonium vulgare* and the microspecies *Rubus lindebergii*): ". . . it is odd that there are not more higher plants among this non-Irish element. Maybe there were some which died out before modern records began".

Whereas Praeger (1934) believed the reduction of the Irish flora was largely due to its insularity, Webb (Meenan & Webb 1957) agreed that lack of certain habitats and a smaller climatic range in Ireland compared with Great Britain accounted for a large number of species that are absent from Ireland. What this analysis, outlined in Table 8, suggests is that we should not be surprised at the small number or that it is very much smaller than Webb's final figure of 186. It discloses that there is a group of species, mainly of Continental and Continental Southern distribution, which could be in the Irish flora and that 17 out of the 22 are either woody species or are herbs of woodland, woodland margin or hedgebanks. This is part of a group of warmth demanding woodland species which did not begin to arrive in Britain until the climatic amelioration of the Boreal period of the Flandrian post-glacial about 9,000 BP.

The other five species in the group in Table 8 are all species which include cliff-tops or sand dunes amongst their habitats today. They are species of open habitats suited to the sea-cliffs and sandy shores which had no doubt already been formed by the time they arrived at the points where the land bridges had been. Because they do form a distinctive, though smaller group, than the woodland

species it seems to add weight to the case for including *Hornungia petraea*, which appears in Table 8 with a question mark, and leaving the final number of candidate species at 22.

The fact that, whilst the 22 species are mainly woodland, there are five others of more open habitats would support the view of Synge (1985) that the land bridge was broken in the Allerød when both woodland and open habitat species would have been prevented from crossing rather than in the Boreal proposed by Godwin (1975) when only some woodland species might have been prevented from so doing.

This may still be a minimal list: perhaps there are others, which do not occur in the selected areas today, which were in them once and have since retreated or for which no suitable habitat existed (though St David's, Anglesey and Man between them, for example, exhibit a considerable range) but it is unlikely to result in a final list anywhere near as large as the 186 postulated by Webb (1983) and any additions should be looked for amongst thermophilous species of woodland and woodland margins or of dry, open grassland and cliffs.

ACKNOWLEDGMENTS

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# Alien plants at ports and in coastal habitats on the east coast of Ireland

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ABSTRACT

There have been no specific or long term studies of alien plants at Irish ports. In contrast, aliens in other coastal habitats have been better documented. This paper discusses the origins and distribution of the alien plants which have been found at seven ports, with a summary list of 66 aliens found at Dublin Port from 1988 to 1994, and in strictly coastal habitats, along the Irish coastline between Rosslare Harbour in Co. Wexford and Greenore in Co. Louth. Observations are chiefly based on fieldwork since 1988. Earlier records are also included, and reference made to the occurrence of these aliens on the coasts of Cos Down and Antrim further north on the east coast. A distinction is made between established aliens which are likely to spread, and casual species.

KEYWORDS: casuals, naturalization, grain aliens, introduced plants, Dublin Port.

DEDICATION

With affection, I dedicate this paper to the memory of David Webb. Initially, he did not approve of my interest in aliens and thought that I would be better off concerning myself only with the native flora. However, with time, his attitude softened and he would discuss the status of obscure aliens in Ireland. He was a valued botanical influence and friend for over half my life.

## INTRODUCTION

In Ireland, aliens have tended to be under-recorded (Clement & Foster 1994), although the spread of some, for example, *Senecio squalidus* and *Matricaria discoidea*[1], is well documented since their arrival in Ireland last century. Webb (1977) included mainly established aliens in *An Irish Flora*, whereas many casuals and even planted species capable of becoming naturalized are included in the more recent *Flora of the north-east of Ireland* (Hackney 1992). There have been no specific or long term studies of plants at Irish ports, which would be the main points of entry for many aliens apart from cultivated plants. However, there have been occasional observations on weed contaminants in foreign grain which has long been and continues to be imported for milling and brewing. Many aliens were found growing near the Belfast Distillery (Stewart & Praeger 1894–1895), and weed seeds picked out from foreign barley imported for brewing were grown on in Dublin (Brunker 1940). Aliens were found in feeding stuff from Co. Wicklow (Adams 1909b), and more recently, they were also considered to have been introduced with animal feed at Irish ports (Reynolds 1990, 1992). On the whole today, grain is much freer of seed impurities. In the past, the grain was screened and the screenings frequently used to feed poultry, and where the poultry were fed, aliens grew (Praeger 1893b; Knowles 1906; Adams 1909a). Almost certainly, *Matricaria discoidea* was introduced in the late 1800s with damaged American corn fed to poultry; it became widespread in Ireland within a very few years (Colgan 1899; Scully 1912). Commodities such as wool and cotton have never been imported into Ireland as they have been in Britain, and so their accompanying aliens are lacking. In Ireland, some aliens may have come in with timber, and ships' ballast used to be an important method of introduction. It is thought that *Sisyrinchium californicum* may have

[1] Nomenclature follows Stace (1991) unless otherwise stated.

arrived in Co. Wexford from a wreck carrying Indian corn (Druce 1907). Otherwise, in Irish coastal habitats non-native species were mostly deliberately planted and have spread, or have originated as discards from gardens.

This paper discusses the origins and distribution of the alien plants which have been found at ports or in strictly coastal habitats along the Irish coastline over some 300 km between Rosslare Harbour in Co. Wexford and Greenore in Co. Louth (Fig. 1), with some reference to their occurrence on the

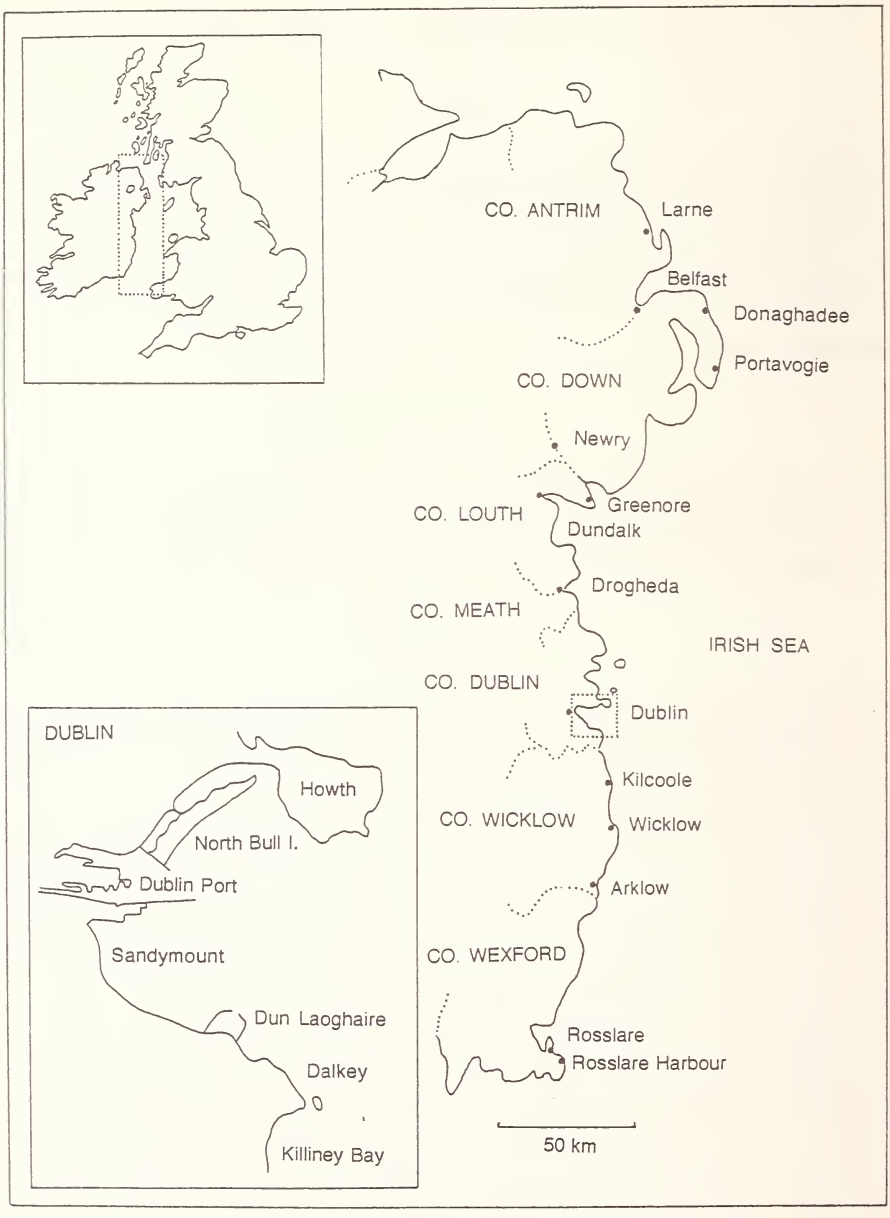


FIGURE 1. Map of the east coast of Ireland, showing the principal locations mentioned in the text, with inset of the Dublin area.

coasts of Cos Down and Antrim further north on the east coast. The proposed check-list for Co. Wexford (FitzGerald 1993) and urban flora of Belfast (Beesley 1995) will undoubtedly add much new information. Alien plants are defined as those listed in the *Census catalogue of the flora of Ireland* (Scannell & Synnott 1987) as "certainly introduced" and established in Ireland, as well as casuals not listed in that work. Observations are based on fieldwork since 1988 for which only selected records have already been published (Reynolds 1990, 1992, 1993, 1994, 1996). Aliens to be discussed fall into two broad categories: plants of ports and plants of coastal habitats. In each, distinctions are made between established aliens which are likely to spread, and casual species. The principal locations mentioned in the text are shown in Fig. 1.

## DUBLIN PORT

Regular fieldwork has been carried out since 1988 at Dublin Port, with the kind permission of the Dublin Port and Docks Board. Apart from Belfast, Dublin is the largest port on the east coast of Ireland with a land area of 263 ha and an annual total throughput of about 8.5 million tonnes (Dublin Port Fact Sheet 1994). Grain and animal feedstuffs, probably the main source of alien plants, make up about 5.3% of imports, and when unloaded are conveyed directly, with little spillage, to stores on Alexandra Quay. Within the port area, aliens were looked for on quays, roadsides and waste ground. Until 1993, the surface of Alexandra Quay was made up of large granite blocks and, although the quays were cleaned regularly, small numbers of alien plants such as *Alopecurus myosuroides*, *Chenopodium glaucum*, *C. murale*, *Erucastrum gallicum*, *Lappula squarrosa*, *Malva pusilla*, *Salsola kali* subsp. *ruthenica*, *Setaria pumila*, *Silene muscipula* and *Vaccaria hispanica* were found in the cracks between the blocks. Common cereals there were unawned and awned *Triticum aestivum*, *Avena sativa* and *Hordeum distichon*, and less commonly *Secale cereale* and *Hordeum vulgare*. *Conyza canadensis* thrived on roadsides in Dublin Port particularly where there was gravel.

In 1993, the quay was resurfaced with an unbroken tarmacadam surface, and new lamp posts were erected. The raised bases around the lamp posts were topped with bricks and, in 1993 and 1994, this became a site for aliens, for example, *Neslia paniculata* and *Apera spica-venti*. For several years, the sweepings from Alexandra Quay were dumped on newly reclaimed land north-east of the car ferry terminal. Many aliens were found here including *Bassia scoparia*, *Brassica fruticulosa*, *Panicum miliaceum*, *Setaria viridis*, *Triticum spelta* L. and *Chamaemelum mixtum* (L.) All, as well as potatoes, tomatoes, beans and peas.

Since there are so few earlier published records of alien plants at Dublin Port, a summary list of 66 such plants found there from 1988 to 1994 is given in Table 1. Some 22 of the plants listed are known grain aliens (Clement & Foster 1994; T. B. Ryves, pers. comm., 1995) and many others are of garden or agricultural origin. One old reference to *Vaccaria hispanica* on newly-made ground at the North Wall at Dublin Port where sand and mud had been dredged from the River Liffey noted that the plants probably originated from seeds which came with a cargo of grain (Gunn 1912).

On less disturbed waste ground within the Port, well established aliens were *Buddleja davidii*, *Centranthus ruber*, *Epilobium ciliatum*, *Hirschfeldia incana*, *Hordeum murinum*, *Matricaria discoidea*, *Melilotus officinalis*, *Senecio squalidus*, *Sisymbrium orientale* and *Rapistrum rugosum* with a relatively limited range of common native plants. It is likely that the crucifers *Rapistrum rugosum* and *Hirschfeldia incana* were introduced through the port with grain. *R. rugosum* was reported from the Dublin area in 1921 (Grierson 1922). It was considered firmly established in Dublin city by the early 1980s (Wyse Jackson & Sheehy Skeffington 1984), and is now found in the suburbs, for example, on dumped soil and on rubbish dumps. However, there are few records of it outside Dublin. Similarly, *H. incana* is largely confined to Dublin and environs, though it was found by the River Boyne at Drogheda Port, Co. Louth in 1986 (D. Synnott, pers. comm., 1995; **DBN**) and more recently at Foynes Port in the west of Ireland (Reynolds 1993). It was recorded in Co. Dublin in 1867 and 1890 (Colgan 1904), again in 1921 (Grierson 1922), and Rich (1988) reviewed its more recent history. At Dublin Port in 1991, it was noticed that its leaves were being eaten by caterpillars of *Pieris brassicae* L., the Large White butterfly.

For several years in the early 1990s, there were thousands of freely seeding *Conyza canadensis* plants at Dublin Port, particularly in one area which has since been developed. This species was first

TABLE 1. ESTABLISHED AND CASUAL ALIEN PLANTS FOUND AT DUBLIN PORT FROM 1988 TO 1994, WITH YEAR(S) WHEN FOUND.

* = listed in Scannell & Synnott (1987) as an established alien in Ireland. Gr = known grain alien (Clement & Foster 1994; T. B. Ryves, pers. comm., 1995, for the grasses). Cult = of garden or agricultural origin.

| | | | |
|---|---|---|---|
| *Alopecurus myosuroides* | 94 | *Lobularia maritima* | 90; Cult |
| *Amaranthus retroflexus* | 88–91; Gr | **Lolium multiflorum* | 93, 94; Cult |
| *Apera spica-venti* | 94; Gr | *Lycopersicon esculentum* | 90–94; Cult |
| *Aster* × *salignus* | 88; Cult | **Malva neglecta* | 88, 90 |
| **Avena fatua* | 88–94 | *Malva pusilla* | 90, Gr |
| *Avena sativa* | 88–94; Cult | **Matricaria discoidea* | 88–94; Gr |
| *Bassia scoparia* | 91; Gr | **Matricaria recutita* | 88, 94 |
| *Brassica fruticulosa* | 90 | **Medicago sativa* subsp. *sativa* | 91; Cult |
| **Brassica oleracea* | 93, 94; Cult | **Melilotus albus* | 91; Cult |
| **Buddleja davidii* | 88–94; Cult | **Melilotus indicus* | 91, 93; Gr |
| *Calendula officinalis* | 90; Cult | **Melilotus officinalis* | 88–94; Cult |
| **Centranthus ruber* | 88–94; Cult | *Neslia paniculata* | 93; Gr |
| **Chaenorhinum minus* | 93 | *Oxalis debilis* | 93; Cult |
| *Chamaemelum mixtum* (L.) All. | 90; Gr | *Panicum miliaceum* | 90; Gr |
| *Chenopodium glaucum* | 89 | **Phalaris canariensis* | 90, 91; Gr |
| **Chenopodium murale* | 90, 91 | *Pisum sativum* | 90, 94; Cult |
| *Conyza canadensis* | 88–94 | *Salsola kali* subsp. *ruthenica* | 89, 94; Gr |
| *Conyza sumatrensis* | 88–94 | *Secale cereale* | 88; Gr |
| **Cymbalaria muralis* | 88–94; Cult | **Senecio squalidus* | 88–94 |
| **Echinochloa crus-galli* | 88, 89, 91 | **Senecio viscosus* | 89–91, 93 |
| **Epilobium ciliatum* | 88–94 | *Setaria pumila* | 90; Gr |
| *Erucastrum gallicum* | 93; Gr | *Setaria viridis* | 88–91; Gr |
| **Erysimum cheiranthoides* | 88 | *Silene muscipula* | 90; Gr |
| **Fallopia japonica* | 93; Cult | **Sisymbrium altissimum* | 90 |
| *Helianthus annuus* | 88, 90–92; Cult | **Sisymbrium orientale* | 88–94; Gr |
| **Hirschfeldia incana* | 88–94; Gr | *Solanum tuberosum* | 90–92; Cult |
| *Hordeum distichon* | 89–91, 93, 94; Cult | **Thlaspi arvense* | 88–94 |
| **Hordeum murinum* | 88–94 | **Trifolium hybridum* | 93; Gr |
| *Hordeum vulgare* | 93; Cult | *Triticum aestivum*, unawned | 88–94; Cult |
| **Impatiens glandulifera* | 90; Cult | *Triticum aestivum*, awned | 89, 94; Cult |
| *Lagurus ovatus* | 93; Gr, Cult | *Triticum spelta* L. | 90 |
| *Lappula squarrosa* | 88; Gr | *Vaccaria hispanica* | 89; Gr |
| *Linum usitatissimum* | 91; Cult | *Vicia faba* | 90; Cult |

Nomenclature follows Stace (1991) with the exception of two taxa not listed in that work.

reported in Ireland inland in Co. Kildare in 1978 (Holland 1979), then in Dublin city in 1984 (Reynolds 1990). In the last few years it has become more widespread in the city, though nowhere in large numbers. With time, it is likely that it will become more or less established as it has already done in London and elsewhere in Britain (Burton 1983; Stace 1991). In Ireland, it has also been found on the east coast at Rosslare Harbour (see below) and in Belfast (Beesley 1995). In contrast, *Conyza sumatrensis*, which was also at Dublin Port for the last seven years, though sparingly, and which needs slightly warmer conditions to thrive (Wurzell 1988), so far has shown little tendency to spread, and has not been found outside the port.

The perennial grass *Ceratochloa carinata* was noticed in rough grass on the south side of the River Liffey across from Dublin Port in 1987 (Reynolds 1988b). That grass verge has since been reseeded, but a few plants grew nearby in stony soil in 1994. It is not clear how *C. carinata* arrived here as it is not an obvious port alien. In Britain it has been widely introduced into agricultural use (Clement 1981).

*Senecio squalidus* is a familiar sight on walls and wasteground in Dublin city. It was first noticed in Ireland in Cork about 1800, but it is not known how it got there. However, its spread in Ireland since then has been well documented (e.g. Kent 1964). It arrived in Dublin about 1890 supposedly with old building and railway material from the Cork railway terminus (Phillips 1900), and was thence introduced south to Newcastle, Co. Wicklow, with large quantities of clinker and rubbish used to

make concrete blocks for coastal defence (Brunker 1950). At Killiney, Co. Dublin, small plants grow among *Leymus arenarius*. It was only recorded in Belfast as recently as 1964, and was possibly a ship-borne import there (Boyd 1965) rather than having spread to Belfast from within Ireland.

## OTHER EAST COAST PORTS

A number of small ports along the east coast of Ireland have been visited in the last six years: Greenore, Dundalk and Drogheda, Co. Louth in 1989, Wicklow in 1989 and 1994, Arklow, Co. Wicklow in 1989, 1990 and 1994, and Rosslare Harbour, Co. Wexford in 1994. No aliens of interest were found at the ports in Co. Louth. At Wicklow Port in 1994, several plants of *Malva nicaeensis* were found, which has only been recorded once before from Ireland with many aliens where hens were fed with grain screenings in Co. Kildare (Knowles 1906). *Amaranthus retroflexus* and *Thlaspi arvense* were found at Arklow Port in 1989 and 1990. *A. retroflexus* was also in small numbers at Dublin Port, where the quays are kept clean and it is difficult for casuals to establish themselves. However, this species was found in large numbers at Foynes Port, Co. Limerick, and on roadsides at many other places in Ireland at that time, associated with animal feed (Reynolds 1992). Where plants were not disturbed, abundant seed was produced in early autumn and dense self-sown patches found the following year, for example, near the docks at Rosbercon, Co. Kilkenny, at Foynes Port and on roadsides near Foynes with self-sown *Setaria viridis*. This has been repeated every year up to 1994, and so it is possible that *A. retroflexus* may become an established alien in Ireland.

The first record for *Epilobium ciliatum*, now widespread in Ireland, was from Arklow in 1958 (Doogue, Kelly & Wyse Jackson 1985). It is possibly originally a timber alien (Clement & Foster 1994), and timber has been imported through Arklow for many years. There are a few records of aliens from Arklow Port, for example, *Conringia orientalis* (for which there are no recent records) and *Lepidium draba* on wasteground at the docks in 1939 (Brunker 1950) and *Phalaris canariensis* on the North Quays (Brunker 1955). *L. draba*, a grain, straw and ballast alien at ports (Adams 1909a; Clement & Foster 1994) was also known on waste ground at Newry docks, on the Co. Armagh side (Praeger 1893a), at Larne Harbour, Co. Antrim (Chase 1927), and more recently at Belfast docks, on the upper seashore south of Donaghadee, Co. Down (**DBN**), and on the north Co. Dublin coast. *Sisymbrium altissimum*, now found occasionally in the Dublin area, was not only reported as a ballast plant at Dublin Harbour (Colgan 1903), but also at Dun Laoghaire as an introduction with fodder for army horses during the week of the Easter week uprising in 1916 (Colgan 1918).

At Rosslare Harbour, Co. Wexford, *Conyza canadensis*, *Senecio viscosus* and *Hordeum distichon* grew sparingly near the port entrance, while on the sandy beach adjacent to the port, thousands of plants of the annual grass *Lagurus ovatus* grew among *Ammophila arenaria*. *L. ovatus* has been known there since the early 1980s (Reynolds 1994), and it is possible that this grass was introduced via car ferries or other shipping which plies between Rosslare Harbour and ports on the northwest coast of France, where it is a native on the dunes. Another alien annual grass found at the top of the beach at Rosslare Harbour is *Anisantha diandra*, again known there for some time (Lady R. FitzGerald, pers. comm., 1993). During fieldwork for the forthcoming *Flora of County Dublin* by members of the Dublin Naturalists' Field Club, it was also found to be locally common in sandhills and arable land in the north of the county.

## ALIEN PLANTS IN COASTAL HABITATS

Away from the ports, one well established alien along the coast is *Hippophae rhamnoides*. Originally planted to stabilize sand, it was already considered thoroughly naturalized on the Wexford coast and becoming so in Dublin over a hundred years ago (Praeger 1901); it remains well established on the north Co. Dublin coast. In Co. Wicklow, *Hippophae* was planted along the railway to stabilize sand dunes (Carvill & Curtis 1973), and in northeast Ireland, it is locally abundant and spreading (Hackney 1992). Despite the availability of suitable substrates, it is absent from Cos Meath and Louth (M. Norton & D. Synnott, pers. comm., 1995). It should be noted that

the native grass *Leymus arenarius* was also planted to prevent coastal erosion, and it was sown by the Railway Company in Co. Dublin north of Bray to protect clay banks from sea action, and the "identical species" was used to protect the coasts of Holland (Meade 1901). It may also have been sown as a binder of shifting sands at some of its stations, for example, on the coasts of Wexford (Colgan 1901), and it was known to have been planted at Kilcoole, Co. Wicklow, in 1939, from where it spread (Carvill & Curtis 1973).

Just as *Hippophae* and *Leymus* were used to bind sand, *Spartina* was used in the reclamation of soft mud. *Spartina* was first planted in Ireland at Little Island, Co. Cork, in 1925. Apart from young plants being useful for grazing, this new grass "could be used to improve the ugly appearance of extensive mud-flats so prevalent in tidal districts" (Glavin 1947). In the 1930s, it was introduced to several places on the east coast. It is well established in the muddy estuaries of north Co. Dublin. *S.* × *townsendii* was considered the widespread taxon in Ireland (Scannell & Synnott 1987) until the recognition of *S. anglica* as a separate species. In the Shannon estuary, where earlier records were of *S.* × *townsendii*, more recently it has all been found to be *S. anglica* (Reynolds 1988a; Brady & Rich 1991). *S. anglica* is also the only species listed for Co. Down, where it is abundant in parts of Strangford Lough (Hackney 1992). It is likely that *S.* × *townsendii* and *S. anglica* were introduced together into Ireland (Boyle 1977). At the UNESCO Biosphere Reserve at North Bull Island on the outskirts of Dublin city, there have been unsuccessful attempts to eradicate *S. anglica* as it was thought to impoverish bird feeding areas (Boyle 1977); it is also known to compete with *Zostera* (Madden, Jennings & Jeffrey 1993).

Quite a few plants of garden origin have established themselves on the east coast either by self-seeding, such as *Hebe* × *franciscana*, or after being discarded, such as *Crocosmia* × *crocosmiiflora*. There are relatively few published Irish records for any *Hebe* species. *H.* × *franciscana* is a common seaside shrub, and earlier records for *H. elliptica* and *H. speciosa* are probably referable to this (Clement 1985). *H.* × *franciscana* is not found in truly wild situations, but in Co. Dublin it is well established on cliffs and slopes of Howth peninsula (D. Nash, pers. comm., 1995), and with *Erysimum cheiri* at Dalkey, and many small plants are self-sown in cracks in the walls along the Sandymount sea-front in Dublin with other *Hebe* species. Hackney (1976) reported that it (as *H. speciosa*, now known to be *H.* × *franciscana* (P. Hackney, pers. comm., 1995)) was naturalized on sand dunes at Portavogie in Co. Down. *Lupinus arboreus* escaped from gardens at Rosslare, Co. Wexford, spreading rapidly in hedges and on banks, and on to sandhills north of Rosslare (Webb 1948, 1977); it is on a roadside at Kilmore Quay. It is also abundant and totally naturalized on the Portavogie dunes for at least 20 years, having come from nearby gardens (Hackney 1992).

Woody-stemmed, perennial *Carpobrotus edulis* occurs at several sites on Howth where it appears to be competing with the native vegetation (D. Nash, pers. comm., 1995) as do 'mesembryanthemums' on the Isles of Scilly (Lousley 1973). At Orlock, Co. Down, *C. edulis* is abundant on rocks by the shore (Hackney 1992), and it has also been known on the coast between Kilcoole and Wicklow town for many years up to the present (Carvill & Curtis 1973; D. Nash, pers. comm., 1995). *Bryonia dioica*, native in Britain but not in Ireland, is naturalized along the west and south coasts of Howth, and is still flourishing at its original site at Earlscliffe. Praeger (1895) reported one large plant on the rocky slope below Earlscliffe "where it has grown for some years", and that it was not in any garden in the area. Colgan (1903) wrote that "if the plant should have been wilfully introduced and spread, it is to be hoped that the offender will make the only amends now possible by publishing a full confession in this journal [*Irish Naturalist*]". No such confession was however made. Various other exotics are now common on the south slopes of Howth, such as *Echium pininana* (Nelson 1994), *Kniphofia* sp. and *Libertia formosa*, and it remains to be seen whether these become more permanent as has *Allium triquetrum* in the same area.

A conspicuous and permanent member of the flora on the drift banks and sea cliffs around Killiney Bay, Co. Dublin, is *Senecio cineraria*. The population there originated from a packet of seed sown at Sorrento Cottage about 1875, and by the turn of the century, it was already established and hybridizing readily with *S. jacobaea* (Colgan 1904). It is otherwise only an occasional garden escape. In contrast, *Artemisia stelleriana* has not persisted. It was naturalized on sandhills on North Bull Island from 1891 to 1924, when the whole dune which formed its headquarters was swept away (Colgan 1904; Brunker 1952). This plant was cultivated at the nearby estate of St Anne's, and probably originated on Bull Island as a garden throwout. It is also known on coastal dunes in Britain (Clement & Foster 1994).

*Rosa rugosa* is not properly naturalized in Ireland. It rarely occurs far from where it was originally planted or thrown out, and mostly spreads by suckering. A colony, initially a garden discard, at Craigavad on Belfast Lough, Co. Down, lasted some years before being finally washed away by a storm (Praeger 1946). The common garden plant *Matthiola incana* is infrequently found as a casual, but for the last ten years it has been known on a clay cliff at Killiney, Co. Dublin. Many plants, presumably garden relics, grow at the top of the cliff and as the cliff erodes, plants fall down and grow temporarily on its face and at the bottom. Other garden escapes and discards have persisted at the top of the shore at Killiney in recent years – *Tristagma uniflorum*, *Oxalis debilis* and *Oenothera glazioviana*; the last has also been found on sandhills in north Co. Dublin (Brady 1974) and in Co. Down (Hackney 1976, 1992). Colgan (1904) considered *Lycopersicon esculentum* a garden outcast, or as originating from tomatoes thrown overboard in refuse from passing ships. It was recorded along the shore at Cardy Rocks on the north Dublin coast for over 40 years (Anonymous 1961). Nowadays, the presence of tomato plants on the coast often indicates that there is a sewage treatment plant in the vicinity. Each summer there are at least a few plants growing on the stony shore just north of the sewage works at Shankill in south Co. Dublin; and in 1983, there were hundreds, some producing ripe fruits.

Finally, rare casuals along the east coast are drift seeds and fruits originating in tropical America. *Entada gigas* and *Mucuna sloanei* have been collected in Co. Louth (Nelson 1978), and *E. gigas* (Hurley 1982) and *Canavalia nitida* (Nelson 1982) in Co. Wexford though these are not known to germinate. Nelson (1978) points out that surface currents seem to deflect from the south and east coasts, and so most tropical drift is deposited on the west and north coasts.

## DISCUSSION

In Ireland, there are approximately 800 alien flowering plant and fern taxa (from information compiled by the author), of which nearly 300 are considered established (Scannell & Synnott 1987). In the British Isles as a whole, excluding grasses, Clement & Foster (1994) have listed over 3500 alien taxa, of which nearly 900 are established. It must be remembered that some species which are native in Britain are not native in Ireland, for example, *Chaenorhinum minus*, *Malva neglecta*, *Hippophae rhamnoides* and *Spartina* spp. (Scannell & Synnott 1987; Stace 1991). If one considers that there are about 1000 native vascular plants in Ireland and about 1500 in Britain, then alien taxa, particularly those already established, are an important component of the flora of the British Isles. Also, aliens which are now only casuals may become more widespread and even have detrimental effects on the native vegetation as has already happened in the case of *Heracleum mantegazzianum*, *Impatiens glandulifera* and *Rhododendron ponticum*. Until about 1950, *R. ponticum* was not considered a 'respectable alien', and so early records for it in Ireland are lacking (Webb & Scannell 1983).

Ellis (1991, 1994) has written about the need for an alien register, especially to monitor those plants which are considered to be spreading aggressively. Nearly 80 years earlier, Nathaniel Colgan, when writing about some alien plants of Co. Dublin, noted that "the discrimination of native from introduced species is one of the most difficult of the problems which confront the compilers of local Floras, and this difficulty is to a great extent insurmountable, since it arises mainly from the defect of early records for alien plants. . . . It is not enough to note the first appearance of immigrant species. Their varying fortunes should be followed up by continuous observation . . ." (Colgan 1918).

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# Over the sea to Skye: Celtic plant-names round the Irish Sea

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ABSTRACT

In this paper the Irish names of a number of coastal plants (*Cochlearia*, *Atriplex*, *Crithmum maritimum*, *Glaucium flavum*, *Armeria maritima*, *Matricaria maritimum*, *Calystegia soldanella*, *Atriplex portulacoides* and *Ammophila arenaria*) are discussed. The close relationship between the Irish and Scottish Gaelic nomenclature is noted as well as several other aspects of Gaelic phytonomy.

KEYWORDS: coastal plants, Irish Gaelic, Scottish Gaelic, etymology, ethnobotany.

## INTRODUCTION

Some years ago I made a study of Gaelic plant-names and Gaelic ethnobotany. The names I collected were from various sources, including dictionaries and published lists, manuscripts in the Department of Folklore in University College, Dublin, and elsewhere. Many names I collected myself from Irish-speakers and from people who used Irish plant-names in their English. A portion of my research on this topic has been published in Irish (Williams 1993).

In this paper I will discuss briefly the names, both Irish and Scottish Gaelic, of a few plants found on the sea-shores of Ireland. Not only are such names interesting in themselves but taken together they give a good idea of the nature of Gaelic plant nomenclature. I shall refer on occasion to the official Irish name. By this I mean the Irish name listed in the most recent *Census catalogue of the flora of Ireland* (Scannell & Synnott 1987).

## SCURVYGRASS

A number of different species of Scurvygrass (*Cochlearia* L.) are found in Ireland but since they are not distinguished in popular speech, I shall take them together. The generic name *Cochlearia* is derived from Latin *cochleare* or *cochlearium* (a spoon) and is a reference to the shape of the leaves. *Cochlearium* is the origin of the French word *cuiller* (a spoon) and is based on the word *cochlea* (a snail or snail-shell). This is a reflection of the way in which shells were in former times used as spoons. The word *cochlea* (snail) itself is borrowed from the Greek *kokhlos* (a snail); Greek *kokhlos* in turn is closely related to the Greek word *kongkhos* (a mussel), which is the origin of the English word *conch*.

*Cochlearia* is full of vitamin C or ascorbic acid. At one time the plant was eaten or made into drinks as a remedy for scurvy. Hence the name Scurvygrass. The taste is not pleasant and when citrus fruits arrived in these islands Scurvygrass was entirely superseded.

In English Scurvygrass is sometimes known as *spoonwort* and *Löffelkraut* (spoon herb) is the German name. Although there are several Irish names for *Cochlearia*, none refers to the shape of the leaves; all allude to the use of the plant as an antiscorbutic. One name is *biolar trá* (cress of the sandy beach). The reference to the beach is self-explanatory. The similarity with cress is two-fold. In the first place *Cochlearia*, like the cresses, is a member of the Brassicaceae (Cruciferae) and is superficially similar to the cresses. In the second place Water-cress *Rorippa nasturtium-aquaticum* (L.) Hayek, like Scurvygrass, was in former times used widely as a remedy against scurvy.

The name *biolar* (cress) is itself not without interest. The related Welsh word is *berwr* with a medial *r*. In Breton, a language which is very close to Welsh, the word for cress is *beler* with a medial

*l*, as in Irish. In Early Irish one finds two forms of the word cress, *bilar* and *birar*. The Proto-Celtic word, from which the Welsh, Breton and Irish forms derive, was probably either **beror-* or **belor-*, and the underlying root was the word **ber-*, **bir-* "water". **Berola*, a variant of **belor-* was apparently attested in the Celtic dialects of Gaul. This word was borrowed into Latin as *berula*. *Berula* is now the generic name of the fresh-water umbellifers, water-parsnips. Although not a crucifer, *Berula* is an edible water plant and it is not difficult to see how it was confused with the water-cresses.

A second Irish name for Scurvygrass is *carrán*, a name which appears to be a diminutive in *-án* on the base *carr* (scab, scurvy). *Carrán*, therefore, would mean "little plant for scurvy", again a reference to the use of *Cochlearia* as an antiscorbutic. *Carrán* in some dialects is pronounced *corrán*, *currán* and has become confused with the name *corrán coirce* (Corn Spurrey, *Spergula arvensis* L.). (For a discussion of the Irish name *corrán coirce* see Williams 1989.)

The third name is usually given in Irish dictionaries as *amaraich* (Dinneen 1927: s.v.) or *amarach* (Ó Dónaill 1977: s.v.). This is a book-name only and I suspect that it has never been in spoken use in Ireland. The proper form is *am maraiche* which is a distinctively Scottish Gaelic name. There are two reasons for thinking the form is Scottish. In the first place Scottish Gaelic, unlike Irish, tolerates palatalised *-ch-* between vowels; in Irish it becomes *-gh-* and then disappears in speech. In the second place the first element *am* is the definite article *an*, which in Scotland, though not in Ireland, is assimilated to a following *m*. *Am maraiche* literally means "the mariner" or "seafarer" and refers either to the fact that Scurvygrass grows on the sea-shore or more probably that mariners used the plant as a remedy against scurvy. Dwelly (1977: 632) gives an illustration of Scurvygrass and calls it *Maraiche* (mariner) (without the definite article).

In this brief discussion of the Irish names of Scurvygrass two things have become clear. Firstly, that Scottish Gaelic names of plants are sometimes found in dictionaries of Irish. This is because the two dialects, though no longer mutually intelligible, are sufficiently close to be recognisable variants of the same original language. Secondly, it is noteworthy that all three names *biolar trá*, *carrán* and *am maraiche* seem to refer to the use of the plant as an antiscorbutic. One of the Manx names for Scurvygrass is *lus ny minniag* or *lus y vinniag* (the scurvy plant). Vernacular names of plants frequently reflect the uses of a plant as food, medicine, poison or magic, rather than any of its intrinsic characteristics.

## ORACHE

There are many species of Orache (*Atriplex* L.) and not all are coastal plants. Some are, however, and I think we can legitimately include the name here. The Latin name *Atriplex* is itself borrowed from Greek *atrophaxis*, *atrophaxys* (orache). The English name *orach(e)* or *arrach* is a Northern French reflex of the Latin name.

There are several names for Orache in Irish. The plant is sometimes known as *praiseach fhiáin* (wild prashagh) or *praiseach iarla* (earl's prashagh). Although the Irish word *praiseach* (prashagh) now refers to Charlock (*Sinapis arvensis* L.), the name derives from the Latin *brassica* (cabbage). The use of *praiseach* to describe *Atriplex* is merely a reflection of the status of *Atriplex* as a pot-herb. Orache is closely related to spinach and tastes very like it. Other Irish names for *Atriplex* are *araitse* (orache), *ceathrú chaorach* (sheep's quarter), *meille* and *eilifleog*. The first of these is a gaelicisation of *orache* and is probably fairly recent in origin. Had *araitse* been in Irish since the Middle Ages, it would almost certainly have become **araiste*. *Ceathrú chaorach* is a loan-translation of the English name Sheep's-quarter. This is probably a reference to the leaves which are often mealy in texture and of whitish tinge. *Meille* is a borrowing from Old English *melde* (orache). This is related to the word *meal* with the sense "flour" and refers to the floury feel of the leaves. Interestingly enough the ordinary German word for orache is *Melde*, which is identical with the Old English. The word *meille* is well established in Irish, since it occurs in the medieval tale of *Buile Shuibhne*. Suibhne, the wild man of the woods, says that his diet includes among other things *siomsán* (wood sorrel), *creamhlus* (wild garlic), *biororáin* (little cresses), *dercain sléibhe* (mountain acorns) and *bun melle* (the stems of orache) (O'Keeffe 1931: 62). There is a place in County Louth near Drogheda that is known as *Mell* (*Meille* in Irish). This is probably the word for Orache.

The third name *eilifleog* is almost certainly derived from Latin *atriplex*. I assume that the oblique

stem *atriplic-* was borrowed into Irish at a very early date and as a result shows what is known as lenition of the medial consonants: *atriplic-* > **athriphlich* > **aithirflich*. Then the consonantal sequence *-th-rfl-* appears to have undergone metathesis and simplification to **airiflich*. This by assimilation of the first *r* > *l* would have given **ailiflich* which developed regularly as **ailifligh*, **eiliflig* in Irish. The unusual final *-ig(h)* was replaced by the common diminutive suffix, *-eog*, and we have the name of the plant as it is actually attested: *eilifleog*.

### ROCK SAMPHIRE

The official name for Rock Samphire (*Crithmum maritimum* L.) is *craobhraic*, which itself appears to be an Ulster form. Other variants include: *créifric*, *creimhric*, *greibhric*; *greimhric* (Mayo); *greidhric* (Kerry), *creidhric* (Kerry and Cork) and the diminutives *creimhricín*, *greimhrigín* (Leinster), *geirgín na trá* (Kerry) and *craidhreacán* (Kerry). Some of these forms have been respelt in standard orthography from Threlkeld (1726), who is an important source for the variants of the Irish name. The basic form seems to be either *greibhric* or *creibhric*. Notice that *greidhric* and *creidhric* with the diphthong [ei] are Munster forms. This is only to be expected since slender *bh* (pronounced [v] elsewhere) disappears internally in Munster and leaves a long vowel or a diphthong behind.

It is impossible not to connect *greibhric*/*creibhric* with Old Irish *crebar*, a word that variously means "gadfly", "leech", "woodcock" and even "a small stack of hay" (Vendryes *et al.*: 224–225). I suggest that *creibhric* is in origin the word *crebar* + the diminutive suffix *-ac*, Modern Irish *-ag*, seen in Old Irish *daeteac* (daddy) and with further suffixation in *Isucán* (little Jesus), *Flannacán* (little Flann), etc. Old Irish **crebrac* would then mean "little creature with the sharp mouth, little leech", a reference to the way samphire grows tightly in the crevices of rocks. There are some difficulties with this etymology, however. Why, for example, is the medial consonant cluster of *creibhric* slender and not broad? Old Irish **crebrac* would give Modern Irish **creabhrag*, an unattested form. It is apparent that the Ulster form of the word has been influenced by the word *craobh* (branch). It seems not unlikely that original **creabhrag* has become *creibhrig*, **creibhric* under the influence of the word *creimim* (I gnaw). The initial *gr* for *cr* in the variant *greibhric* may also have been influenced by other plant-names: *greabhán* (dropwort) and *grafán* (horehound) for example or the word *greim* (grip, bite).

A further name for Rock Samphire is attested in Connaught, *greilig*, *greileog* and *griolóigín*. *Greilig* I take to be a variant of *greibhrig* in which the consonantal sequence *gr-bhr-g* has been simplified and dissimilated to *gr-l-g*. *Greileog* is the same form with the common diminutive suffix *-eog* replacing *-ig*. *Griológín* is a further diminutive of *greileog*.

Sea Rocket (*Cakile maritima* Scop.) is known as *cearbhacán mara* (*cearbhacán* of the sea). *Cearbhacán*, *cearbhachán* by itself is well attested in Irish literature where it means "rocket", "colewort", "carrot". *Craidhreacán* (rock samphire), a variant of *craobhraic* attested from Kerry, looks similar to *cearrbhacán*, but the two words must be unrelated. *Craidhreacán* is merely a further diminutive of *creidhric*. *Cearrbhacán* is a compound of *cerr-* (bent) and *baccán* (hook, distaff) and refers to the shape of the plant.

### YELLOW HORNED-POPPY

The Yellow Horned-poppy (*Glaucium flavum* Crantz) is known in Irish as *caillichín na trá* (little old woman of the strand). This name, which appears to be an authentic vernacular one rather than a learned invention, is based on the name *cailleach dhearg* (red old woman), the most frequent name for the Common Poppy (*Papaver rhoeas* L.). It would seem that *cailleach* (old woman) in *cailleach dhearg* was understood to mean "poppy" and the smaller coastal plant was called the "small old woman", that is, "poppy of the strand".

*Cailleach* nowadays means "old woman", "witch", but the original sense was "nun". *Cailleach* is a feminine noun in *-e(a)ch* derived from the word *caille* (nun's veil). This latter was borrowed from Latin *pallium* (mantle, veil) at a time when the Irish had not learned how to pronounce *p* and said *k(w)* instead. Why should the red poppy be called the red nun / old woman in the first place? The

answer is simple: it wasn't. The Common Poppy is also known in English as the Corn-poppy and eve. the Corn-rose, because it so commonly grew in cornfields. When wheat was harvested, threshed and winnowed, the red petals of the Common Poppy must have been a substantial element in the chaff. One Irish word for chaff is *cáithleach*, a masculine collective noun in *-leach* on the base *cáith* (chaff, husks). The original name for the Common Poppy was *cáithleach dearg* (red chaff), and this was the name of the plant in counties Wicklow and Kilkenny. Since, however, the word *cáithleach* (chaff) was less common than *cailleach* (old woman), it was not long until *cáithleach dearg* was replaced in some places by *cailleach dhearg*. When the red poppy had become "the red old woman", it was inevitable that the smaller yellow poppy of the sea-shore should become the "little old woman of the strand", *caillichín na trá*.

Moloney (1919: 12) claims that *cailicín* (i.e. *caillichín*) is an Irish name for *Papaver rhoeas* itself. Moloney's work is very unreliable, however.

## THRIFT

Thrift (*Armeria maritima* (Miller) Willd.) has no uses at all but it is such a distinctive plant that it has a number of vernacular names in Irish. The Latin name *Armeria* is interesting in itself, since it properly refers to a kind of *Dianthus* and has been applied to the unrelated plant by extension. The only connection between Thrift and *Dianthus* is, I suppose, the colour of the flowers, that in either case can range from white to scarlet. The English name Thrift suggests parsimony and it used to figure on the old British threepenny-bit. In fact the word *thrift* is related to the verb *thrive* and in the case of the *A. maritima* refers to the success that the plant has in growing profusely in the most unpromising surroundings.

Irish has three names for Thrift: *nóinín an chladaigh*, *tonn/tonóg an chladaigh* and *rabhán*. The first of these is the easiest to understand. *Nóinín an chladaigh* means literally "daisy of the stony beach". *Nóinín* (daisy) more usually refers to *Bellis perennis* L. (and *Leucanthemum*). The word is a diminutive in *-in* of the word *nóin*, genitive *nóna*. This is a Latin borrowing in Irish and originally referred to the monastic office or service of nones, said at the ninth hour or 3 o'clock in the afternoon. As a result *tráthnóna* (time of nones) in Irish means "afternoon", "evening". Later nones were moved forward in the day. This is reflected in the English word *noon* which refers to mid-day. *Nóinín* (daisy) then means "little plant of the afternoon" because *Bellis perennis* and other composites resemble the sun and like the sun go in (close) late in the day. With the name *nóinín* compare the English *daisy* < Old English *dæges eage* (eye of the day). The second element in *nóinín an chladaigh* is the genitive of the Irish word *cladach* (shore, beach, stony beach). It is not difficult to see why Thrift in Irish is called the daisy of the shore. Like the Daisy, Thrift is a small but distinctive flower and both *Armeria maritima* and *Bellis perennis* are tinged pink.

The name *tonn/tonóg an chladaigh* is more of a problem. The element *an chladaigh* (of the beach) is of course identical with the second part of *nóinín an chladaigh*. *Tonn* means "wave of the sea", "surface", "skin", "profusion". *Tonóg* is almost certainly for **tonnóg* (a little wave, etc.). In the present case *tonn/tonnóg* either refers to the profusion with which Thrift grows or it may have to do with the way in which the plant undulates with the sea-breeze. I have no certain example of *tonn/tonóg an chladaigh* recorded from speech rather than from dictionaries and it is therefore possible, though unlikely, that *tonn an chladaigh* is merely a corruption of *nóinín an chladaigh*.

The third name, *rabhán*, is the most interesting. It is attested from West Kerry in two different forms: firstly as the simplex *rabhán* and secondly with the addition of the word *nóiníní* (daisies) in the forms the *neoiníní an rabháin*, *nóiníní an ruáin* (daisies of the *rabhán/ruán*). We can be fairly sure that *ruán* is the Modern Irish development of Early Irish *ruadán*. The word *ruadán* is a noun in *-án* on the root *ruad* (red). It is attested in literature (see Royal Irish Academy 1983: s.v. *rúadán*), where it means "something red" and is frequently applied to Buckwheat (*Fagopyrum esculentum* Moench). *Rabhán* is also sometimes spelt *ramhán* for the pronunciation would be the same. Both are phonetic developments in the Munster dialect of the basic form *ruán*. Between the first unstressed syllable and the second stressed syllable a glide consonant has developed: [ruˈaːn > ruˈwaːn > rəˈvaːn]. Compare the Munster form *Siobhán*, which has developed regularly from Middle English *Joanne*. One might notice incidentally that the official Irish name for Shinrone,

County Offaly, is *Suí an Róin* (the seal's seat). Since seals are unknown in the Irish midlands, it seems possible at least that the second element of *Suí an Róin* is not *rón* (seal) but *ruán* (buckwheat).

*Rabhán*, *ramhán* < *ruán*, then, means "little red flower". It is clear why this name was applied to Thrift. Thrift is usually pink and sometimes red. In English it is known as Sea-pink and the Latin name *Armeria* itself properly refers to the *Dianthus*. Interestingly one of the Manx names for Thrift is *kione jiarg* (the redhead).

### SEA MAYWEED

The various white composites are not very well distinguished in the popular mind and as a result the name for one is not infrequently used for others. The commonest Irish names for the mayweeds (*Matricaria* L.) are *lus Bhealtaine*, *camán meall* and *meá drua*.

*Lus Bhealtaine* means "plant of Bealtaine (May)" and is quite obviously a translation of the English name. The second, *camán meall*, is also used for various kinds of chamomile. *Camán meall* literally means "the bent thing/hurling stick of lumps". This does not seem to make much sense. Sometimes the name appears as *camán meala* (the hurley stick of honey), which is equally meaningless. If, however, one says *camán meall*, *camán meala* to oneself, one realises that they are attempts to reproduce in Irish *chamaemelon*, *chamomilla*, *chamomile*. *Chamaemelum* itself is Greek, a compound of *khamai* (on the ground) and *melon* (apple) and refers to the fact that some varieties of chamomile have the fragrance of apples. In the same way the introduced species *Matricaria discoidea* DC. is called Pineapple-weed in English because it has the fragrance of pineapples.

The habit of attempting to gaelicise the sound of the Latin name of a plant was not uncommon. Mallow is known as *lus na meall Mhuire* (the herb of the Blessed Virgin's lumps). This again does not seem to mean very much, but the name sounds rather as though it were **lus na Malva* (the herb of *Malva*, mallow) and I have no doubt that this is the origin of the Irish name. Similarly Field Scabious (*Knautia arvensis* (L.) Coulter) is known in Irish as *cab an ghasáin*, *cab an deasán* or *gob an ghiusáin*. The basic form, *cab an gheasáin* (mouth of the sprig), seems to be an attempt at representing *Scabiosa* in Irish.

Before I discuss the third name for *Matricaria*, *meá drua*, something should be said about the name *Matricaria* itself. It derives from the Latin *matrix*, *matricis* (womb), which is itself based on the word *mater* (mother). Seventeenth and eighteenth century botanists call the uterus the *mother* and in German the womb is the *Mutterleib* or mother-organ. *Matricaria* is so called because plants of the genus were used for a number of gynaecological conditions. So for that matter was the genus *Artemisia*, which was named for the virgin goddess, Artemis, patron of women.

*Meá drua* was in earlier Irish *meadh druach*. On the face of it this name means "druids' mead" and seems curiously inept. *Matricaria* has never, as far as I am aware, been used in the preparation of any alcoholic drink for druids or for anybody else. Again I think we are dealing with a phonetic approximation. *Meá druach* is a rather rough approximation to the first two syllables of *Matricaria* and that, I believe, is the origin of the name.

### SEA BINDWEED AND SEA PURSLANE

We have already seen that some Irish plant names are borrowed from Scottish Gaelic. The practice of plundering the Scottish lexicon has continued until the present, and indeed when the Irish names were determined for the *Census catalogue* a number of Scottish Gaelic names were included. The names of two coastal plants are of interest here.

There was no Irish name available for Sea Bindweed (*Calystegia soldanella* (L.) R. Br.), so the Scottish name *flùr an phrionnsa* (the prince's flower) was borrowed and respelt as Irish *plúr an phrionsa*. Dwelly (1977: 442–443) to whom we owe the name *flùr an phrionnsa* says the plant was first planted in Eriskay by Prince Charles Edward Stuart, when he landed there.

It is true that Charles Edward Stuart did land in Eriskay in 1745, but he had more urgent matters on his mind than planting wild flowers on Hebridean beaches. I am therefore sceptical about the alleged origin of the Gaelic name for *C. soldanella*. I suspect that the name has a more mundane

origin. Since the flower grew widely where the Young Pretender landed and since its pinkish-white flower resembled the white cockade of the Jacobites, the Sea Bindweed was called the Prince's flower. I am quite sure that Charles Edward, while he was in Eriskay, neither noticed the plant nor had any interest in it. All the same, the story has given us a good Gaelic name for which we should be grateful.

My second example of a Scottish name aspiring to be Irish in the *Census catalogue* is the name for Sea-purslane (*Atriplex portulacoides* L.). The *Catalogue* calls this *lus an ghaill*, which is an Irish respelling of the Scottish Gaelic *lus a' ghoill* (the foreigner's plant). We owe this name to Father Allen Macdonald (1859–1905), parish priest of Eriskay, who says: "This name I heard in Mingulay, where the purslane grew on the strand. It is said that a stranger strewed the seed on the sand (possibly with the intention of binding the loose sand)" (Campbell 1958: 170).

The second element in *lus a' ghoill* is *gall*, a word of long pedigree in the Gaelic languages. Originally it meant "person from Gaul", the Roman provinces that are now France and Northern Italy. Then it came to mean "foreigner" in general and "Viking", "Norseman" in particular. Later still the word *gall* was applied in Ireland to the English and in Scotland to the English-speaking Lowlanders.

In the Gaelic world the Norsemen and the English/Lowlanders are usually thought of collectively. The word *gall* is more often than not in the plural, for example, in *Dún na nGall* (the fort of the foreigners), Donegal, and *Inse Ghall* (the islands of the foreigners), the Hebrides. I am very suspicious indeed of the singular of *gall* in *lus a' ghoill*. If Macdonald's explanation is correct then we have to assume that *lus a' ghoill* is named after a solitary foreigner. If the term is medieval, he was a Viking; if the name is more recent, he was a Lowlander. He lived in Mingulay and for some reason grew, or at least encouraged, Sea-purslane on his land.

I cannot believe this explanation. Sea-purslane is a "much-branched undershrub" (Webb 1977: 152) and I suspect that it is in the branched nature of the plant that have to seek the etymology of the name *lus a' ghoill*. The Scottish Gaelic word for bifurcation is *gobhal* (*gabhal* in Irish) and I suggest that quite possibly the original name for Sea-purslane in the Hebrides was **lus a' ghobhail* (the bifurcation plant, the branching plant). Later the original sense of the name was forgotten and the name was by popular etymology reshaped as *lus a' ghoill* (the foreigner's plant).

Since I first wrote the above it has been pointed out to me that *A. portulacoides* does not occur in the Outer Hebrides. It is possible therefore that another plant of the Chenopodiaceae rather than *A. portulacoides* was meant by Macdonald.

## MARRAM-GRASS

I perhaps should not end this paper without referring to at least one of the monocotyledons. Probably the commonest monocotyledon on the sea-shore is Marram-grass (*Ammophila arenaria* (L.) Link). Notice that the generic and specific names are in a sense tautologous. *Ammophila* is Greek and means "sand-loving", *arenaria* is Latin and means "of the sand".

There are really only two names for Marram-grass in Irish. The first has several variants: *maithíne*, *meatháin*, *meithín*. These are clearly the same word in origin as *meathán* (wicker, twig) (<*meath* "weak, pliable") and refer to the way in which marram was used. Evans (1957: 205), for example, says: "Mats and baskets of many kinds were fashioned from straw and other materials such as marram grass. This tough grass is harvested in places all around the coast and put to many uses".

The other name has many variants: *muiríneach*, *muiriúnach*, *bríneach*, *biríneach*, *muilíneach*, *muraoileach*. The Scottish Gaelic form is similar: *murain*. Indeed the Island of Uidhist in the Outer Hebrides was known as *Tir a' Mhurain* (the land of Marram-grass) because of the extent of the plant there and the islanders themselves were known as *Muranaich* (marram people).

The Old Irish for sea was *muir*, genitive *mara*. This word was replaced in Modern Irish by *farraige* (open sea) and in Scottish Gaelic and Manx by *cuan*, *keayn* (harbour, bay). *Muir*, *mara* survives in place-names *Connmhaicne Mara* > *Conamara* (Connemara) and in certain set phrases, *snáth mara* (high water mark) for example. The Scottish Gaelic *maraiche* (mariner), discussed above, also contains the word. The word *muiríneach* (Marram-grass) is a further compound that contains *muir*, *mara*. The Old Irish for marram in *muirín*, a simple derivative of *muir* (sea). This is the immediate

origin of Scottish *murain*. *Muiríneach* and its variants is a collective in *-each* based on the original *muirín*. It therefore means "collection/mass of plants by the sea". Not a very inspiring name, it must be admitted, but an apt one.

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# Coastal ecotypic variants of two vetches, *Vicia sepium* L. and *V. sylvatica* L. (Fabaceae), in Britain and Ireland

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ABSTRACT

Plants from some coastal populations of *Vicia sepium* L. and *V. sylvatica* L. (Fabaceae) in Britain and Ireland are dwarfed and prostrate in habit. The taxonomy, nomenclature, morphology, ecology and distribution of these variants are discussed. **Vicia sepium** var. **hartii** Akeroyd, **var. nov.**, from sand-dunes in north-western Ireland and northern and western Scotland, and *V. sylvatica* var. *condensata* Druce, a plant of shingle beaches and occasionally cliffs in the north and west of Britain and Ireland, and also in Denmark, are described.

KEYWORDS: Denmark, Bush Vetch, Wood Vetch.

## INTRODUCTION

A number of widespread species in our flora occur on the coast as distinctive variants recognizable even to the casual observer. I have been recording and studying these variants since 1975, with a view to publishing accounts of individual species. Although they were well-known to nineteenth century botanists, at the present day they are largely neglected by both field recorders and by the authors of Floras.

About 200 such variants, the majority of them named taxa, have been described from the coasts of Europe, mostly from the British Isles and from Scandinavia. The apparent north-westerly trend in their distribution reflects both the thorough exploration of the flora of this part of Europe, and perhaps also the relatively severe northern Atlantic climate, with strong winds. Coastal variants tend to be dwarfed or compact relative to plants from all, or the great majority of, inland populations of the same species. Some have hairy or more dissected leaves, or have different flowering times, growth rates and germination requirements; some are salt-tolerant and many are more perennial than plants from inland habitats. These features are probably all of some adaptive significance, reflecting different ecological conditions between the contrasting habitats, and many of them have at least some genetic basis.

Many examples of coastal ecotypic variation in our flora were noted by G. C. Druce (1850–1932), who described large numbers of intraspecific taxa of British and Irish plants. Druce's herbarium at the Botany School, University of Oxford (**OXF**), together with duplicates at other institutes, is a major source of information and is important for the typification of any published names for coastal and other intraspecific variants. The present paper looks at two native species of *Vicia*, *V. sepium* L. (Bush Vetch) and *V. sylvatica* L. (Wood Vetch), within each of which Druce reported a coastal variant of prostrate and compact habit, in contrast to the sprawling, trailing or scrambling habit of typical plants. Both coastal variants are here recognized at varietal rank, and it is hoped that this paper will stimulate the search for further records of these and other similar coastal variants. Details of all distribution records are held at the Biological Records Centre, Abbots Ripton.

## *VICIA SEPIUM* VAR. *HARTII* AKEROYD

### TAXONOMY

This variant was first reported from Ireland. Hart (1898: 141) observed plants of *Vicia sepium* on sand-dunes at Kincashla Point, W. Donegal (v.c. H35), that were small, prostrate, and with stems

that "creep under the sand". He remarked that "Mr [A.G.] More has met a similar form . . . in Scotland". Praeger (1905) recorded *V. sepium* from sand-dunes on the remote Mullet Peninsula, W. Mayo (H27), "in a dwarf form six inches [15 cm] high and almost devoid of tendrils, . . . forming patches many yards in area amongst the bent [*Ammophila arenaria* L.]". During the summer of 1979, I collected this variant in open *Ammophiletum* communities on the Mullet, where it forms mats and hummocks on the loose sand. The plant was common on the sand-dunes west of Carn Prospect, south of Annagh Head (Curtis *et al.* 1981). Similar plants, but with tendrils reduced to a terminal leaflet, were reported from the island of Duvillaum More, off the coast of the Mullet by Walsh (1968). There are apparently no other Irish records.

In Scotland, Druce collected this variant at Bettyhill, W. Sutherland (v.c. 108) in July 1907 (material at **BM**, **OXF**; Fig. 1A, left), reporting that this "pretty dwarf procumbent form of the Hedge Vetch occurred in some quantity on the sandy bay between Betty Hill and Four Points" (Druce 1908b). Elsewhere, Druce (1908a) described his gathering as "forma *prostrata*". There is further material at **OXF**, for Murkle Bay, Caithness (H. E. Fox, 5 August 1885), from where it had been collected in the same summer by F. J. Hanbury (5 July 1885, **BM**). In 1919, Druce collected the plant at Reay, Caithness, and named it as "*Vicia sepium* var. or forma *dunensis*" (Druce 1920). He thus appears to have been undecided both about the taxonomic status of this variant and what to call it.

*Vicia sepium* L., *Species plantarum* 737 (1753)

(i) var. *sepium* (Fig. 1A, right)
Stems 30–120 cm, ascending, climbing or trailing. Leaves 3–7 cm. Leaflets 8–18, 8–30(–40) × 4–12(–18) mm, ovate to ovate-oblong, subacute, obtuse or truncate. Tendrils 1–3 cm, 1- to 4-branched. Hedges, woodland margins and scrub; widespread in Europe.

(ii) var. **hartii** Akeroyd, **var. nov.** (Fig. 1A, left)
Synonyms: *V. sepium* forma *prostrata* Druce, *Annals of Scottish natural history* **1908**: 42 (1908); "forma or var. *dunensis*" Druce, *Report of the Botanical Exchange Club of the British Isles* **1919**: 814 (1920), nomen nudum.

A var. *sepium* caulibus plerumque procumbentibus vel decumbentibus, caulibus foliisque brevioribus, et cirrhis saepe simplicibus differt.

Stems 5–20(–35) cm, procumbent, decumbent or weakly ascending, forming mats and low hummocks (sometimes climbing *Ammophila arenaria* stems). Leaves 2–4 cm. Leaflets 6–14, 5–13 × 3–5 mm, ovate to elliptical or suborbicular, truncate to rounded. Tendrils 0·5–2 cm, usually unbranched or 1- to 2-branched, often absent or vestigial, sometimes replaced by a terminal leaflet. Sand-dunes.

Holotypus: W. Donegal, Rosses, Kincashla Point, bare sandhills, July 1894, *H.C. Hart*, **DBN**. Isotypus: **BM**.

Specimens seen. Mid Ebudes (v.c. 103): Isle of Coll, sandhills, July 1896, *S. M. Macvicar*, **BM**; Sutherland (v.c. 108): Bettyhill, July 1907, *G. C. Druce,* **BM**, **OXF**; Melvich, sandhills, 23 July 1887, *F. J. Hanbury*, **BM**; Caithness (v.c. 109): Murkle Bay, sands, 5 July 1885, *F. J. Hanbury,* **BM**; Murkle Bay, sandy shore, 5 August 1885, *H.E. Fox*, **OXF**; Reay, July 1919, *G.C. Druce*, **BM**; W. Mayo (v.c. H27): Mullet peninsula, south of Annagh Head, GR FF/67.33, open sand-dune community, 28 June 1979, *J. R. Akeroyd H119*, **CGE**, **DBN**, **TCD**; W. Donegal (v.c. H35): Kincashla Point, bare sandhills, July 1894, *H.C. Hart*, **BM** (isotypus), **DBN** (holotypus).

Druce (1908a) described forma *prostrata* from Bettyhill, Sutherland, and later described "forma or var." [sic] *dunensis* from Caithness (Druce 1920). Rather than take the earlier of Druce's two epithets (he seems himself to have been rather muddled about what to call his plant), I have described this as a new variety, based on a collection made by Henry Chichester Hart (1847–1908) in W. Donegal that was reported in his Flora of Donegal (Hart 1898). I am pleased to commemorate Hart in the epithet, as both the first botanist known to have published a description of this variant,


FIGURE 1. A. Left. *Vicia sepium* var. *hartii*. Sutherland, Bettyhill, *G. C. Druce* **OXF**; Right. *V. sepium* var. *sepium*. Bucks, Great Marlow, *W. H. Holliday*, **OXF**. B. Left *V. sylvatica* var. *condensata*. Angus, between Lunan Bay and Redheed, *G. C. Druce*, **OXF**; Right. *V. sylvatica* var. *sylvatica*, Oxon., Windrush Valley below Burford, *R.C. Palmer 67/57*, **OXF**. Drawings by Rosemary Wise.

and as a significant, vigorous and colourful figure of late nineteenth century Irish floristic botany (Webb 1986).

Var. *hartii* is a distinct coastal variant, although the population on the Mullet, for example, is variable, with some plants more or less intermediate between vars *hartii* and *sepium*. *V. sepium* occurs but rarely on sand-dunes, so there is less chance of hybridization with inland variants than is the case with many coastal plants. There is a tendency for the tendrils to be replaced by a small terminal leaflet, as on Duvillaun More (Walsh 1969) and on Coll (material at **BM**). It is perhaps significant that these two populations are isolated on islands, where genetic drift events may occur.

Druce did not apparently test this variant in cultivation. The only cultivation experiment has been a limited trial of three clones that I carried out in Dublin. Two clones of var. *hartii* from the Mullet, together with a clone from a hedgerow at Enniskerry, Co. Wicklow, were established in July 1979 in the Trinity College Botanic Garden, in pots of garden compost. One of the Mullet clones was an extreme variant, very dwarfed and without tendrils; the other was more spreading in habit, with short tendrils, and closer to var. *sepium* in general appearance. In July 1989 and on subsequent visits the clones were still flourishing. The dwarf plant was compact, with stems c.20 cm long and tendrils absent to vestigial; the other Mullet plant had stems c. 50 cm long and had distinct tendrils; the inland plant had sprawling stems 100–200 cm long, and luxuriant, much-branched tendrils. This suggests that the features of var. *hartii* have at least some genetic basis, but more study with larger samples is required.

It is difficult to assess the taxonomic status of this variant on the basis of the material available. Druce was apparently undecided, which is curious in view of his obvious interest in, and careful study of, the analogous case of *V. sylvatica* var. *condensata* (see below). Var. *hartii* does not present a clear-cut facies of habitat-correlated variation; nor do we know its total distribution. Variation occurs within and between populations and, despite the distinctive and unusual nature of var. *hartii*, it is best not raised above varietal rank in the absence of further data.

A number of chromosome counts of *V. sepium* have been published, based on European material of wild origin, but all show 2n = 14 (Chrtkova-Žertová 1969; Roti-Michelozzi & Serrato 1980). No counts are available of var. *hartii*.

ECOLOGY

Few ecological data are available for *V. sepium* var. *hartii*. This variant has been observed infrequently, occurring as it does in a few remote, widely scattered stations, and the labels of herbarium specimens yield little information, other than that the plants were growing on sand. The underground organs of *V. sepium* are well-adapted to vegetative spread through loose, unstabilized sand. Even in inland habitats, *V. sepium* can spread with considerable vigour by means of slender, profusely branched, yellowish-brown rhizomes, and there does not seem to be any difference between the underground parts of vars *hartii* and *sepium*. The network of rhizomes of var. *hartii* spreading through the sand, noted by Hart (1898: 141), was very striking when I was excavating plants at the Mullet peninsula.

Open, sandy habitats by the sea are an unusual place to find this familiar hedgerow species. On the Mullet, var. *hartii* grows in communities dominated by *Ammophila arenaria*, in a type of vegetation that can be loosely termed "yellow dunes". Other species consist mostly of various rosette-forming biennial and perennial composites and winter annuals. The topography is very uneven, with steep, unstable slopes, and there is considerable accretion of fresh sand blowing in from the strand. Sand is constantly eroding and being redeposited by the wind. Probably the only species that is consistently associated with *V. sepium* var. *hartii* is *Ammophila arenaria*.

DISTRIBUTION

This variant is, so far as is known, endemic to the British Isles, where it is restricted to western and northern Scotland (v.cc. 103, 108–9) and north-western Ireland (v.cc. H27, H35).

## *VICIA SYLVATICA* VAR. *CONDENSATA* DRUCE

TAXONOMY

*Vicia sylvatica* var. *condensata* was described from coastal shingle at Port William in Wigtownshire

(v.c. 74) in south-western Scotland (Druce 1884). It was stated to differ from var. *sylvatica* in a number of features, notably the dwarf, procumbent habit, the smaller, subcoriaceous, somewhat glaucous leaves, and the shorter and denser racemes of fewer and smaller flowers (Druce 1884, 1885) (Fig. 1B, left). Druce later reported it from the Mull of Galloway in Wigtownshire and from Kirkcudbrightshire (Druce 1910a, b). He raised plants from seed that he had collected on coastal shingle on the Mull of Galloway and, after a year in cultivation in his Oxford garden, noted that they retained "their small size, with the glaucescent leaves, of a thicker texture than the type, and more roundly elliptic [and] very short racemes" (Druce 1911). He did not, however, report whether he had grown any plants of var. *sylvatica* for comparison. There has been little subsequent mention of this variant in the literature, although it has been collected fairly frequently in Galloway. Hansen & Peterson (1965) reported it from the coast of Denmark, where it had been collected as early as 1873.

*Vicia sylvatica* L., *Species Plantarum* 734 (1753)

(i) var. *sylvatica* (Fig. 1B, right)
Stems 50–100 cm, weak, trailing or scrambling. Leaves 4–8 cm. Leaflets 12–20, more or less distant, 8–18 × 4–8 mm, ovate to ovate-oblong or elliptical, thin in texture. Tendrils 2–7 cm, 2- to 4-branched. Peduncles 5–18 cm. Raceme usually distinctly exceeding the leaves, lax, with 8–20 flowers. Corolla 15–20 mm. Open woods, scrub, rocky slopes, sea-cliffs.

(ii) var. *condensata* Druce, *Naturalist (Hull)* **10** (n.s.): 85 (1884) (Fig. 1B, left)
Synonym: *V. sylvatica* var. *maritima* Lange, *Rettelser og Tilfojelser Haandbog i den Danske Flora* (1897).

Stems 20–50 cm, somewhat rigid, procumbent to decumbent, forming compact patches and low hummocks. Leaves 2·5–5 cm. Leaflets 8–14, rather crowded, 6–10(–12) × 3–6 mm, ovate to suborbicular or broadly elliptical, slightly fleshy, often glaucous. Tendrils 1–4 cm, unbranched or 1- to 3-branched. Peduncles 2–5 cm. Raceme about as long as or only slightly exceeding the leaves, compact, with 4–8(–12) flowers. Corolla 13–18 mm. Coastal shingle, sea-cliffs.

Lectotypus (here designated): Wigton, Port William, shingly shore, July 1883, *G. C. Druce*, **OXF**. Isolectotypi: **ABN**, **CGE**. (Fig. 1B, left)

Var. *condensata* is distinct in appearance, but populations occur that are intermediate between it and var. *sylvaticum*. It can be distinguished by the condensed habit, the small and usually suborbicular leaflets, and the compact, few-flowered racemes that are about as long as the leaves. Var. *sylvatica* has a more trailing habit, variable but usually ovate to ovate-oblong leaflets, and lax racemes that distinctly exceed the leaves (Fig. 1B, right). Coastal populations of *V. sylvatica* may be variable, and most are indeed referable to var. *sylvatica*; however, only rarely do plants from inland habitats approach var. *condensata*. As noted above, Druce (1911) reported that var. *condensata* remained distinct when cultivated from seed. A letter from the collector attached to a gathering of var. *condensata* from the coast at Campbeltown, Kintyre (*Mrs Macneal*, 14 July 1910, **E**) reported differences between closely adjacent populations, noting the distinctness of plants "among the pebbles and stones of the shore . . . nearly a mile from the specimens in the wood".

This variant does not form a distinct regional or ecological facies, although locally it may be the predominant coastal variant, as in Galloway (Fig. 2), and the variation in relation to typical populations of *V. sylvatica* is quantitative and continuous. Although Druce collected a good deal of material of var. *condensata* from Drummore (v.c. 74), a specimen from shingle between Drummore and Sandhead (*G. Halliday 21/71*, July 1971, **OXF**) falls closer to var. *sylvatica*, and one of several specimens collected near Drummore by C. D. Preston (11 July 1986, **CGE**) is more or less intermediate between the two varieties. Var. *condensata* is therefore best retained at varietal rank.

A number of chromosome counts of *V. sylvatica* have been published, based on European material of wild origin, but all show 2n = 14 (Roti-Michelozzi & Serrato 1980). No counts of var. *condensata* are available.

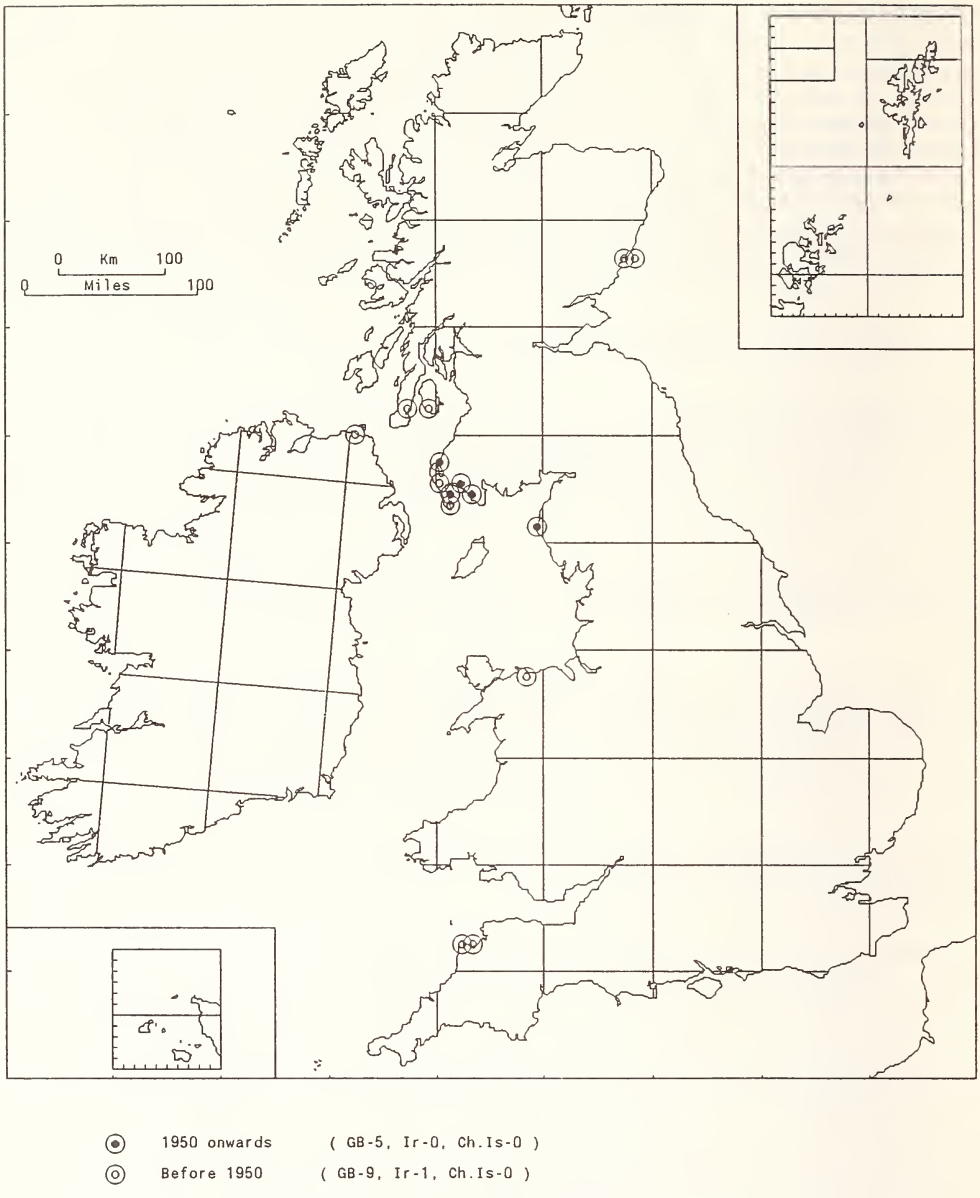


FIGURE 2. The distribution of *Vicia sylvatica* var. *condensata* in Britain and Ireland.

ECOLOGY

*V. sylvatica* var. *condensata* is a plant of coastal shingle beaches and, less frequently, low sea-cliffs. C. D. Preston recorded five relevés on shingle amongst open vegetation associated with this variant near Port William and Drummore in Wigtownshire in July 1986 (Table 1). These do not reveal any clear group of associated species, although they emphasize the open nature of the community. A number of other ecotypic variants of common species are present. Hansen & Petersen (1965) noted that *V. sylvatica* var. *condensata* has a similar ecology to *Galium aparine* L. var. *maritimum* Fries, *Geranium robertianum* L. subsp. *maritimum* (Bab.) H. G. Baker and *Solanum dulcamara* L. var.

TABLE 1. VEGETATION ASSOCIATED WITH *V. SYLVATICA* VAR. *CONDENSATA* IN FIVE QUADRATS ($m^2$) ON COASTAL SHINGLE IN WIGTOWNSHIRE (V.C. 74).
Nomenclature follows Kent (1992). Values record cover-abundance on the Domin scale.

| | Quadrat | | | | |
|---|---|---|---|---|---|
| Species | 1 | 2 | 3 | 4 | 5 |
| *Vicia sylvatica* var. *condensata* Druce | 9 | 8 | 5 | 6 | 5 |
| *Arrhenatherum elatius* | 1 | | | 1 | |
| *Dactylis glomerata* | + | | | 2 | |
| *Galium aparine* | | 4 | | | |
| *Festuca rubra* | | | 8 | 8 | |
| *Plantago lanceolata* | | | 2 | 2 | |
| *Senecio jacobaea* | | | + | 2 | |
| *Hypochoeris radicata* | | | | 1 | |
| *Raphanus raphanistrum* subsp. *maritimus* | | | | + | 4 |
| *Rumex crispus* subsp. *littoreus* | | | | 1 | |
| *Taraxacum* sp. | | | | 1 | |
| *Vicia hirsuta* | | | | 1 | |
| *Prunus spinosa* (prostrate variant) | | | | | 6 |
| *Geranium robertianum* subsp. *robertianum* | | | | | 4 |
| Bare shingle (%) | 20 | 35 | 1 | 1 | 50 |
| Maximum sward height (cm) | 30 | 15 | 25 | 25 | 15 |

*marinum* Bab. Populations of *Vicia sylvatica* on cliffs, where the plant is a member of a more closed, taller community, generally belong to var. *sylvatica*. It always grows in well-drained sites.

### DISTRIBUTION

The distribution of var. *condensata* in Britain and Ireland, derived mostly from an examination of herbarium collections, is shown in Fig. 2. In Britain it occurs in v.cc. 4, 50, 70, 73 (Druce 1910a, b), 74, 100 and 101 (vide Cunningham & Kenneth 1979, p. 19), but in Ireland is known only from White Park Bay, Co. Antrim (v.c. H39). Most of the records are from the northern part of the Irish Sea, particularly Galloway, from where Druce (1884) first found the plant between Port William and Monreith Bay, Wigtown, although it occurs in scattered localities southwards to N. Devon. Outside these islands, var. *condensata* has been reported only from Denmark, on the Djurland peninsula in eastern Jutland (Hansen & Petersen 1965).

### ACKNOWLEDGMENTS

I am grateful to C. D. Preston for his collaboration with me over 20 years of research on coastal ecotypic variants, for his help in preparing the list of localities of *V. sepium* var. *hartii* and the map of *V. sylvatica* var. *condensata*, and for allowing me free use of the data in Table 1.

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# A. B. Lambert's annotated *Flora Anglica*, its Irish-Linnaean connections, and an account of his Irish expedition, 1790

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ABSTRACT

A. B. Lambert visited Ireland in 1790 and collected plants in counties Mayo and Dublin. His annotated copy of W. Hudson's *Flora Anglica*, now in The Natural History Museum, London, contains notes about his Irish collections. There are also links between this annotated book and Patrick Browne's manuscript *Fasciculus Plantarum Hiberniæ*, now in the possession of the Linnean Society, London.

Keywords: Ireland, Mayo, Dublin, Patrick Browne, botanical history.

## INTRODUCTION

Among manuscripts in the archives of the Linnean Society, London, is *Faciculus* [sic] *Plantarum Hiberniæ*, a Flora of Ireland, inscribed "*JESmith, ex dono amiciss. ABLambert*" (Fig. 1). Completed in 1788, this manuscript was one of the last works of Carl Linnaeus' disciple and correspondent, Dr Patrick Browne (Nelson & Walsh 1995). Aylmer Bourke Lambert (1761–1842) acquired the manuscript during a visit to western Ireland in 1790 and presented it to the Linnean Society soon afterwards (Lambert 1798). Had the *Fasciculus* been published in the 1780s, as Browne intended, it would have been the first 'Linnaean' Irish Flora.

Recently I had an opportunity to examine a copy of William Hudson's *Flora Anglica* (2nd ed. 1778) which once belonged to Lambert and which evidently was used by Lambert during that Irish visit; the volume is in the Botany Library, The Natural History Museum, London. As noted by Britten (1893, 1905) this particular copy is copiously annotated; most of the annotations are apparently cryptic, there being only a few extended notes. Having studied the annotations, I can present a reasoned interpretation of most of them; many of the marks relate directly to the Linnean Society's manuscript Flora by Patrick Browne.

## PATRICK BROWNE

Dr Patrick Browne (c. 1720–1790), a native of County Mayo, studied medicine in Paris and graduated from the University of Rheims in 1742. Subsequently he lived in Leiden and London, and from 1746 worked as a medical practitioner in the West Indies, retiring about 1770 to his home country where he undertook the preparation of a Flora (Nelson & Walsh 1995). Browne corresponded with Carl Linnaeus, and Linnaeus acquired Browne's Caribbean herbarium which contained the vouchers for the taxa he described in his famous book, *The civil and natural history of Jamaica*, issued in London in 1756. Lambert evidently did not know Browne was alive and living in Mayo, but he rejoiced at being able to meet a fellow disciple of the great Linnaeus. Dr Browne died on Sunday 29 August 1790, within four months of meeting Lambert.

## A. B. LAMBERT IN IRELAND

Aylmer Bourke Lambert's mother was the Hon. Bridget Bourke, heiress of John, Viscount Mayo, whose family had estates in western Ireland. To visit members of his mother's family, Lambert

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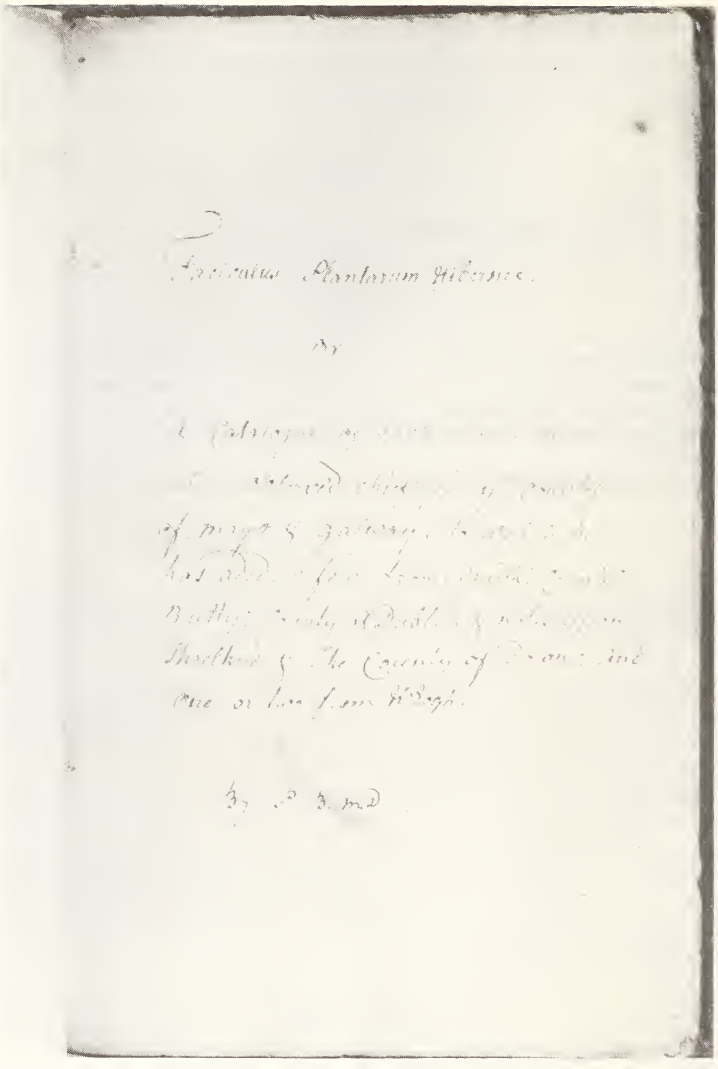

FIGURE 1. Title-page of Dr Patrick Browne's manuscript Flora of Ireland, now in the Linnean Society, London (photograph by Dr E. J. Diestelkamp).

undertook a journey to County Mayo in the province of Connacht (Connaught), starting about the beginning of January 1790 and lasting until about July that year. He had been to Ireland before, but had not had much opportunity for carrying out any research during the previous journey.

In a letter to J. E. Smith, dated 21 December 1789 and written from Salisbury (Wiltshire) (Smith ms. 6:32, Linnean Society; see Dawson 1934: 62), Lambert stated that in about a fortnight he would leave England for Ireland, adding that

> I hope to be more fortunate than I was last time in my researches after the Natural History of that Kingdom which I shall take any opportunity I can of investigating & I am going to a part, from the Accounts I have heard, that promises me success which is Connaught a province which contains many very high mountains & large lakes. You will oblige me very much by giving me any hints that you might think of service or of any particular observations that you may like to have made – I

think I heard of a Flora Hibernica in M.S. when I was last in London, can you inform me any thing of it, by whom it was wrote.

The manuscript Flora is not further identified, but there are excellent reasons, argued below, for equating this with the *Fasciculus* by Patrick Browne. Browne had recently written to Sir Joseph Banks about the possibility of publishing his Irish Flora, and it is probable that a copy of the manuscript *Fasciculus* was in Banks' hands about this time. However, Lambert does not seem to have been aware that Dr Patrick Browne lived in south-eastern Mayo, his own destination – Lambert's correspondence suggests that he was surprised to encounter so eminent a disciple of Linnaeus in remote Mayo.

Lambert's journey to Mayo brought him first to Dublin, and he probably returned home by way of Dublin too. He must have stayed for a time in or near the city because he had time to collect plants on the Hill of Howth which lies on the northern side of Dublin Bay, and between Dublin and Dun Laoghaire on the southern side of the bay. (It is equally probable that he collected and observed plants on his return journey across Ireland – he left towards the end of June or early in July – and that he visited localities in and near Dublin in the summer too. No chronological record of his itinerary is known.) He also made contact with Dr Walter Wade, a surgeon and man-midwife, who was one of the few botanists busy in Ireland at this period. Lambert learned from Wade about his unsuccessful attempts to publish a *Flora Dubliniensis* (Nelson 1980), and it may well be that they botanized together. About this time, Wade was actively campaigning for the formation of a botanic garden in Dublin under public patronage (Nelson & McCracken 1987). In February 1790 he petitioned the Irish parliament to establish a botanic garden as a "great national object", and eventually this was achieved in 1795. Dr Wade became Professor of Botany to the Dublin Society and thereby director of the Society's Botanic Gardens at Glasnevin. In 1811 he was elected a Fellow of the Royal Society of London, Lambert being one of his proposers. Dr Walter Wade was a correspondent of James Edward Smith (see Dawson 1934), and was elected an Associate of the Linnean Society in 1792.

As Lambert travelled westwards through Athlone, he continued observing and collecting. Lambert arrived at Westport, County Mayo, staying for much of April as a guest at Westport House, the seat of his kinsman the third Earl of Altamont (John Dennis Browne (1756–1806) had succeeded to the title in 1780, and was created Marquess of Sligo in 1800). Westport town is situated within the drumlin landscape of Clew Bay, overshadowed by The Reek (Croagh Patrick). Lambert explored the hinterland, climbed The Reek and had ample opportunity to observe the earl's Irish wolf dogs (Lambert 1794).

About the beginning of May 1790 Lambert moved to stay at Castle Bourke, a fifteenth century fortified towerhouse (Lavelle 1994) on the north-eastern shore of Lough Carra, about 20 km east south-east of Westport. In a letter addressed to James Sowerby (Lambert in Sowerby 1806), Lambert recounted that while staying at Castle Bourke, "hardly a day passed without my catching" fish, particularly gillaroo, a trout (see e.g. Went 1951). About this time too Lambert called on Dr Patrick Browne who, having retired from medical practice in the West Indies, had settled at Rushbrook, a short distance outside Claremorris and about 17 km east of Castle Bourke. Lambert's next letter to Smith (Smith ms. 6:34), which was answered by Smith on 22 May 1790, was written at Castle Bourke perhaps early in May.

. . . since my arrival here have been taken up with business so that I have not been able to pay that attention to the Natural History of this country as I could wish as yet, I have been this last month in the county of Mayo at Westport the seat of Lord Altamont surrounded by the Hibernian Alps the most mountainous country I ever saw, & near it is the famous M[ountain]. of Crow Patrick reckoned one of the highest in Ireland & seems to promise a fine field for a Naturalist it took me up two hours walking from the foot to the top of it. I found the Andromeda Daboecia growing in great abundance on the sides of the mountains the Empetrum nigrum & some other plants which were new to me not being in flower could not determine them, & within a few yards of the top the Saxifraga umbrosa. the London pride. not in Hudson. if any one should wish for plants of the Andromeda Daboecia ec. I can send them plenty. I hope this summer to be able to give you a good account of the plants of Mayo & nothing would give me greater pleasure than to see a Brother Member of ye L. S. at Castle Bourke where I reside which is situated on Lake Carra. joining Lake Mask & L. Corrib & being surrounded with immense High Mountains & Bogs which

seem to promise much gratifyation [sic] to a Botanist & have been I believe but little examined . . . .

Lambert continued, recounting his meeting with Dr Patrick Browne

D[r] Brown the author of the N[atural]. History of Jamaica I heard chiefly resided in that Country in lodgings at Ballinrobe. I paid him a visit one morning, & found him in bed quite a cripple with old age & the gout he shewed me a copy of a Flora Hibernica which seemed not much more than a catalogue & very imperfect some old plants he has mentioned as new species he shewed me a specimen of the Juncus sylvaticus for one. the copy that was in London is coming over here for correction, which I rather think he will have some difficulty in doing.

The reference to the copy of the manuscript in London apparently explains Lambert's earlier remark to Smith, in December 1789, about 'a Flora Hibernica'.

Smith read this letter to a meeting of the Linnean Society on 1 June ([Smith] 1790). Several weeks later, Lambert returned to London, and as far as we know he did not make any other visits to his mother's homeland.

## LAMBERT'S ANNOTATIONS

Lambert's annotations in the copy of Hudson's *Flora Anglica* are abbreviated, the principal contractions being "Ir:B", "Th" (which often looks like "T2") and "Sm:K". These can be interpreted as follows:

Ir:B – i.e. Ireland: Browne; clearly this refers to the manuscript *Fasciculus Plantarum Hiberniæ* by Dr Patrick Browne, now in the Linnean Society, London. By Lambert's own account, we know that Browne gave Lambert a copy of the *Fasciculus* (see Nelson & Walsh 1995). Evidently at some stage, Lambert decided to transfer information from Browne's manuscript into the copy of *Flora Anglica* and thus the annotation Ir:B.

Th – i.e. Dr Caleb Threlkeld's *Synopsis stirpium Hibernicarum* published in Dublin, 1726 (see the facsimile edition, Nelson & Synnott 1987).

Sm:K – Charles Smith's *The antient and present state of the county of Kerry* published in Dublin, 1756.

Lambert also used a mark that seems to represent the letters L or V, or maybe merely a tick ( √); its significance is not obvious but this mark could indicate a plant that Lambert himself had seen, and I cannot suggest another literary interpretation, like those explained above. Other annotations refer to British (not Irish) plants and to works relating to the British flora, but none seems of remarkable significance although they might profitably be studied by an historian of British botany.

The fuller annotations concerning Irish plants indicate that Lambert collected in counties Mayo (including the summit of Croagh Patrick), and Dublin (particularly on the Hill of Howth and near Dun Laoghaire), as well as near Athlone.

## LAMBERT'S MANUSCRIPT RECORDS OF IRISH PLANTS

Following are transcriptions of the extended annotations from Lambert's copy of *Flora Anglica* followed, when required, by a commentary by the present author. An asterisk (*) in front of a name indicates that the species was also noted by Lambert on the single manuscript sheet interpolated into the copy of *Flora Anglica*: these additional notes are also transcribed at the end (p. 87). In each instance, the first name cited is that used by Lambert, and where necessary, in the following commentary, I have used modern nomenclature (according to Kent 1992).

*Veronica serpyllifolia*: "I found it plenty [sic] in Mayo about Castle Bourke"

*Veronica montana*: "I received a specimen of this from Dr Wade who found it on ye Hill of Howth?"

Wood Speedwell is not included in Hart's *Flora of Howth* (1887), neither as a verified record nor as an excluded one; if the name is correct Lambert seems to have been misinformed about the

locality for the only Wade record is from Luttrelstown, on the road from Dublin westwards to Lucan (see Colgan 1904: 151).

*Anchusa sempervirens*: "I found it at Glasseven [sic] in Mr Costello's plantations"
Glasnevin, north of Dublin city, was a tiny village in 1790; nowadays it is a suburb notable as the site of the National Botanic Gardens which was established in 1795. Costello's land was mainly on the north bank of the River Tolka (now the grounds of the Holy Faith Convent). Wade (1794) reported *Pentaglottis sempervirens*, Green Alkanet (an alien escaped from a garden), from Finglas, a neighbouring suburb to Glasnevin (Colgan 1904: 277).

*Lycopsis arvensis*: "I found it on a bank [near?] the sea shore between the Black Rock & Dublin"
Blackrock is a southern suburb of Dublin. *Anchusa arvensis*, Field Bugloss, was first reported by Rutty (1772), and Colgan (1904) indicated that this species was confined to the coasts of north Dublin, rather than the southern coasts. To interpret the phrase "the Black Rock" as a reference to a boulder in an unspecified locality is not apposite.

**Samolus valerandi*: ". . . Dr Wade shewed me a specimen of it"

*Anethum foeniculum*: "I found it in great plenty on the Hill of Howth by the side of the hill near the inn & about the Black Rock"
*Foeniculum vulgare*, Fennel, was reported from Howth in 1794 by Wade, but from a different locality (see Hart 1887, Colgan 1904).

*Parnassia palustris*: "I found this in great plenty growing about the Lakes in Mayo Ireland"
Grass of Parnassus is widespread in certain parts of Mayo, for example on the shore of Lough Mask at Ballinrobe.

*Allium ursinum*: "I found it growing in plenty about Castle Bourke Mayo about the rocks"
Castle Bourke is now surrounded by farmland; *A. ursinum*, Ramsons, has not been noticed nearby in recent years, and is recorded only near Ballinrobe (cf. Synnott 1986).

*Juncus acutus*: "sea rock about Dunlary"
Wade (1794) also recorded *Juncus acutus*, Sharp Rush, on the north Dublin coast, but Colgan dismissed his records as errors for *J. maritimus*, Sea Rush. Lambert's locality on the southern Dublin coast may be more accurate but this species can easily be confused with the more common *J. maritimus*. In the absence of herbarium specimens Lambert's record cannot be verified, but it could be the first for the county.

**Erica daboeci*: "I found it frequent in Mayo about Westport and Old Head near Clew Bay, but never above a mile from the sea coast – A.B.L."
Old Head lies to the east of Louisburgh, about 16 km west of Westport, on the southern shore of Clew Bay. *Daboecia cantabrica*, St Dabeoc's Heath, is recorded further inland than suggested by Lambert (Woodell 1959). One specimen collected by Lambert in 1790 is extant in the herbarium of the Department of Botany, The Natural History Museum, London (**BM**!).

*Erica daboeci* (or **Andromeda Daboeci*) were contemporary synonyms for *Daboecia cantabrica*, and it is remarkable that Lambert brought specimens back to England. James Sowerby had access to Lambert's material, and in the autumn of 1791 drew *D. cantabrica* for *English botany*: the hand-coloured engraving is dated 1 October 1791 and this is usually taken as the date of publication. The accompanying text, written by James Edward Smith, reads (in part: Sowerby [& Smith] 1791):

> Although [John] Ray has mentioned this plant as a native of Ireland, he has been frequently suspected of having committed an error. We are at length enabled to confirm his account, having been favoured with fine wild specimens gathered last year on the sides of mountains in the county of Mayo, by Aylmer Bourke Lambert, Esq. F.L.S. It flowers in June and July, and is frequently cultivated with us in gardens . . . Ray tells us in his History of Plants that this is called St. Dabeoc's heath (from whence the Linnæan trivial name has been corruptly taken), and that the Irish girls gird themselves with its long trailing branches as a protection to their chastity – With what success he unluckily has omitted to inform us.

Sowerby's handsome illustration (Fig. 2) was used as the template for the sprig of St Dabeoc's Heath that was blocked in gold on to the front cover (and blind-stamped on to the back cover) of

FIGURE 2. St Dabeoc's heath (*Erica dabeoci*, Irish heath) from County Mayo as depicted in Sowerby [& Smith], *English botany*, drawn from one of Lambert's specimens.

some copies of David Moore and A. G. More's book, *Contributions toward a Cybele Hibernica* (1866).

*Chlora perfoliata*: "I found it frequent between the Black Rock and Dunlary"

*Blackstonia perfoliata*, Yellow-wort, was reported by Colgan (1904) as "abundant and luxuriant along the coasts" of County Dublin, and the first record was published by Threlkeld (1726).

*Elatine alsinastrum*: "In the M.S. of Dr P Brown [sic] Flora Hibernica he says he found the Elatine in Mr Canons yard the Inn in *Althone* [sic] in a heap of Moss it came from about a Mile from the Town he was told"

An inexplicable record.

**Andromeda polifolia*: "near Athlone Ireland I found 1790 L."
Bog Rosemary is frequent in bogs in central Ireland. There is a footnote to Lambert's letter to J. E. Smith (6:34; before 22 May 1790, see above), reading "I found the *Andromeda polifolia* growing in a Bog near *Athlone*."

*Saxifraga tridactylites*: "frequent on walls in Mayo I found it"
Rue-leaved Saxifrage does grow on the walls of Ballintubber Abbey, not far from Castle Bourke, for example.

**Saxifraga umbrosa*: ". . . I found on Crow Patrick – a high Mountain in Mayo Ireland growing on the top of it in great plenty 1790 L."
*Saxifraga spathularis*, St Patrick's Cabbage, is still present on Croagh Patrick (Nelson & Walsh 1995).

*Silene amoena*: "I found it on the Rocks near Dunlary near Dublin about stones & Rocks near the sea"
*Silene vulgaris* subsp. *maritima*, Sea Campion, is a common coastal plant in County Dublin; it was first reported by Threlkeld (1726).

*Arenaria peploides*: "Dunlary & Black Rock near Dublin"
*Honckenya peploides*, Sea Sandwort, was first reported from Dublin by Wade (1794); Lambert's record pre-dates this.

*Arenaria marina*: "about the Rocks at Dunlary"
*Spergularia marina*, Lesser Sea-spurrey, was first explicitly reported from County Dublin by Moore & More (1866).

*Sedum acre*: "I found this in great plenty on the rocks of the Hill of Howth Dublin Bay about the Rock Dunlary & Malpoos [Malpas] obelisk near Dalky"
Wade (1794) reported Wall Pepper from the Hill of Howth ("*super montes Howth*"), while the first record for County Dublin is due to Threlkeld (1726).

*Cerastium arvense*: "I found it on a Bank by the seaside about half way between the Black Rock & Dublin"
Colgan (1904) noted that Field Mouse-ear was rare to the south of the River Liffey which is the area of Lambert's record. Wade (1794) reported that *C. arvense* occurred between Clontarf and Howth, on the north side of the river.

*Prunus avium*: "This I saw in the Hedges in Connaught"
Wild Cherry does occur in the province of Connacht, but there is only a single record from west County Mayo (see Synnott 1986).

*Anemone nemorosa*: "I found it frequent in Mayo"
Nowadays Wood Anemone is relatively uncommon in County Mayo (see Synnott 1986).

*Mentha pulegium*: "I found it in Mayo near Claunagary"
Penny-royal is recorded from west County Mayo, as an introduced plant, by Scannell & Synnott 1987 (but was not listed by Synnott 1986). Claunagary may be Cloghannageeragh, a townland situated between Balla and Lough Carra.

*Stachys sylvatica*: "Dr Brown M:S. mentions Stachys alpina? in Ireland, & S. annua"

*Lepidium petraeum*: "I found this plant very frequent about Westport Mayo & many other places in the County about Castle Bourke Ireland L."
*Hornungia petraea* does not occur in Ireland. It is not certain what Lambert saw.

*Geranium cicutarium*: "I found it on the beach between the Black Rock & Dublin"
*Erodium cicutarium*, Common Stork's-bill, was first reported by Threlkeld (1726).

*Geranium moschatum*: "I found this in the Lane leading from the Black Rock to sea point Th[relkeld]"
Threlkeld (1726) was the first to record Musk Stork's-bill, *Erodium moschatum*, from Dublin ("facing Pool-beg"), while Lambert's locality has not previously been published.

*Geranium lucidum*: "I found this on the walls about Castle Bourke Mayo"
Shining Stork's-bill was not noticed on the castle, but it is recorded for County Mayo (Synnott 1986).

*Geranium columbinum*: "I found it about the Black Rock & Dublin frequent"
Colgan (1904) dismissed Wade's 1794 record, "many places near Dublin", as "clearly erroneous". Perhaps both Wade and Lambert were correct, and Long-stalked Crane's-bill has declined.

*Hypericum androsaemum*: "Rocks Castle Bourke I found it"

*Solidago cambrica*: "Dr Wade told me it grew on the Hill of Howth"
Wade (1794) reported *Solidago virgaurea*, Goldenrod, from Howth.

*Jasione montana*: "I found it on the Rocks before Dunlary & Dublin near the sea"
Wade (1794) published the first report, four years after Lambert recorded it.

*Empetrum nigrum*: "I found it on Crow Patrick"

**Juniperus communis*: "I found this on the top of Crow Patrick Mayo"

*Parietaria officinalis*: "I found on the walls at Castle Bourke frequent"
*P. judaica*, Pellitory-of-the-wall, is still present on the ruins of Castle Bourke, and on the walls of Ballintubber Abbey whence Browne reported it (Nelson & Walsh 1995).

*Fraxinus excelsior*: "This tree [plant – del] seems to grow in Ireland better than any other & seems & seems [sic] to be preferred in plantations to any other especially in the County of Mayo where it is chiefly planted about Gentlemans seats"

*Osmunda regalis*: "I have found this frequent in the Bogs of C. Mayo & near NewBrooke by Mr Bingham in great plenty"
Mr G. Bingham was also known to Dr Browne, and is mentioned several times in *Fasciculus* (see e.g. *Samolus valerandi* (f. 18), *Plantago lanceolata* (f. 15)); from those records it is clear that he had a house near Castlebar. Newbrook House, in ruins now, lies to the east of Lough Carra, between Ballyglass and Hollymount. Arthur Young visited the house in the late 1770s (Young 1780).

*Lycopodium* (*Huperzia*) *selago*: "I found this growing in a Bogg which the road runs through above 4 miles from Athlone"

*Allium vineale*: "Bank side of the mill race above Island Bridge & near Bally Griffin in Fingall Th[relkeld]"
Lambert has simply copied Threlkeld's (1726) record into Hudson's volume.

*Lathraea squamaria*: "Found upon a moist acclivity as we came up the sea shore from Dunlery to Newtown Th[relkeld]"
Again, this annotation merely repeats Threlkeld's (1726) original notice.

## LAMBERT'S ADDITIONAL NOTES

There are additional manuscript pages on which Lambert has inscribed further notes about plants that he saw in Ireland. Some of these notes amplify the annotations within the Flora.

*Gnaphalium dioicum*: "I found it in great plenty about the Rocks & grounds at Castle Bourke Mayo"
*Antennaria dioica*, Mountain Everlasting, does occur at Derrinrush, a short distance south of Castle Bourke, with e.g. *Epipactis palustris*, Marsh Helleborine (Nelson & Walsh 1995), but I did not see it at Lambert's locality which nowadays is heavily grazed, and the ground is greatly poached by the cattle.

*Rubus saxatilis*: "I found it in great plenty about the Rocks at Castle Bourke Mayo"
Likewise, Stone Bramble is not found at Castle Bourke today.

*Saxifraga umbrosa*: "I found it growing on the top of one of the highest Hills in the province of Connaught it is near Westport Mayo – Smith History of Kerry vide."

The "highest hill" is evidently The Reek, Croagh Patrick, and *Saxifraga spathularis*, St Patrick's Cabbage, is plentiful on the mountain in suitable habitats (cf. Nelson & Walsh 1995). This species was often named *Saxifraga umbrosa* in eighteenth and early nineteenth century texts.

*Andromeda Daboecia*: "I found it in great plenty of the sides of Crow Patrick"

*Daboecia cantabrica* is present in this general locality today, as described by Lambert (see above).

*Samolus valerandi*: "I found between Dunlary & Bullock in Boggy places near the sea shore"

*Linum perenne*: "I found it between Dunlary & Bullock about ye rocks & near the shore."

*Juniperus communis alpina*: "I found this growing on the top of Crow Patrick it was there quite a trailing plant running along the ground among the moss just as the Empetrum nigrum grows none of the branches being above one Inch above the moss"

~~Ledum~~ [deleted]

*Andromeda polifolia*: "I found it in a Bogg by the Road side about 4 miles from Athlone toward [illegible]"

## CONCLUSIONS

Lambert's Irish visit led to the publication of a biography of Dr Patrick Browne (Lambert 1798) and an account of the Irish wolf dog (Lambert 1794) in the *Transactions of the Linnean Society*, as well as a report of the presence of the gillaroo in Lough Carra, County Mayo (Sowerby 1806). Except for a brief notice of *Saxifraga spathularis* ([Smith] 1790), and a longer one about *Daboecia cantabrica* on Croagh Patrick (Sowerby [& Smith] 1791), none of Lambert's botanical notes was published by him.

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# *Luzula multiflora* subsp. *hibernica*, a new tetraploid taxon of *Luzula* sect. *Luzula* (Juncaceae) from Ireland

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ABSTRACT

The *Luzula multiflora* group is represented in Ireland by tetraploid populations. They are given a detailed description and compared with other taxa of the section, and results of their karyological and allozyme analyses are discussed. The tetraploids are evaluated as a new subspecies, *L. multiflora* (Ehrh.) Lej. subsp. *hibernica* J. Kirschner & T. C. G. Rich **subsp. nov.** Evidence is presented in favour of the hypothesis that the new taxon is an alloploid derivative of *L. campestris* × *L. pallidula* parentage. The distribution and ecology of *L. multiflora* subsp. *hibernica* is outlined.

Keywords: biosystematics, taxonomy, speciation

## INTRODUCTION

*Luzula* section *Luzula*, as circumscribed by Chrtek & Křísa (1980) or Novikov (1990), is an almost cosmopolitan group of very similar taxa. In Europe, it comprises 15 species and subspecies, and its diversity centres are in the Balkans and in the Iberian Peninsula (Kirchner 1992a,b, 1993). In the British Isles, *L. pallidula* Kirschner, *L. campestris* (L.) DC., *L. congesta* (Thuill.) Lej. and *L. multiflora* (Ehrh.) Lej. have been recorded (Buchanan 1960; Stace 1991; Kirschner & Rich 1993).

The taxonomic complexity of the group is a consequence of specific features of speciation in the group. Agmatoploidy (i.e. simultaneous chromosome fragmentation), alloploid partial agmatoploidy, autoploidy and true alloploidy have been documented to operate in the section (Nordenskiöld 1951, 1956; Kirschner 1992a,b). Karyological differentiation is therefore the major way of speciation in the group, and detailed local karyotaxonomic investigations have proved efficient at resolving taxonomic problems in the group (cf. Nordenskiöld 1966, 1969; Kirschner 1992a). On the other hand, morphological differentiation is less conspicuous, and only a few, semi-qualitative characters are available to help delimit the taxa that mainly differ in a number of quantitative, slightly overlapping traits.

The most complicated species of the section in Europe is *Luzula multiflora* (Ehrh.) Lej. sens. lat. Its population diversity is centred on the Iberian Peninsula but it is also differentiated elsewhere in its European range. Populations in the marginal parts of its range are so distinct that they are recognised as subspecies (see also Fig. 1): hexaploid populations in northern Europe represent *L. multiflora* subsp. *frigida* (Buchenau) V. Krecz., and hexaploids in the N. Urals belong to subsp. *sibirica* V. Krecz. In the Balkans, a partially agmatoploid tetraploid, *L. multiflora* subsp. *snogerupii* J. Kirschner, is the most common representative of the *L. multiflora* group. Recently, a diploid agmatoploid of *L. multiflora* sens. lat. has been revealed in the Pyrenees.

The type subspecies, *Luzula multiflora* subsp. *multiflora*, has an extensive ecological and geographical distribution in Europe. It consists of two cytotypes, tetraploids and hexaploids. The

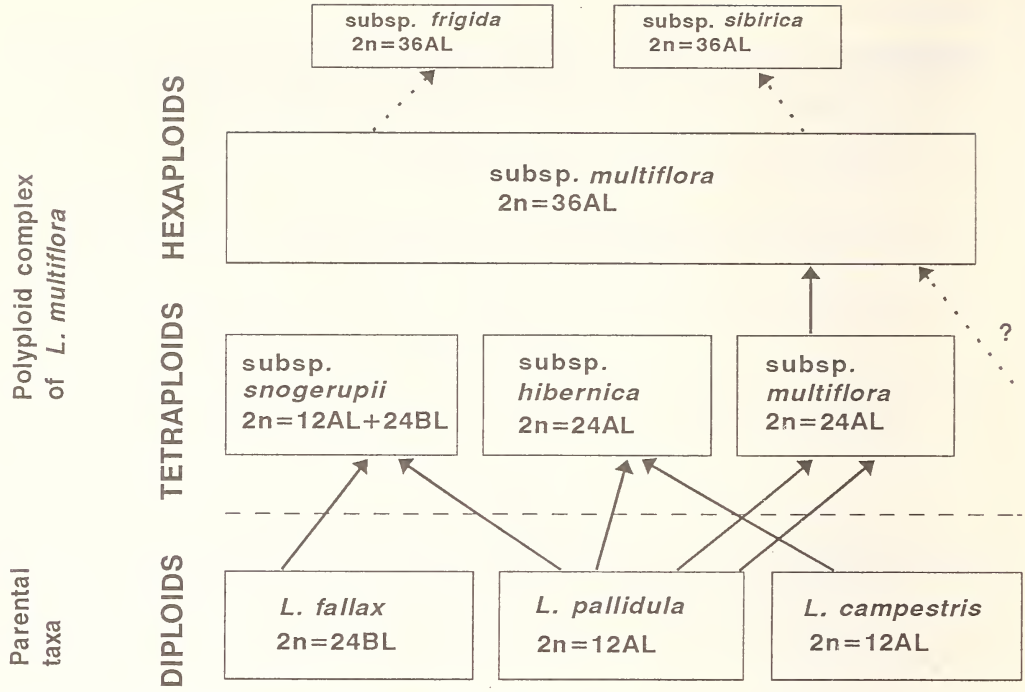


FIGURE 1. Evolutionary relationships in the *Luzula multiflora* group.

latter is common, widely distributed in continental Europe and Britain, occupying a wide range of habitats from the lowlands to the mountains, mostly in meadows and mesophilous woodlands. In the regions with common occurrence of the *L. multiflora* hexaploids, there is no niche for another polyploid of the group, but in ecologically and geographically marginal areas, other polyploid populations of *L. multiflora* sens. lat. can be found. The tetraploids of *L. multiflora* subsp. *multiflora* have a remarkable distribution pattern, being confined to alpine habitats on the continent, the Tatra Mountains, the Alps, the Massif Central and the Pyrenees.

Thus, a finding of a tetraploid, morphologically distinct form of *L. multiflora* in Ireland (Co. Mayo, 1989, T.C.G.R.) was of great interest. During later visits to Ireland (1992, 1994), the tetraploids were found at a number of additional sites (no hexaploids were found). The tetraploids have been studied karyologically (Jarolímová & Kirschner, in press) and electrophoretically (Kirschner, in press) confirming their differentiation and possible origin. A general evaluation of the taxonomy and origin of the Irish tetraploids is given in this paper.

## MATERIALS AND METHODS

Live material was collected in the field mainly in western Ireland. Part of each collection was pressed (vouchers in **P**), and the remainder were cultivated in unheated greenhouses at Průhonice, Czech Republic. Chromosomes were counted from root tips of mature plants (or seedlings) using methods described in Kirschner (1992b) and Jarolímová & Kirschner (in press), and meioses were studied following Nordenskiöld (1961). Chromosome nomenclature follows Nordenskiöld (1961); AL = normal size, BL = half size. Methods of allozyme analyses and further details on the principles of the interpretation of zymograms are given in Kirschner (in press).

Within the *L. multiflora* group, measurements of quantitative (especially floral) characters are of principal importance. In order to get comparable results, the lower florets of pedunculate clusters

TABLE 1. A COMPARISON AMONG *L. MULTIFLORA* SUBSP. *HIBERNICA*, *L. MULTIFLORA* SUBSP. *MULTIFLORA*, *L. CAMPESTRIS*, *L. PALLIDULA* AND AN ARTIFICIAL HYBRID OF THE LATTER TWO

| | *L. campestris* | an artificial hybrid (*L. campestris* × *pallidula*) | *L. pallidula* | *L. multiflora* subsp. *hibernica* | British hexaploid *L. multiflora* subsp. *multiflora* |
|---|---|---|---|---|---|
| Habit | laxly caespitose | densely caespitose | densely caespitose | densely caespitose | densely caespitose |
| Stolons | present | absent | absent | absent | absent |
| Width of basal leaves (mm) | 3–4 mm | 2–2·5 mm | Usually 2 mm | 2·2–2·8(–3·5) mm | 3–5 mm |
| Number of flower clusters | (2)3–5(6) | (8)9–12(15) | (6)8–15(22) | (5)6–8(9) | (6)7–12(17) |
| Shape of flower clusters | broadly ovoid | ellipsoidal | cylindrical | ovoid | cylindrical to ovoid |
| Peduncles | some recurved | erect to flexuous | erect | some recurved or flexuous | usually erect, straight |
| Peduncles | smooth | slightly papillose | papillose | smooth | smooth |
| Peduncle branches | absent | usually present | usually present | usually present | usually present |
| Number of flowers in pedunculate clusters | (3)4–7(9) | 6–8(10) | (10)12–20 | 5–8(10) | (6)8–13(18) |
| Tepal (outer) length (mm) | (2·8)3·0–3·8(4·1) | 2·9–3·2 | 2·0–2·6(2·8) | 2·6–3·0(3·2) | (2·7)2·8–3·3(3·5) |
| Anther length (mm) | 1·1–2·1 | 0·7–1·0 | 0·4–0·6 | 0·6–0·7 | 0·7–1·1(1·6) |
| Ratio anther/ filament length | (2·5)3–4 | c. 2 | c. 1 | 1·0–1·2 | 1·1–2·2(2·5) |
| Style length (mm) | (0·9)1·1–1·6 | 0·6–0·8 | 0·2–0·3 | 0·6–0·7 | 0·4–0·8(0·9) |
| Stigma length (mm) | (1·5)2·4–3·8(4·2) | 1·3–1·7 | 0·5–0·6 | 1·2–1·4 | 1·3–2·0(3·1) |
| Seed length (mm) | 1·0–1·1 | 0·9 | 0·7–0·8 | 0·8–0·9 | 0·9–1·1 |
| Seed width (mm) | (0·8)0·9–1·0 | 0·6–0·7 | 0·5–0·6 | 0·7 | 0·7–0·9 |
| Caruncle length (mm) | 0·4–0·7 | 0·4 | 0·2(0·3) | 0·2–0·3 | 0·4–0·5 |

were measured in fresh material. Seeds were measured in dorsal view; seed length excludes the appendage.

Characters summarized in Table 1 were measured in herbarium specimens of population samples from the whole of Europe (if not specified otherwise). Localities of the samples are given in Kirschner (1992b). Vouchers are deposited at **PR**. In addition, British and Irish material was studied at **BM**, **K**, **BEL** and **DBN**.

## MORPHOLOGY, VARIATION AND TAXONOMIC TREATMENT OF THE IRISH TETRAPLOIDS

Morphologically, *L. multiflora* subsp. *multiflora* is the closest neighbour of the Irish tetraploids. Thus, in order to accommodate them taxonomically, the whole *L. multiflora* complex requires consideration.

*Luzula multiflora* sens. lat. can be characterized as an assemblage of mostly polyploid forms that


FIGURE 2. *Luzula multiflora* subsp. *hibernica*. Scale bars: plant 1 cm; detail of cluster 1 cm; floret 1 mm; seed 1 mm. (del. A. Sier).

share close evolutionary relationships to *L. pallidula*. Nordenskiöld (1956) documented these links between *L. pallidula* and the tetraploid *L. multiflora* subsp. *multiflora*, and *L. multiflora* subsp. *snogerupii* is an alloploid of the *L. pallidula* and *L. fallax* J. Kirschner parentage. Karyological and allozyme analysis shows that the Irish tetraploid also belongs to this group as an alloploid with *L. pallidula* and *L. campestris* as parental species (Jarolímová & Kirschner, in press; Kirschner, in press).

The morphological analysis of the Irish tetraploid is in agreement with the karyological and allozyme data. The Irish plants combine some features of *L. campestris* and *L. pallidula* (Table 1).

They are even morphologically close to the diploid artificial hybrid between these two taxa (see also Kirschner 1991). Features indicating the *L. campestris* parentage include some peduncles recurved (and/or several peduncles flexuous), the reddish tinges to the bract and some peduncles, and the relatively long stigmas. The larger number and smaller size of flower clusters, the smaller size of flowers and some floral parts (especially anthers), the often unequal tepals, the absence of stolons, and, in particular, the smaller seeds and short caruncles suggest the influence of *L. pallidula*.

The morphological variation ranges of *L. multiflora* subsp. *multiflora* and related taxa are wide, and phenetic differentiation usually does not allow sharp lines to be drawn between the type subspecies and other local segregates. The Irish tetraploid is also phenotypically plastic without any clear geographical pattern (measured on the samples from populations listed on p. 94). Despite this variation, the Irish tetraploid plants share a set of features that allow their recognition in the field (see Table 1). In many other important characters, however, there are overlaps between the ranges of the subsp. *multiflora* and the Irish plants. The morphological relationship and similarities in origin are the main reasons why we treat the Irish plants as a member of the *L. multiflora* group.

As the populations of the Irish tetraploid occupy a relatively large area situated at the margin of the geographical range of *L. multiflora* sens. lat., and because of its relative distinctiveness, we treat the Irish populations as a subspecies of *L. multiflora*. This treatment is also consistent with the taxonomic tradition in the group (alloploids in less complex groups are, as a rule, accorded the rank of species).

**Luzula multiflora** (Ehrh.) Lej. subsp. **hibernica** J. Kirschner & T. C. G. Rich **subsp. nov.** (Fig. 2)

Plantae caespitosae sine stolonibus, rhizomate brevi. Caules erecti, 12–27 cm, dein usque ad 35 cm alti, plerumque tenues. Folia basalia ciliata, plerumque 2·2–2·8 mm lata, folia caulina plerumque numero 2–3, ea summa 4–8·5 cm longa et 1·5–2·2(–2·5) mm lata, marginibus dense papilloso-serratis (microscopium). Bractea infima inflorescentia aequans vel paulo superans. Inflorescentia ex 5–9(–18) capitulis ellipsoideis-ovatis usque hemisphaericis composita, ramis inflorescentiae plerumque ramosis, erectis, plerumque flexuosis, uno reflexo, non papillosis. Capitula 5–8(–10)-flora. Tepala subaequilonga (vel externa ad 0·6 mm longior), pallide stramineo-badia, 2·6–3·2 mm longa. Antherae 0·6–0·7 mm longae, filamenta ± aequantes. Stylus 0·6–0·7 mm longus, stigmate subdeciduo, 1·2–1·4 mm longo. Segmenta capsularum 1·9–2·2 mm longa. Semina ovoidea, 0·8–0·9(–1·0) mm longa (sine caruncula), 0·7 mm lata, cum carunculis 0·2–0·3 mm longis. Chromosomatum numerus tetraploideus, 2n = 24.

(Diagnostic characters in *italics*)
Plants ± densely caespitose, without stolons. Rhizome short. Stems usually slender 12–27(–35) cm tall. Basal leaves ± densely to sparsely ciliate, *2·2–2·8(–3·5) mm wide.* Cauline leaves usually 2–3, with densely papillose-serrate margin (microscope). Upper cauline leaves 4·0–8·5 cm long, 1·5–2·2(–2·5) mm wide. Lower bract usually 1·7–4·3(–5·5) cm long, shorter than, or over-topping the inflorescence, often reddish. Inflorescence with pedunculate clusters, most peduncles straight, *some of them flexuous, usually at least one in a plant recurved*, often with secondary branches, smooth. Clusters 5–9(–18), sub-sessile clusters 1–2, ellipsoidal-ovoid to ovoid, rarely hemispherical, flowers in pedunculate clusters 5–8 (–10), bractlets 1·5–1·8 mm long, ciliate. Tepals pale straw-brown or brown, outer tepals ± equalling the inner ones or *often up to 0·4–0·6 mm longer*, 2·6–3·2 mm long, acuminate. *Anthers 0·6–0·7 mm long*, anther-filament length ratio 1·0–1·2, ovary 0·9–1·0 mm long, style 0·6–0·7 mm long, stigma 1·2–1·4 mm long. Capsules equalling or shorter than perianth. *capsule segments 1·9–2·2 mm long. Seeds ovoid, 0·8–0·9(–1·0) mm long*, 0·7 mm wide, *caruncles 0·2–0·3 mm long.*

Typus: Ireland, West Mayo (H27), Cluddaun (grid reference G/018.285) in mesotrophic grassland in small valley in blanket bog to west of conifer plantation, July 1989, *T.C.G. Rich no. L254.* Holotypus: **PR**. Isotypi: **BEL**, **BM**, **DBN**, **E**, **K**, **LD**, **PRC**, **TCD**.

IDENTIFICATION KEY TO THE MEMBERS OF *LUZULA* SECT. *LUZULA* IN THE BRITISH ISLES

1a. Plants with creeping stolons, rhizome long, creeping. Seeds (without appendage) globular. Anther/filament length ratio usually > 2·5 ..... *L. campestris* subsp. *campestris*
1b. Plants without stolons, rhizome short, oblique or vertical, not creeping. Seeds ovoid to oblong-ovoid. Anther/filament length ratio < 2·5 ..... 2

2a. Peduncles densely papillose throughout (microscope). Outer and inner tepals of conspicuously unequal length. Seeds 0·5–0·6 mm wide ..... *L. pallidula*
2b. Peduncles smooth or sparsely papillose below the flower clusters. Outer and inner tepals equal or outer tepals slightly (by 0·2–0·4(–0·6 mm)) longer. Seeds 0·7 mm wide or wider ..... 3

3a. Seeds (excluding appendage) 1·2–1·5 mm long. Inflorescence usually congested, sometimes pedunculate ..... *L. congesta*
3b. Seeds up to 1·1 mm long. Inflorescence composed of conspicuously pedunculate clusters ... (*L. multiflora*) 4

4a. Peduncles erect, usually straight. Seed appendages 0·4–0·5 mm long. Basal leaves usually >3 mm wide. Capsule segments 2·0–2·8 mm long ..... *L. multiflora* subsp. *multiflora*
4b. Some peduncles recurved, others often flexuous. Seed appendages 0·2–0·3 mm long. Basal leaves usually <3 mm wide. Capsule segments 1·9–2·2 mm long ..... *L. multiflora* subsp. *hibernica*

ORIGIN OF *L. MULTIFLORA* SUBSP. *HIBERNICA*

*L. multiflora* subsp. *hibernica* has been examined karyologically and electrophoretically. The Irish populations proved to be invariably tetraploid with 2n = 24. The analyses of meiosis revealed that the taxon is characterised by a regular pairing and the formation of twelve bivalents with very few aberrations. This and the absence of multivalents indicate that *L. multiflora* subsp. *hibernica* is of alloploid origin (Jarolímová & Kirschner, in press).

Allozyme analysis of *L. pallidula*, *L. campestris* and *L. multiflora* subsp. *hibernica* provided further evidence (Kirschner in press). Self-fertilisation (through geitonogamy) prevails in *L. pallidula* and probably also in *L. multiflora* subsp. *hibernica*. In *L. campestris* outcrossing is common. The presumed parental taxa differ in several allozyme loci, and allozyme divergence between them is relatively high. The Irish tetraploid combines alleles of *L. campestris* and *L.*

TABLE 2. LOCALITIES FROM WHICH *LUZULA MULTIFLORA* SUBSP. *HIBERNICA* HAS BEEN VERIFIED

North Kerry (H2), Killarney, Ross Castle, woodlands (V/94.88).
West Galway (H16), Connemara, a bog east of Derryrush (L/89.39).
West Galway (H16), Connemara, banks of Joyce River near Kilmeelickin (L/93.55).
West Galway (H16), Connemara, Maum, banks of Bealanabrack River near the village bridge (L/97.53).
West Galway (H16), Connemara, Cashel, near a turning to Derryrush (L/82.42).
West Galway (H16), Connemara, by the road near Derryclare Lough, c. 3 km NW of Recess (L/84.49).
Offaly (H18), Shannonbridge, near Derryharan Ho., roadside in a bog c. 0·5 km NW of Shannon, c. 1 km E. of the mouth of Blackwater (N/009.216).
Offaly (H18), Tullamore, Cloncon (N/36.21).
Offaly (H18), Mountmellick, W. of Kyletalesha (N/45.03).
Offaly (H18), Tullamore, Killeigh, a clearing along the road to Gorteen Bridge (N/34.18).
Westmeath (H23), Athlone, Mongan Bog north of Ballynahown (N/0.3).
West Mayo (H27), Cluddaun, upper part of a small valley in a blanket bog (G/018.285). Type locality. Further samples were collected along the lower part of the valley to the west.
West Mayo (H27), Keerglen River, SW of Ballinglen, a small stream in a conifer plantation (G/073.325).
West Mayo (H27), Glenmore, a grassland by Owenmore River (G/096.231).
West Mayo (H27), Owenmore River NW of Corvoley, along stream south of conifer plantation (G/050.282).
West Mayo (H27), Altderg River, north of Cluddaun (G/018.318).

TABLE 3. VEGETATION OF MESOTROPHIC GRASSLAND COMMUNITY AT THE TYPE LOCALITY OF *LUZULA MULTIFLORA* SUBSP. *HIBERNICA* (2 M × 2 M SAMPLE AREA)
Nomenclature for vascular plants follows Stace (1991). Cover estimates are given on the Domin Scale. Vegetation cover = 100%; mean vegetation height = 25 cm.

| Vascular plants | | Bryophytes | |
|---|---|---|---|
| Species | Domin value | Species | Domin value |
| *Carex echinata* | 6 | *Lophocolea bidentata* | 3 |
| *Agrostis canina* | 4 | *Pseudoscleropodium purum* | 3 |
| *Anthoxanthum odoratum* | 4 | *Rhytidiadelphus squarrosus* | 3 |
| *Molinia caerulea* | 4 | *Thuidium tamariscinum* | 3 |
| *Rhinanthus minor* | 4 | *Hylocomium splendens* | 3 |
| *Succisa pratensis* | 4 | *Calliergon cuspidatum* | 3 |
| *Calluna vulgaris* | 3 | | |
| *Carex nigra* | 3 | | |
| *Carex panicea* | 3 | | |
| *Danthonia decumbens* | 3 | | |
| *Holcus lanatus* | 3 | | |
| *Luzula multiflora* subsp. *hibernica* | 3 | | |
| *Myrica gale* | 3 | | |
| *Plantago lanceolata* | 3 | | |
| *Potentilla erecta* | 3 | | |
| *Ranunculus acris* | 3 | | |
| *Trifolium pratense* | 3 | | |
| *Trifolium repens* | 3 | | |
| *Viola palustris* | 3 | | |
| *Carex pulicaris* | 2 | | |
| *Dactylorhiza fuchsii* | 2 | | |
| *Euphrasia* cf. *scotica* | 2 | | |
| *Hypochaeris radicata* | 2 | | |
| *Leontodon autumnalis* | 2 | | |
| *Luzula congesta* | 2 | | |
| *Nardus stricta* | 2 | | |
| *Angelica sylvestris* | 1 | | |
| *Equisetum palustre* | 1 | | |
| *Lotus corniculatus* | 1 | | |
| *Pedicularis palustris* | 1 | | |

Also associated with this type of grassland were: *Caltha palustris*, *Cerastium fontanum*, *Crepis paludosa*, *Menyanthes trifoliata*, *Triglochin palustre*.

*pallidula*, and in two loci it invariably exhibits an additive pattern composed of alleles of presumed parents. All the allozyme alleles of subsp. *hibernica* are found in either of the diploid species. Most importantly, subsp. *hibernica* exhibits a high frequency of heterozygotes but relatively low overall genotype diversity. All these facts support the hypothesis that *L. multiflora* subsp. *hibernica* represents an alloploid derivative of the *L. campestris* × *L. pallidula* parentage.

Finally, the geographical context of *L. multiflora* subsp. *hibernica* requires consideration. The restricted distributions of the *L. multiflora* sens. lat. tetraploids in Europe, and the character of their habitat indicate their relic nature. As there is only a minor morphological divergence among the populations from the mountain regions, we suppose that tetraploids occupied much larger territories in most of continental Europe during the late glacial period, and were replaced by the ecologically less specialised hexaploids during the spread of open mesophilous woodlands. A different course of development of the flora in Ireland may have allowed the tetraploids to retain their geographical range. As stated above, the greatest population diversity of *L. multiflora* sens. lat. in Europe is found in the Pyrenees and adjacent regions, and consequently the Irish tetraploids may be of Iberian origin (as are a number of other taxa in Ireland; Webb 1983). Low genotype diversity suggests that subsp. *hibernica* originated as a result of a single hybridization alloploidization event.

### DISTRIBUTION AND HABITAT IN IRELAND

From our limited field work it appears that *L. multiflora* subsp. *hibernica* is widespread in western Ireland. Although no hexaploids were found, it is improbable that *L. multiflora* subsp. *multiflora* is absent from Ireland altogether. However, in the regions visited *L. multiflora* subsp. *hibernica* is the only representative of *L. multiflora*, and was found almost as commonly as *L. campestris* and *L. congesta*. To date, we have recorded subsp. *hibernica* in the localities listed in Table 2.

*Luzula multiflora* subsp. *hibernica* grows in a relatively wide range of habitats in Ireland. Its natural habitat appears to be the mesotrophic grassland communities of the small river valleys between areas of blanket bog. It also occurs in habitats of a secondary nature, such as tracks and road verges, disturbed bog margins, open conifer plantations and denuded places in clearings and secondary woodlands. It is commonest on stream banks, on well-drained, peaty/mineral soils and not in water-logged conditions. It grows scattered through the vegetation rather than being in large stands. A representative quadrat sample from the type locality is given in Table 3; this vegetation type is referable to the *Caricetum nigrae* association of White & Doyle (1982). The soil was typical humic alluvium, with an upper horizon composed of mineral soil and peat about 50 cm deep, and a lower horizon about 20 cm layer of sandy soils over large stones. *L. congesta* was also present at the locality (it should be added that tetraploids are not known to hybridise with octoploids in section *Luzula*).

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# A rediscovered site for *Erica erigena* R. Ross (Ericaceae) on Achill Island, County Mayo (v.c. H27), Ireland

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ABSTRACT

A site of *Erica erigena* R. Ross on Achill Island, Co. Mayo (v.c. H27) which was originally found by the author in 1969 has been rediscovered. Its location, ecology and vegetation are described. It is argued that it is probably the same site described by Praeger over 90 years ago.

KEYWORDS: distribution, ecology, vegetation.

## INTRODUCTION

The distribution of *Erica erigena* R. Ross in Ireland has been comprehensively surveyed and discussed by Foss *et al.* (1987). They identified seven main areas of distribution, from Galway to north Mayo, and a number of outliers which include two sites on Loch Conn, one near Crossmolina, one on Clare Island and two on Achill Island (W. Mayo, v.c. H27). Since their survey, a further isolated site, near Formoyle (National Grid Reference G/050.226), has been added (Lockart 1988) and it is not unlikely that other such sites will be discovered in the future.

## THE REDISCOVERED SITE

On Achill Island, Foss *et al.* (1987) refound only the two sites described by McClintock (1966, 1969), at Lough Nakeeroge East (Lough Annagh) and at Doogort. However, in 1969, when I visited a range of sites supporting *Erica erigena*, I recorded this species flanking a streamside on Knockmore, Achill Island. On 14 August 1994, a quarter of a century later, I revisited Achill Island and refound the site. Access to the site is situated some 2·4 km from Dooega Post Office on the right hand (south-eastern) side of the road, where the road begins to descend towards its junction with the R319 (NGR F/691.005). A short track leads on to an area of cut peat and reveals a stream, which is otherwise obscured from the road by a ridge. The stream is made obvious by some stunted pine and spruce trees accompanied by Rowan and Rhododendron. *Erica erigena* is found continuously up this stream from just below the trees to its source, where it spreads through a wet flush. There are numerous flushes feeding the stream from the slopes of Knockmore and all these support *Erica erigena* up to an altitude of about 120–150 m above sea level. Over 150 bushes of *E. erigena* were counted in the first (the most north-easterly) flush examined. *E. erigena* is less frequent or absent where the lower reaches of the flushes disappear into bog. In the flushes surrounding the main stream *E. erigena* is found only in the areas supporting green and vigorous tussocks of *Molinia caerulea**, and is absent from more peaty areas with poorer growth of *Molinia*. Larger bushes of *E. erigena* are over 1 m tall on the streamside and up to 0·65 m tall in the flushes. In the boggy areas the remaining specimens are often less than 0·25 m tall.

The sites in which *E. erigena* occurs usually contain *Molinia caerulea* and *Potentilla erecta*, associated with other woody plants such as *Myrica gale*, *Calluna vulgaris*, *Erica tetralix*, and *E. cinerea* in drier areas. This vegetation fits the *Potentilla erecti-Ericetum erigenae* association described by Foss (1986). A 4 × 4 m streamside quadrat from 1969 recorded the following species: *Erica erigena*, *Potentilla erecta*, *Molinia caerulea*, *Carex nigra*, *C. pulicaris*, *Juncus effusus*, *Blechnum spicant*, *Galium saxatile*, *Ranunculus flammula*, *Viola palustris*, *Sphagnum palustre*,

* Nomenclature follows Stace (1991) for vascular plants.

*Pellia epiphylla*, *Pseudoscleropodium purum*, and seedlings of *Sorbus aucuparia* and pine. Adjacent species included *Calluna vulgaris*, *Erica cinerea*, *Myrica gale*, *Rhododendron ponticum*, *Rubus fruticosus* agg., *Athyrium filix-femina* and *Dryopteris filix-mas*. The presence of seedlings of Rowan and pine, and of Rhododendron is significant as older trees and bushes are now found at the site, which is, therefore, almost certainly the one seen in 1969.

The question remains as to whether this is an entirely new site, or one that has been recorded earlier. Praeger (1904) describes three sites on Achill Island, two of which were refound by Foss *et al.* (1987). The third site, however, is described as "by the streamlet which rises near Black Lough, from its source to its mouth near Salia". Mweelin Lough (where *E. erigena* was found by D. A. Webb (McClintock 1969) but not relocated by Foss *et al.* (1987)) has a connection with the Black Lough, and its exit stream joins the Owenbegacashel which flows into the sea opposite Salia. Examination of the appropriate 1:50,000 map (Ordnance Survey of Ireland, Discovery Series 30) indicates that the stream described here belongs to the same catchment (Fig. 1). A possible reason for the site being ignored is the presence of a small hillock on the opposite side of the road, which separates the site from the Black Lough, and makes it look as though the stream described in this paper belongs to a different catchment.

The stream was not followed downhill to its mouth, as no plants of *E. erigena* were found as it neared the main road, but it is possible that plants of *E. erigena* may be found in its lower reaches. On Knockmore itself, some flushes that ran down the mountain beyond the headwaters of the stream also contained *E. erigena* and were potentially part of the catchment of the Dooega River to

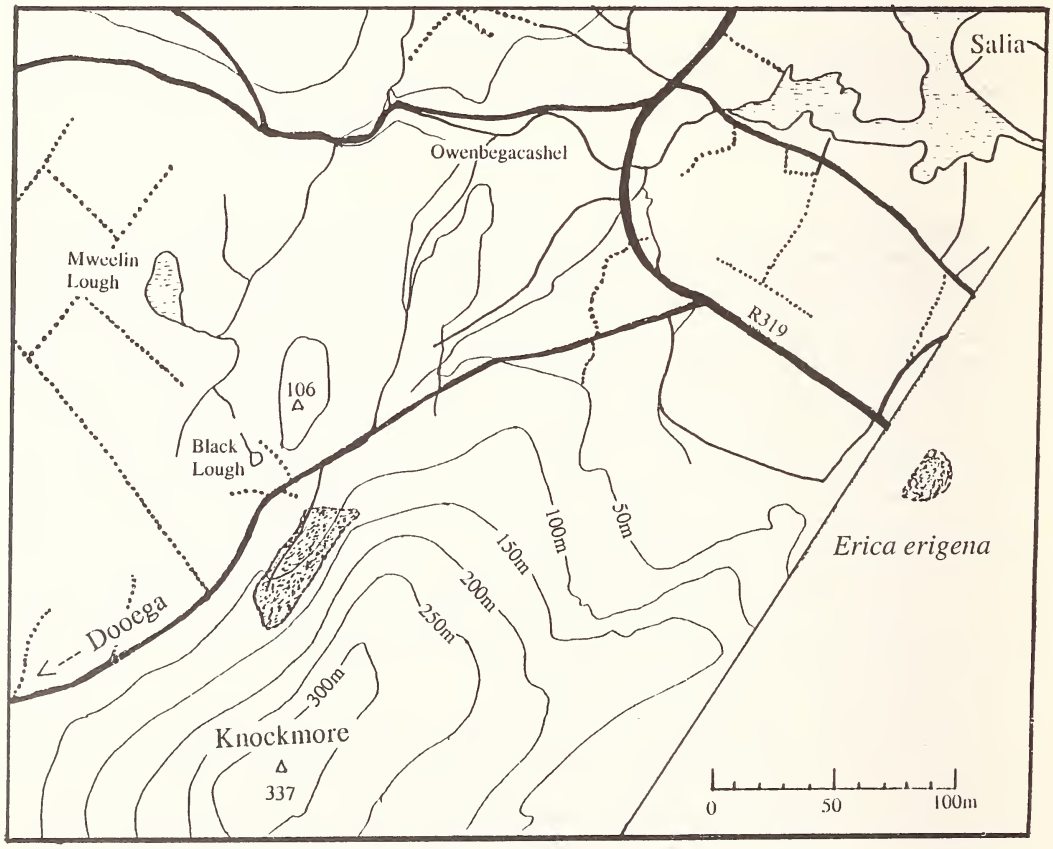


FIGURE 1. Map of part of Achill Island, showing the approximate extent of the site where *Erica erigena* was found and its relationship to the Black Lough and the Owenbegacashel catchment.

the south-west. It is thus possible that a more intensive search of the area may extend the range of *E. erigena*.

The described site is about 15 ha in area and is certainly the largest yet described for Achill Island. The site at Annagh Lough contains only about 40 bushes and the site near Doogort extends for only 2 ha (Foss *et al.* 1987). I visited this latter site, and it appears to have been burnt, cut or heavily grazed, as the remaining plants are regenerating from their bases and no longer obvious from the road, although the few bushes south of the road are undamaged.

In conclusion, the Knockmore site is the major site for *Erica erigena* on Achill Island and is probably the site "by the streamlet that rises near Black Lough" mentioned by Praeger (1904).

Voucher specimens for the population have been deposited in the National Herbarium, National Botanic Gardens, Glasnevin (**DBN**).

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# British *Apium repens* (Jacq.) Lag. (Apiaceae) status assessed using random amplified polymorphic DNA (RAPD)

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ABSTRACT

Random amplified polymorphic DNA was used to assess the taxonomic status of the only known remaining British population of putative *Apium repens* (Jacq.) Lag., on Port Meadow, Oxfordshire. This study reveals that the population comprises both true *A. repens*, and also *A. nodiflorum* (L.) Lag. in a prostrate dwarf phenotype almost indistinguishable from *A. repens*. A cultivation experiment supports the molecular evidence.

KEYWORDS: Creeping Marshwort, Port Meadow, phenotypic plasticity, *Apium nodiflorum*, plastodeme, Umbelliferae.

## INTRODUCTION

Creeping Marshwort, *Apium repens* (Jacq.) Lag., is listed in Annexes II and IV of the *E.U. Directive on the Conservation of Habitats and Wild Fauna and Flora* ("*Habitats Directive*") and also Appendix I of the Council of Europe's *Bern Convention*. The belief that *A. repens* occurs in Britain has led to its inclusion in Schedule 8 of the *Wildlife and Countryside Act*, 1981, giving it full protection. Under the *E.U. Directive*, Special Areas of Conservation must be designated for the species listed on Annex II, and species on Annex IV must be given full protection. Listing on Appendix I of the *Bern Convention* also means that full protection is required for this species in countries which are signatories.

The only known remaining location of putative British *Apium repens* is Port Meadow, Oxfordshire (v.c. 23). Port Meadow is grazed today by the horses and cattle of the Freemen of Oxford in the same way as was recorded in the Domesday Book of 1087. This continuity of land management may explain the survival of *A. repens* at the site. However, recent cultivation experiments have drawn the status of this population into question since cultivated plants have tended to revert, either completely or partially, to *A. nodiflorum* (L.) Lag. (M. Southam, pers. comm. 1994). In fact less recent cultivation of putative *A. repens* from older sites met with similar reversions "the plant becoming much larger, the leaves increasing to four inches . . . the number of the involucres is reduced" (Druce 1927). Such cultivation experiments highlight the continuum of form often observed between *A. repens* and *A. nodiflorum* which has confused botanists for over a century. Such confusion is exemplified by Professor Babington belatedly pointing out that "the *repens* of Engl. Bot., 1431 [Smith 1795], is a form of *nodiflorum*" (cited in Lees 1880) and also by the large number of infraspecific taxa of *A. nodiflorum* (e.g. var. *vulgare* Schultz (Schultz 1854); var. *depressum* Schultz (Schultz 1854); var. *longipedunculatum* Schultz (Schultz 1854); var. *ochreatum* DC. (De Candolle 1805); var. *pseudorepens* Watson (Watson 1867); var. *repens* Syme (Syme 1865); see Riddelsdell & Baker 1906).

The continuum of form between *A. repens* and *A. nodiflorum* may be a result of hybridization

between the two species and/or phenotypic plasticity. Indeed it appeared possible that *A. repens* was extinct in Britain, with hybrids or *A. nodiflorum* phenocopies of the *A. repens* habit causing taxonomic confusion.

Morphological studies cannot fully resolve this point. However, in the past, claims of hybridity have been made on the basis of morphology: "*Helosciadium [Apium] nodiflorum* Koch . . . growing with presumptive *H. repens* Koch., and apparently hybridising with it" (Riddelsdell 1917b), or refuted: "*A.* × *riddelsdellii* Druce, *nom. nud.* was reported doubtfully from Binsey Common and Port Meadow (v.c. 23), in 1917 but all the specimens seen appear to be variants of *A. nodiflorum*" (Tutin 1975). Fruit morphology has been suggested as the best diagnostic character (Riddelsdell & Baker 1906) but it is rarely accessible in the field, due to grazing (A. Roberts & C. Huxley-Lambrick, pers. comm. 1994), flooding or failure of fruits to mature (Lees 1880). Other characters suggested for identification (Tutin 1980), such as rooting at the nodes and the number of involucral bracts, overlap in the field. The character of rooting at the nodes is particularly poor as it merely distinguishes between upright *A. nodiflorum* and prostrate *A. repens*. Prostrate *A. nodiflorum* roots readily at the nodes.

Cytological evidence does not clarify the situation since both *A. repens* and *A. nodiflorum* are generally thought to have the same number of chromosomes, 2n = 22 (Rutland 1941; Baksay 1956; Hlavacek *et al.* 1984). The B.S.B.I. handbook count of 2n = 16 for putative *A. repens* (ex Witney; Tutin 1980) has been corrected from the original slides to give 2n = 18 (A. J. Richards, pers. comm. 1994). This count needs to be confirmed with other material but accords with the count of 2n = 20 for putative hybrid material in Cambridgeshire (Stace 1984). Putative *A. repens* is now extinct at Witney (R. Palmer, pers. comm. 1994).

In this paper we present a preliminary random amplified polymorphic DNA (RAPD) analysis of non-British (Frankfurt, Swiss and Moroccan) *A. repens*, putative *A. repens* from Port Meadow, and *A. nodiflorum* from two different British localities (Table 1). Two plants of *A. nodiflorum* came from ditch habitats at Port Meadow, and two further plants were collected at a sufficient distance from Port Meadow to be certain of representing another population (East Hagbourne, just on the Oxfordshire side of the Oxfordshire/Berkshire border, grid reference SU/525.879). The Frankfurt material came from the Frankfurt Botanic Garden via the Reading University Harris Botanic Garden, and the Swiss material came directly from the Neuchâtel University Botanic Garden. There is some doubt about the exact provenance of both these specimens, but they certainly represent wild origin non-British *A. repens*. The Moroccan *A. repens* was collected wild by Dr Stephen Jury in the High Atlas and was received via the Reading University Harris Botanic Garden.

RAPD techniques are a proven, relatively inexpensive and effective way of determining the taxonomic identity of specimens with only nanograms of extracted DNA (Hadrys *et al.* 1992; Marsolais *et al.* 1993; Crawford *et al.* 1993; van Buren *et al.* 1994). Short random sequence primers are added to total DNA extracted from leaf tissue, and the mixture subjected to thermal cycles that promote a polymerase chain reaction (PCR). The resultant amplification products (RAPDs) can then be separated on an agarose gel, and the polymorphic DNA bands used to determine taxonomic identity. RAPDs are thus ideal for determining whether pure *Apium repens* occurs on Port Meadow, and hence whether *Apium repens* occurs in Britain. This is important for the forthcoming

TABLE 1. *APIUM* OPERATIONAL TAXONOMIC UNITS (O.T.U.s) CULTIVATED AND USED TO ANALYSE RAPD VARIATION

| O.T.U. | Taxon | Grid ref. | Locality |
|---|---|---|---|
| 1,2 | *A. nodiflorum* | SP/495.085 | Port Meadow, Oxon. In ditch. |
| 3,4 | *A. nodiflorum* | SU/525.879 | East Hagbourne, Oxon. S.W. of East Hagbourne church in shady ditch. *Grassly & Cronk* s.n. (**OXF**). |
| 5-10 | putative *A. repens* | SP/495.085 | Port Meadow, Oxon. |
| 11 | *A. repens* | — | Morocco |
| 12 | *A. repens* | — | Frankfurt |
| 13 | *A. repens* | — | Switzerland |

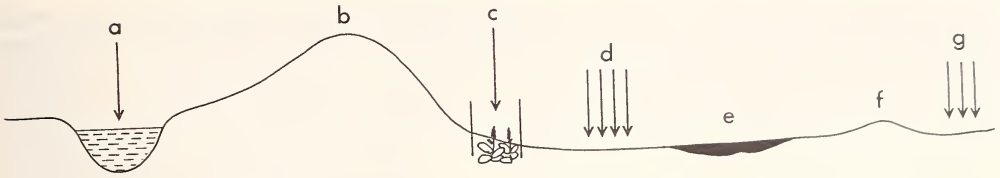


FIGURE 1. Highly schematic representation of the ecological distribution of *Apium repens* and *A. nodiflorum* plastodemes on Port Meadow. Illustrated is the ditch around Port Meadow (a), the Victorian rubbish dump (b), the *Rumex* sp. zone denoting the edge of winter flooding (c), the main area of *A. repens* distribution (d), the area heavily poached by horses and cattle (e), remains of English Civil War defences (f), and the southern site for *A. repens* (g). O.T.U.s 1 & 2 were sampled from habitat (a), O.T.U.s 5–9 were sampled from habitat (d), and OTU 10 came from the southern site (g).

statutory 5-yearly review of Schedule 8 of the *Wildlife and Countryside Act*, 1981, the imminent revision of the plant *Red Data Book* (Perring & Farrell 1983) and for actions to implement the *E.U. Habitats Directive*. For these reasons we are contracted by the Joint Nature Conservancy Council (J.N.C.C.) to undertake a study of *A. repens* at Port Meadow.

## METHODS

Authentic *Apium repens* plants from Frankfurt, Switzerland and Morocco were cultivated in the Oxford Botanic Garden, along with *A. nodiflorum* collected from a ditch in East Hagbourne and on Port Meadow (Fig. 1). In addition, with an appropriate licence from English Nature under the *Wildlife and Countryside Act*, 1981, putative *A. repens* samples from Port Meadow were collected by one of us (Q.C.B.C.) and cultivated at the Oxford University Botanic Garden. Thus 13 operational taxonomic units (O.T.U.s) were available for study as listed in Table 1.

In order to carry out the RAPD analysis total DNA was extracted from 9 mm diameter leaf discs following Harris (1993). Discs were homogenised in a 1·5 ml Eppendorf tube using a disposable grinder (Anachem). To each homogenate 1 ml of 2 × CTAB extraction buffer (2% CTAB, 1·4 M sodium chloride, 100 mM Tris-HCl, pH 8·0, 0·2% $\beta$-mercaptoethanol, 1% PVP-40T) was added and the tubes incubated for 30 minutes at 65°C. Extracts were then purified using chloroform: isoamyl alcohol (24:1) before precipitating the CTAB-DNA complex, removing the CTAB and resuspending in 100 $\mu$l TE (10 mM Tris-HCl, pH 7·3, 1 mM EDTA). Seven ten-base-pairs-long primers [B1,2,5,7,11,12,20 (Operon Technologies Inc., Alameda, California) selected to give useful polymorphic genetic markers] were used in PCR amplifications with DNA extracts from the 13 O.T.U.s. Amplifications were done in 50 $\mu$l of reaction mixture containing: 17·5 $\mu$l distilled deionised water; 5 $\mu$l DNA; 5 $\mu$l 1 mM dATP; 5 $\mu$l 1 mM dCTP; 5 $\mu$l 1 mM dGTP; 5 $\mu$l 1 mM dTTP; 5 $\mu$l 10 × Dynazyme$^{TM}$ buffer (100 mM Tris-HCl, pH 8·8; 15 mM $MgCl_2$; 500 mM KCl; 1% Triton-X-100); 2 $\mu$l 100 nM primer; 1 unit Dynazyme$^{TM}$ (Finnzymes OY; Flowgen Laboratories). The reaction mixture was subjected to 45 thermocycles each consisting of 1 minute at 92 °C, 3 minutes at 35 °C and 2 minutes at 72 °C. A final cycle of 3 minutes at 72 °C ensured complete extension of the remaining products prior to holding the samples at 4 °C until analysis.

After the products were separated on 2% agarose gels in tris-acetate buffer containing 0·5 $\mu$g/ml ethidium bromide, 53 genetic markers were scored. Repetition confirmed the validity of these markers.

A 13 × 53 binary matrix indicating marker absence/presence for each O.T.U. was thus obtained (Appendix 1). Using Jaccard similarity (an asymmetric similarity measure suitable for binary data that makes no assumptions about the nature of the characters being scored), the shared genetic markers allowed the O.T.U.s to be related in 53 dimensional space, each dimension representing a genetic marker. The 53 dimensions were then reduced to two by the use of eigen-values as calculated by the program PCoord of the R-package (Legendre & Vaudor 1991). The two dimensions were then plotted to show the genetic similarity of all 13 O.T.U.s (Legendre & Vaudor 1991).

The morphological reversions of new leaves produced by the putative *Apium repens* after seven weeks of cultivation were assessed and a series of leaf silhouettes taken, using the second leaf down from the tips of shoots produced in cultivation.

## RESULTS

The discrete nature of genetic markers obtained from RAPDs is shown in Fig. 2. This figure is a photograph of RAPD products separated on an agarose gel stained for DNA and illuminated with UV light. It clearly shows bands from primers that are genetic markers (primer 5) which distinguish

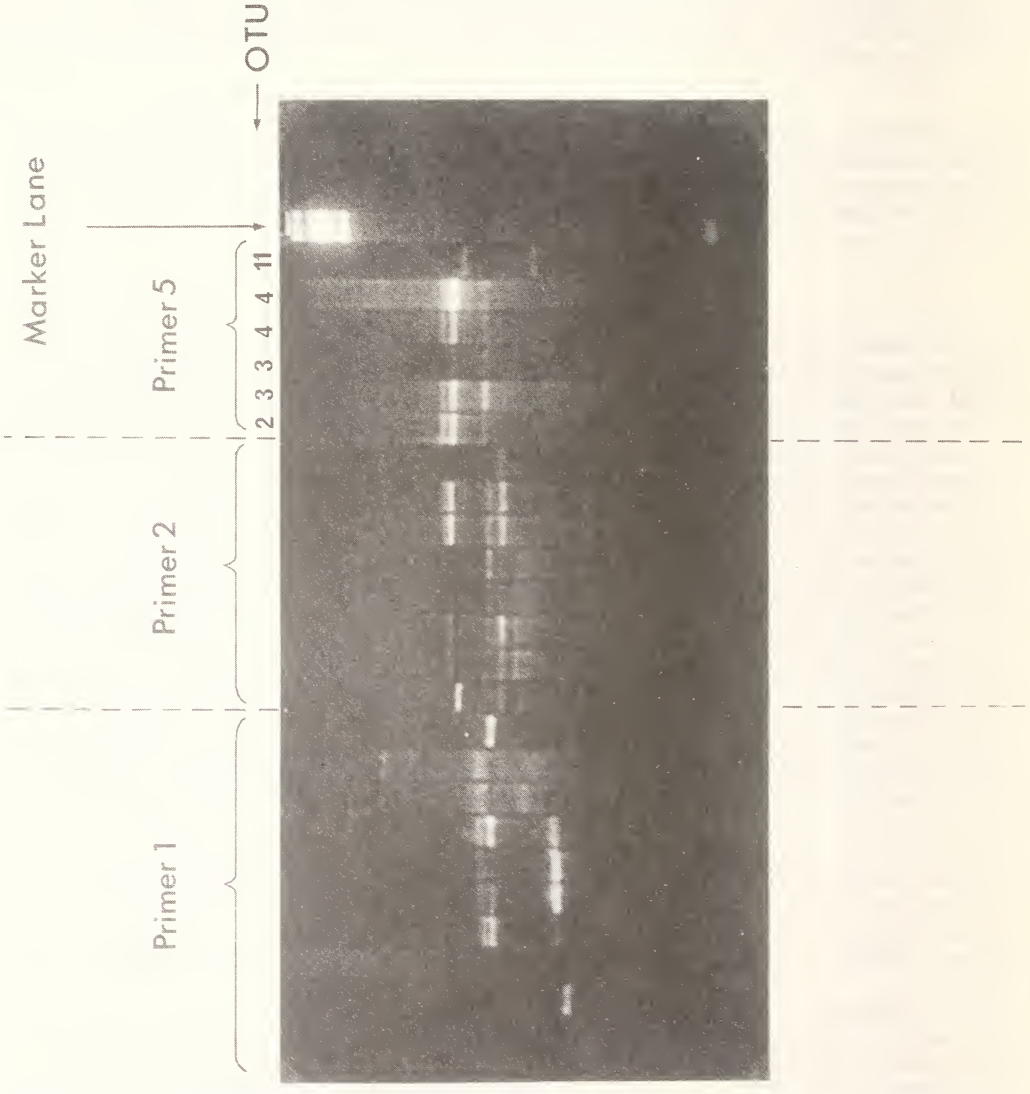


FIGURE 2. The photograph shows RAPD products obtained when Operon primers B1, 2 & 5 are (sequence 5′-TGCGCCCTTC-3′) added to DNA extracts from the Port Meadow and East Hagbourne *Apium nodiflorum* and the Moroccan *A. repens* (O.T.U.s in order 2, 3, 4, 11). The genetic markers generated by Operon primer B5 (sequence 5′-TGCGCCCTTC-3′) are identical for O.T.U.s 2, 3 & 4 but very different for O.T.U. 11 (*A repens* from Morocco). The second replicate of O.T.U. 3 has failed to amplify because of an excess of DNA.

*Apium nodiflorum* from Moroccan *A. repens*. When such markers (detailed in Appendix 1) were used to calculate genetic similarities of the 13 O.T.U.s by the Jaccard coefficient followed by Principal Coordinate analysis, Fig. 3 was obtained. This clearly distinguishes *A. nodiflorum* from the 'true' (non-British) *A. repens*. In addition, it shows that the Port Meadow putative *A. repens* plants (O.T.U.s 5–10) fall either into the *A. nodiflorum* genetic cluster (O.T.U.s 1–6) or the *A. repens* genetic cluster (O.T.U.s 7–10, 12, 13). The large RAPD divergence of the Moroccan plant is a point of interest and is discussed below.

The cultivation experiments support the RAPD evidence. New leaves produced after only two months cultivation in common garden conditions show that two of the Port Meadow putative *Apium repens* (O.T.U.s 5 & 6) revert partially to *A. nodiflorum* (Fig. 4c, d), not in leaf size but in leaflet toothing and shape. The remaining Port Meadow '*A. repens*' (O.T.U.s 7–10) retain or even increase the distinctiveness of their field morphology (Fig. 4e).

## DISCUSSION

Although this is a preliminary study the data strongly indicate that the Port Meadow '*Apium repens*' population consists of 'true' *A. repens* (O.T.U.s 7–10) similar to the *A. repens* from Frankfurt and Switzerland, and also *A. nodiflorum* phenocopies of *A. repens* (O.T.U.s 5 & 6). The discrete nature of the *A. nodiflorum* and *A. repens* genetic clusters in Fig. 3 is inconsistent with high levels of hybridisation, where a genetic continuum would be expected. However, it is possible that some genetic interchange has occurred, as suggested by the slightly intermediate nature of the Port Meadow *A. nodiflorum* phenocopies of '*A. repens*' in Fig. 2 (O.T.U.s 5 & 6). Further experiments with more O.T.U.s, primers and a wider sampling of Port Meadow '*A. repens*', *A. nodiflorum* and European *A. repens* would allow a more exact assessment of this possible genetic exchange. In addition to the RAPD data, the chemistry of secondary products may provide further useful characters. The leaves of *A. repens* are pleasant tasting (resembling parsley) without the slightly peppery watercress-like aftertaste of *A. nodiflorum*. Riddelsdell (1917a) claimed they were more palatable to slugs, and in the Middle Atlas Mountains of Morocco *A. repens* is sought out and eaten by Barbary Apes (*Macaca sylvana*; G. Drucker, pers. comm. 1994).

The large RAPD divergence of the Moroccan *Apium repens* (Fig. 3) suggests that the population sampled is distinct from European *A. repens*, and has been for some time. This lack of inter-continental genetic exchange is unsurprising. However, much wider sampling of *A. repens* would be desirable before the implications of this observation can be assessed.

The RAPD data do, however, show the tight genetic clustering of *Apium nodiflorum* even though there is great phenotypic plasticity. The plasticity of Port Meadow *A. nodiflorum* can be seen to produce several discrete morphological types as recognisable plastodemes (sensu Gornall 1987; Gilmour & Heslop-Harrison 1954). These plastodemes (assemblages of plants phenotypically rather than genetically distinct) are the result of local environmental conditions and in cultivation the *A. nodiflorum* phenocopies of '*A. repens*' tend to revert towards the phenotype of typical specimens found in ditches (Fig. 4). The plasticity has long been apparent to workers on these species (Riddelsdell 1917a). The plastodemes observed on Port Meadow are shown schematically in Fig. 1.

The large erect form of *Apium nodiflorum* occurs in fresh-water ditches (Fig. 1a) such as those around the edge of Port Meadow and at East Hagbourne. These plants vary in size from 15 cm to 1 m; the main stems root only at the base, and each leaf bears 3–11 leaflets (2–4 cm long elliptic lanceolate or ovate lanceolate). Involucral bracts are usually absent. The ditch plastodeme accords with *A. nodiflorum* var. *vulgare* Schultz (1854).

On Port Meadow a very distinct (approx. 1–6 m wide) zone, characterised by *Rumex crispus* L., marks the edge of winter flooding (Fig. 1c). This zone occurs around that part of the edge of Port Meadow that was deliberately raised in the late 19th century by dumping city waste, both to dispose of rubbish and to provide a refuge for stock from the floodwaters. In this zone smaller prostrate plants of *A. nodiflorum* are found. Such variants approximate to *A. nodiflorum* var. *pseudorepens* H. C. Watson (1867).

On the meadow itself around the edge of areas heavily poached by cattle and horses (Fig. 1e), some almost perfect *Apium nodiflorum* phenocopies of *A. repens* are found together with true *A.*

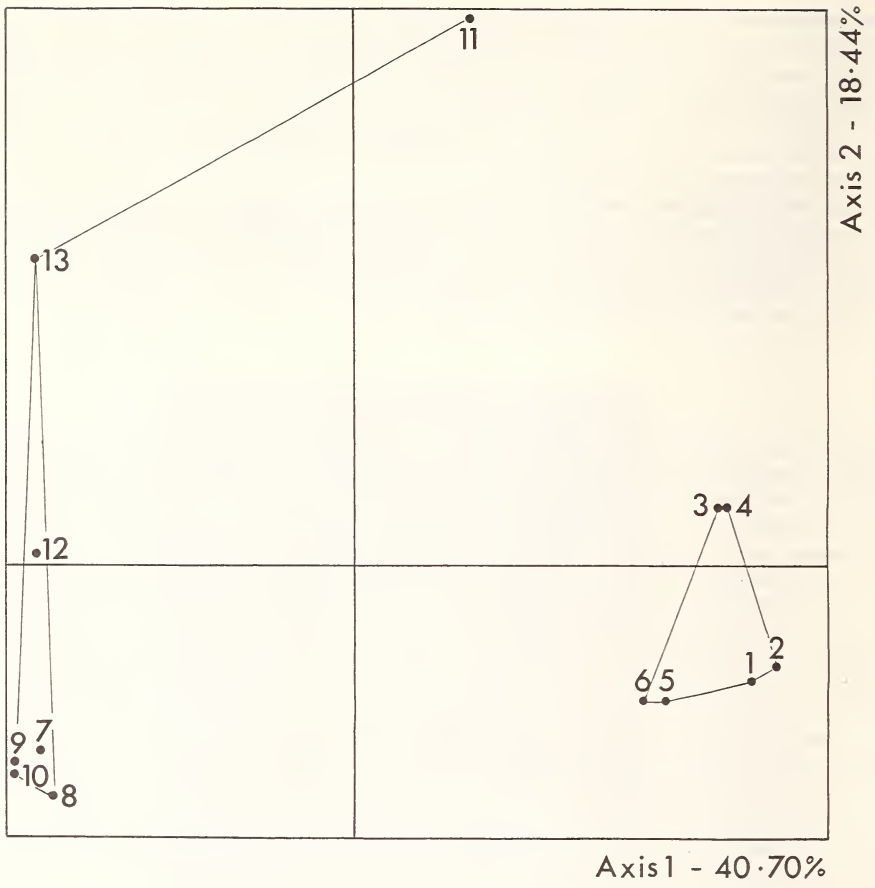


FIGURE 3. Two dimensional principal coordinates plot of the genetic relatedness of the 13 O.T.U.s (listed in Table 1) as calculated using the R package (Legendre & Vaudor 1991). The genetic clusters of *Apium nodiflorum* (O.T.U.s 1–6) and *A. repens* (O.T.U.s 7–10, 12–13) are visible, as is the divergent Moroccan *A. repens* (O.T.U. 11).

*repens* (Fig. 1d). The extent to which these *A. nodiflorum* phenotypes resemble true *A. repens* varies somewhat according to characters such as leaflet shape, size and number, rooting at nodes, degree of procumbency, and involucral bract numbers. These phenovariants broadly correspond to *A. nodiflorum* var. *longipedunculatum* Schultz forma *simulans* Riddelsdell. The existence of *A. nodiflorum* × *A. repens* hybrids (Riddelsdell 1917c = *A.* × *riddelsdellii* Druce, nom. nud.) has also been suggested. There is no definite evidence for the existence of such hybrids. It is also around the area heavily poached by cattle and horses that true *Apium repens* exists as identified by the genetic markers used in this study. Despite growing intermixed with *A. nodiflorum* phenocopies, *Apium repens* has retained a discrete genetic identity as a species in Britain and hence should remain in Schedule 8 of the *Wildlife and Countryside Act*, 1981. The Port Meadow collections which cluster with *A. repens* had the more incised leaflets in the field. O.T.U. 7 was the only plant collected in flower, and had an inflorescence with four involucral bracts. Probably the best characters for indicating *A. repens* in the field are deeply incised leaflets *and* four or more involucral bracts. Less well marked material should be confirmed by cultivation or a RAPD genetic test.

When such a range of phenotypes is assumed by a species such as *Apium nodiflorum*, allowing the occupation of a range of habitats, the selective advantage of phenotypic plasticity is obvious (Coleman *et al.* 1994). There are many examples of variable and widespread species assuming the


FIGURE 4. Leaf spectra for *Apium nodiflorum* and *A. repens* after seven weeks under cultivation. Operational Taxonomic Units (O.T.U.s) as in Table 1. a. O.T.U. 3 – East Hagbourne *A. nodiflorum*; b, c. O.T.U. 5; d. O.T.U.s – Port Meadow putative *A. repens* showing reversion to *A. nodiflorum*; e. O.T.U. 7 – Port Meadow putative *A. repens* not showing reversion; f. O.T.U. 12 – Frankfurt *A. repens*; g. Moroccan *A. repens*. O.T.U.s 5, 6 & 7 had very similar leaf form in the field.

general form of related ecologically specialised species in particular habitats, for instance *Trifolium occidentale* Coombe/*T. repens* L. (Coombe 1961) and *Ranunculus* × *levenensis* Druce ex Gornall/*R. flammula* L. (Gornall 1987). Stebbins (1950, p. 129) gives the case of *Camelina sativa* (L.) Crantz subsp. *sativa* which mimics *C. sativa* subsp. *linicola* Sch. & Sp. when grown in flax (*Linum usitatissimum* L.). He suggests that the directly genetic adaptation of subsp. *linicola* is selectively advantageous in the specialised habitat, over the phenotypic response of subsp. *sativa*. Conservation management on Port Meadow should aim to favour *A. repens* rather than the *A. nodiflorum* meadow plastodeme, now that the discrete genetic identity of British *Apium repens* has been demonstrated. There remain three broad questions to be answered: 1. What is the extent (if any) of

hybridisation that would be revealed by wider sampling in the population? 2. What are the ecological conditions that favour *A. repens*? What is the optimum level of grazing and poaching by stock, and could the plant survive in other parts of Port Meadow if introduced? 3. Does true *A. repens* occur in other Thames flood meadows? However, enough is presently known about *A. repens* to suggest that it would be an excellent candidate for an English Nature species recovery programme.

ACKNOWLEDGMENTS

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## APPENDIX 1

### A. RAW DATA MATRIX

The numbering of the O.T.U.s follows that of the text and figures: *Apium nodiflorum* (1–4) 1 & 2 Port Meadow, 3 & 4 East Hagbourne; putative Port Meadow hybrid (5–10); *A. repens* (11–13) 11 Morocco, 12 Germany, 13 Switzerland.

| MARKER | 1111111111222222222233333333334444444445555 |
|---|---|
| NO. | 1234567890123456789012345678901234567890123456789012345678901234567890123 |
| OTU1 | 011100001000011000111010111001100011100011100000000000 |
| OTU2 | 011100011000011000111010110001100010100011100000000000 |
| OTU3 | 111000011000011000111000100000100010001000100011101000 |
| OTU4 | 111000001000011000111000100001100010001000100011110000 |
| OTU5 | 000011011000011000001010010001100010010011100000000000 |
| OTU6 | 000001011000011000000010100000100010100011100100000000 |
| OTU7 | 000000000000011000000100000010010010100000110000000000 |
| OTU8 | 000010000000011000001100000010010010100000111000000000 |
| OTU9 | 000010000110011000001100000110010010100000011000000000 |
| OTU10 | 000010000110011000001100000110010010100000011100000000 |
| OUT11 | 100000010001100111001001000001001100000100100000000000 |
| OTU12 | 000010100010011000001000000110000000101000110000000001 |
| OTU13 | 000000000010011100000000000001001000010110010000000111 |

### B. GENETIC MARKERS (CHARACTERS)

The following list gives the primer number (Operon B[OPB] series) and the approximate number of base pairs in the order given in the matrix.

OPB1–970, 1335, 1015, 670, 3720, 790, 2680, 700, 980; OPB2–900, 965, 1335, 2680, 1630; OPB5–1215, 645, 1470, 1335, 1015; OPB7–780, 895, 445, 350, 1335, 2680, 1630; OPB7–895, 445, 350, 1060, 485, 1105, 660, 1470; OPB11–1550, 1045, 530, 420, 1335, 970, 1220, 660, 500; OPB12–1550, 1105, 1915, 930, 1410, 1160, 585; OPB20–1635, 1935, 1330, 670, 1120, 1035, 790, 682.

# The allotetraploid nature of *Dactylorhiza praetermissa* (Druce) Soó (Orchidaceae) confirmed

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ABSTRACT

Examination of variation at six allozyme loci in *Dactylorhiza praetermissa* (Druce) Sóo reveals that the species is an allotetraploid that originated in parental taxa closely related to *D. incarnata* (L.) Soó s.l. and *D. fuchsii* (Druce) Soó/*D. maculata* (L.) Soó. This confirms previous hypotheses based on cytological evidence. The genus *Dactylorhiza* contains numerous allotetraploid taxa that originated from the same parental lineages that gave rise to *D. praetermissa*. The similar genomic compositions of the various allotetraploids suggests that hybridization among them is likely to result in introgression. *Dactylorhiza praetermissa* may have gained alleles by this process.

Keywords: allotetraploidy, allozymes, hybridization.

## INTRODUCTION

The Marsh-orchids and the Spotted-orchids, which constitute the major part of the genus *Dactylorhiza* Necker ex Nevski, include a large number of closely similar taxa in north-west Europe (e.g. Heslop-Harrison 1954; Hylander 1966; Soó 1980; Gathoye & Tyteca 1994). Chromosome counts by Hagerup (1938) and Vermeulen (1938) demonstrated two principal ploidy levels in this group (diploids with 2n = 40 and tetraploids with 2n = 80), which indicated that the group formed a polyploid complex. Vermeulen (1938) also suggested that some taxa were allotetraploids derived from extant diploid lineages. Allotetraploids can be characterized as permanent hybrids in which the genomes of two distinct parents are combined. Because recombination only occurs between chromosomes of the same origin during meiosis, the hybrid allotetraploid genotype will be maintained through subsequent generations. Heslop-Harrison (1953) further extended our knowledge by performing cytological studies in triploid hybrids between the diploid *D. fuchsii* (Druce) Soó and the tetraploid *D. purpurella* (T. & T. A. Stephenson) Soó and *D. praetermissa* (Druce) Soó. He found that 20 bivalents and 20 univalents were formed in these triploids during meiosis and therefore concluded that there is a high degree of homology between the *D. fuchsii* chromosomes and half of the chromosomes in the tetraploid genomes. One of the parents of the tetraploids must therefore have been closely similar to *D. fuchsii*, and he suggested that members of *D. incarnata* (L.) Soó s.l. contributed the other constituent genome.

Allozymes are expressed as codominants and may be very useful to describe the structure of polyploid complexes (Roose & Gottlieb 1976; Gottlieb 1981; Crawford 1989). Enzyme electrophoresis and analysis of variation at allozyme loci (Hedrén a, in press) confirmed the general pattern described in the previous cytological studies on *Dactylorhiza*. The diploids *D. fuchsii* and *D. incarnata* s.l. were distinct at the allozyme loci examined, whereas all tetraploids had close affinities with one or both diploid lineages. *Dactylorhiza maculata* (L.) Soó was interpreted as an autotetraploid, originating in the *D. fuchsii* lineage, while *D. majalis* (Rchb. f.) P. F. Hunt & Summerh s.s., *D. traunsteineri* (Sauter) Soó, *D. sphagnicola* (Höppner) Soó, *D. lapponica* (Hartm.) Soó and *D. purpurella* had allozyme profiles conforming with allotetraploidy. Also, the allotetraploids were gradually modified by rare exchange of genes between the constituent genomes, which had resulted in a loss of some characteristic *incarnata* alleles in some populations of *D. purpurella* (Hedrén b, in press).

The studies on the allozyme variation in *Dactylorhiza* studies were based on material collected in

the Nordic countries, where *D. praetermissa* does not occur. However, I have now, by courtesy of British colleagues, been able to examine two populations of this species as well. Although this is a very small sample, results are sufficiently interesting to justify this brief communication.

## MATERIALS AND METHODS

The nomenclature used in the present paper follows Stace (1991) for taxa occurring in the British Isles.

Leaf material of *D. praetermissa* was obtained from two localities in southern England: Cothill, Oxfordshire (v.c. 22, Berks.; ten individuals) and a watermeadow at Winkton near Christchurch, Dorset (v.c. 11, S. Hants.; 25 individuals). *Dactylorhiza praetermissa* was compared with previously analyzed material of *Dactylorhiza* collected in northern Europe. This reference material comprised *D. incarnata* s.l. (including *D. incarnata* s.s., *D. incarnata* subsp. *ochroleuca* (Boll) P. F. Hunt & Summerh. and *D. incarnata* subsp. *cruenta* (O. F. Müll.) P. D. Sell), *D. fuchsii*, *D. maculata*, *D. purpurella*, *D. majalis*, *D. traunsteineri*, *D. sphagnicola* and *D. lapponica*. More detailed information on the origin of this material is given in Hedrén a,b (in press). Electrophoretic procedures are described in Hedrén a,b (in press). Variation was recorded at one locus in each of six enzyme systems: Phosphoglucoisomerase (Pgi, E.C. 5.3.1.9), Phosphoglucomutase (Pgm, E.C. 5.4.2.2), Triose-phosphate isomerase (Tpi, E.C. 5.3.1.1), Diaphorase (Dia, E.C. 1.6.99–), Shikimate dehydrogenase (Skd, E.C. 1.1.1.25) and Phosphogluconate dehydrogenase (Pgd, E.C. 1.1.1.44).

The material of *D. praetermissa* was compared with previously analyzed taxa by means of multivariate statistical methods (e.g. Abbott *et al.* 1985). The variation pattern in the whole group of taxa was summarized by means of a Principal Components Analysis (PCA). The alleles found at Pgi, Tpi, Pgm and Tpi were used as characters, and the number of copies of each allele as character states. Mean values were calculated for populations of each taxon, and the PCA was based on these population means. A Canonical Variates Analysis (CVA) was used to identify the best characters to discriminate among populations of the allotetraploid taxa. This analysis was based on the allozyme compositions of individual specimens, and the source population was used as the grouping variable. The CVA included information from the same four loci used in the PCA. Calculations were made using the SAS computer program (SAS Inst. 1989).

## RESULTS

At the six loci analyzed, *D. praetermissa* contained no alleles other than those found in previously studied taxa (Table 1). Moreover, *D. praetermissa* was similar to the majority of the allotetraploids in that a high proportion of the analyzed individuals have at each locus two alleles in common with *D. fuchsii*/*D. maculata* and two alleles in common with *D. incarnata* s.l.

In the ordination plots obtained from PCA (Fig. 1), the two populations of *D. praetermissa* are grouped with populations of the allotetraploid *D. majalis*, *D. traunsteineri*, *D. sphagnicola* and *D. lapponica*. *Dactylorhiza purpurella* has also been shown to be an allotetraploid (Hedrén b, in press), but it is separated from the other taxa due to low frequencies of *incarnata* alleles at Pgm and Pgd (Table 1). All analyzed populations of *D. incarnata* s.l. were identical, whereas variation occurred in both *D. fuchsii* and *D. maculata*. The allotetraploids are intermediate between *D. incarnata* s.l. and *D. fuchsii*/*D. maculata* in allozyme characters, in accordance with their hybrid origin. The positions of the populations along the third principal component (Fig. 1b) add little further information, except that *D. purpurella* is placed closer to the other allotetraploids and *D. incarnata* s.l. appears more distinct.

Populations of *D. praetermissa* were also compared with other allotetraploid taxa in a CVA. In the diagram formed by the two first canonical axes (Fig. 2a), there is a tight cluster formed by populations of *D. majalis*, *D. traunsteineri*, *D. sphagnicola* and *D. lapponica* to the right. Populations of *D. purpurella* form a separate group to the left, which is in accordance with their position in the PCA ordination plots. As regards *D. praetermissa*, the Cothill population is well embedded in the main group of allotetraploid populations, whereas the Winkton population has a

TABLE 1. ALLELE FREQUENCIES (PER CENT) IN TWO POPULATIONS OF *DACTYLORHIZA PRAETERMISSA*, COMPARED WITH SEVERAL OTHER DACTYLORCHID TAXA OCCURRING IN NORTHERN EUROPE (DATA FROM HEDRÉN A, B, IN PRESS)

| | | Pgi | | | | | Pgm | | | | | | | | Tpi | | | | Dia | | | Pgd | | | | | | Skd | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population/taxon | n | a | b | c | d | e | a | b | c | d | e | f | g | h | a | b | c | d | a | b | c | a | b | c | d | e | f | a | b | c | d |
| *D. praetermissa* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cothill | 10 | 15 | 38 | 0 | 0 | 48 | 0 | 50 | 0 | 35 | 15 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 50 | 50 | 0 | 48 | 25 | 25 | 0 | 2 | 0 | 50 | 50 | 0 | 0 |
| Winkton | 25 | 0 | 50 | 0 | 0 | 50 | 6 | 43 | 0 | 18 | 15 | 18 | 0 | 0 | 0 | 50 | 0 | 50 | 50 | 50 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 |
| Other taxa | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| *D. incarnata* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| subsp. *incarnata* | 86 | 0 | 0 | 0 | 0 | 100 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| subsp. *ochroleuca* | 32 | 0 | 0 | 0 | 0 | 100 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| subsp. *cruenta* | 64 | 0 | 0 | 0 | 0 | 100 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| *D. fuchsii* | 80 | 1 | 99 | 0 | 0 | 0 | 0 | 0 | 3 | 24 | 61 | 11 | 1 | 0 | 1 | 99 | 1 | 0 | 0 | 99 | 1 | 0 | 47 | 52 | 1 | 0 | 0 | 0 | 92 | 2 | 6 |
| *D. maculata* | 100 | 13 | 85 | 2 | 0 | 0 | 0 | 0 | 6 | 51 | 38 | 5 | 0 | >0 | 11 | 89 | 0 | 0 | 0 | 95 | 5 | 0 | 27 | 70 | 3 | 0 | 0 | 0 | 95 | 3 | 1 |
| *D. purpurella* | 116 | 0 | 50 | 0 | 0 | 50 | 0 | 6 | 44 | 3 | 47 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 50 | 50 | 0 | 14 | 76 | 10 | 0 | 0 | 0 | 50 | 47 | 1 | 2 |
| *D. majalis* s.s. | 113 | 2 | 48 | 0 | 0 | 51 | 4 | 46 | 0 | 40 | 10 | 0 | 0 | 0 | 0 | 44 | 6 | 50 | 50 | 50 | 0 | 51 | 38 | 9 | 0 | 2 | 0 | 50 | 50 | 0 | 0 |
| *D. traunsteineri* | 307 | 2 | 48 | 0 | >0 | 50 | 0 | 50 | 3 | 36 | 10 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 51 | 49 | 0 | 51 | 2 | 36 | 4 | 0 | 7 | 49 | 50 | 1 | 0 |
| *D. sphagnicola* | 121 | 6 | 56 | 0 | >0 | 38 | 1 | 50 | 0 | 43 | 7 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 50 | 50 | 0 | 49 | 1 | 26 | 23 | 0 | 1 | 50 | 34 | 16 | 0 |
| *D. lapponica* | 30 | 12 | 38 | 0 | 0 | 50 | 0 | 50 | 9 | 41 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 50 | 50 | 0 | 50 | 0 | 23 | 0 | 0 | 27 | 50 | 50 | 0 | 0 |

n: number of individuals.

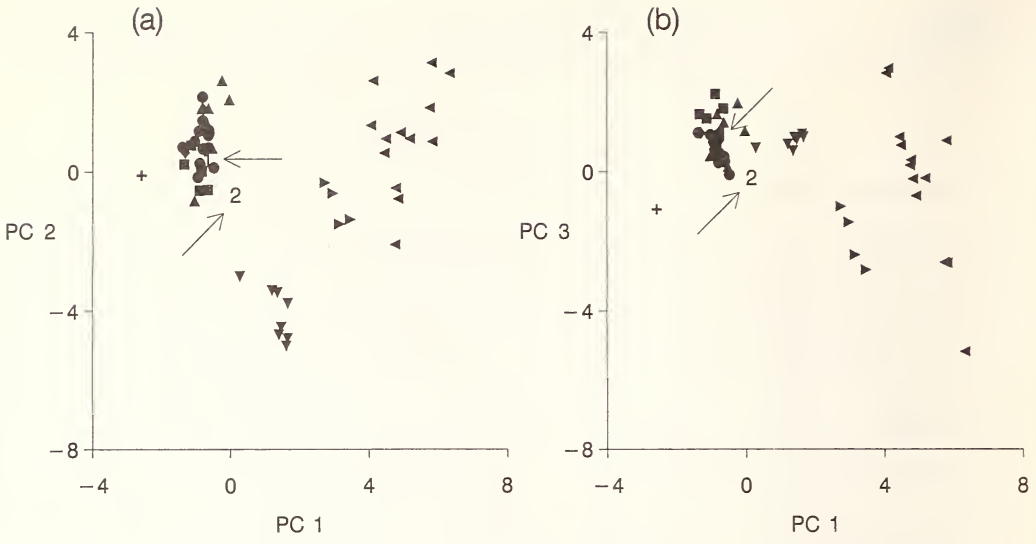


FIGURE 1. Resulting scatter plots from a Principal Components Analysis on allozyme markers in populations of the orchid genus *Dactylorhiza*. The two populations of *D. praetermissa* are indicated by arrows. The analysis was based on mean allele numbers in 83 populations of various diploid and tetraploid taxa, representing altogether 1084 individuals. Twenty-three variable characters (alleles) from four allozyme loci were used in the data matrix. The first three principal components (PC1, PC2, PC3) described 30.1%, 12.0% and 7.8%, respectively, of the total variance. (a): Plot of the first and second principal components. (b): Plot of the first and third principal components.

strongly negative value along axis 2. The reason why this population deviates from the main group, is the frequent occurrence of the allele $Pgm^f$ in many individuals (Table 1). The third canonical axis (Fig. 2b) separates populations of *D. sphagnicola* from the other allotetraploids but reveals no further information on *D. praetermissa*.

## DISCUSSION

Most of the alleles found in *D. praetermissa* are also present in *D. incarnata* s.l. or *D. fuchsii*/*D. maculata*. The two exceptions are rare occurrences of $Pgm^a$ and $Pgd^e$ (Table 1). However, these rare alleles have been found in other tetraploid taxa, indicating that they may be present in non-analyzed populations of *D. incarnata* s.l. or *D. fuchsii*/*D. maculata*. Alternatively, they have been lost from the ancestral lineages after the origin of the allotetraploids. Thus, the allozyme composition of *D. praetermissa* indicates that the taxon is an allotetraploid with close origin in the *D. incarnata* s.l. and *D. fuchsii*/*D. maculata* lineages, as predicted by Heslop-Harrison (1953), although these ancestral lineages may have been slightly modified since *D. praetermissa* evolved.

Various mechanisms have been evoked to explain the multitude of closely similar forms in *Dactylorhiza*, including hybridization followed by polyploidization, hybridization and introgression between taxa at different ploidy levels, and hybridization among taxa at the tetraploid level (e.g. Vermeulen 1938; Heslop-Harrison 1953, 1954; Lord & Richards 1977; Bateman & Denholm 1983; Jenkinson 1991). The analyses of the allozyme variation in northern European *Dactylorhiza* indicated that polyploidization was the most important mechanism, and that allotetraploids have

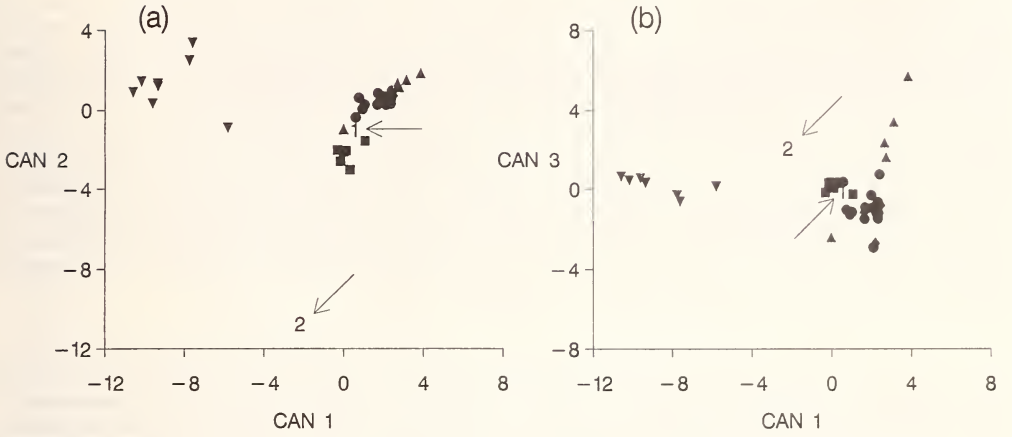


FIGURE 2. Resulting scatter plots from a Canonical Variates Analysis performed on allozyme data from allotetraploid populations of *Dactylorhiza*. Symbols as in Fig. 1. The two populations of *D. praetermissa* are indicated by arrows. The analysis included 691 individuals from 42 allotetraploid populations. Population membership was used as the grouping variable. The data matrix analyzed by the CVA included 19 variable characters (alleles) from the same four loci analyzed by the PCA. The three first canonical axes (CAN1, CAN2, CAN3) described 56.2%, 13.0% and 9.4%, respectively, of the total variance. (a): Plot of the first and second canonical axes. (b): Plot of the first and third canonical axes.

originated repeatedly from the *D. incarnata* s.l. and *D. fuchsii*/*D. maculata* lineages (Hedrén a, in press). The allozyme composition of *D. praetermissa* is consistent with this view. At any given allotetraploidization event, at most two different alleles from *D. fuchsii* or *D. maculata* could be transferred to the allotetraploid derivative. *Dactylorhiza praetermissa* is the only allotetraploid in which the *fuchsii* allele $Pgm^f$ has been found (Table 1). With the inclusion of *D. praetermissa* in the group of allotetraploids, the number of Pgm alleles shared by *D. fuchsii*/*D. maculata* and the allotetraploid group is at least four. This strengthens the view that the allotetraploid group has multiple origins; *D. praetermissa* may have originated as an independent polyploidization event.

It should also be observed that the two analyzed populations of *D. praetermissa* have three Pgm alleles in common with *D. fuchsii*/*D. maculata*. It is possible that *D. praetermissa* itself has multiple origins, but it may also be the case that alleles have been transferred to *D. praetermissa* by hybridization with other allotetraploid taxa. From a theoretical standpoint, hybridization among the allotetraploids may well result in back-crossing and introgression (Hedrén a, in press). It is sometimes also proposed that hybridization with *D. maculata* or with the diploids may contribute to increased variation in the allotetraploid taxa. However, $F_1$ hybrids formed by these combinations are expected to have comparatively low fertility (Hedrén a, in press), and in mixed populations of *D. maculata* and the various allotetraploid taxa studied in Sweden the proportion of $F_2$ hybrids plus back-crossed individuals to $F_1$ hybrids is small (Hedrén a, in press). Still, hybrids between *D. maculata* and the allotetraploids may sometimes have higher fertility than expected (Roberts 1975; Malmgren 1992), and aneuploid back-crosses have been identified in a mixed population of the diploid *D. fuchsii* and the tetraploid *D. purpurella* (Lord & Richards 1977). Therefore, the possibility of gene transfers from *D. maculata* or *D. fuchsii* to an allotetraploid cannot be excluded. Other allotetraploid dactylorchids have also been found to share three or more alleles with *D. fuchsii*/*D. maculata* at some loci, which must also be explained by either multiple origins or introgression from other taxa.

The better-known allotetraploid dactylorchid taxa appear to be fairly homogeneous over large parts of their distribution, both in external morphology and in genetic characters. Furthermore, different taxa may have evolved independently from the same ancestral lineages. The allotetraploids should have poorly developed internal barriers to hybridization, as is indicated by hybridization data (compiled by Roberts 1975). They must accordingly be isolated by external

barriers reflecting differences in flowering period, habitat preference, or distribution. However, many allotetraploid *Dactylorhiza* are partly sympatric. In areas of overlap they are often extremely difficult to separate from each other (Bateman & Denholm 1983; Jenkinson 1991), and at some localities intermediate forms connect the different taxa (e.g. *D. traunsteineri* and *D. sphagnicola* in Sweden (pers. obs.), *D. majalis* and *D. lapponica* in the Alps (S. Hansson, pers. comm.), and various allotetraploid taxa in the British Isles (Jenkinson 1991)). The poor genetic isolation and the morphological intergradation in areas of sympatry indicate that treatment of the allotetraploid marsh-orchids as taxonomic species may not be justified. They might be better treated as subspecies of a single variable species, *D. majalis*, as suggested by some recent studies (e.g. Bateman & Denholm 1983; Jenkinson 1991; see also Sundermann 1975; Soó 1980). This subspecific status still recognizes that these taxa may have evolved independently, and that they have at least partly different distributions and contrasting habitat requirements.

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# The distribution and naturalisation of *Lathraea clandestina* L. (Orobanchaceae) in the British Isles

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ABSTRACT

*Lathraea clandestina* L., the Purple Toothwort, is a native of Belgium, France, the Pyrenees and Italy. It contains no chlorophyll and is parasitic on the roots of many tree species, usually willows and poplars. It was introduced into Great Britain in the late 19th century. Since then it has been extensively planted and has become naturalised in many places. Its seeds are explosively ejected over large distances, and the plant often spreads far from planted colonies, particularly along watercourses. This paper reviews the present distribution of the plant in the British Isles.

KEYWORDS: Purple Toothwort, holoparasite.

## INTRODUCTION

*Lathraea clandestina* L., the Purple Toothwort, is native in Belgium, France, Spain and Italy (Webb 1972). In Belgium it occurs principally in East Flanders (van Rompaey & Delvosalle 1979). It is widespread in the south and west of France (Coste 1937), in the Pyrenees and the eastern end of the Cordillera Cantabrica in north-eastern Spain and occurs very locally throughout the Italian peninsula, from Pisa in the north to the Aspromonte range in southern Calabria (Pignatti 1982). It has become naturalised in the Netherlands (van de Beek 1993). It was introduced to Britain in the late 19th century and has since been extensively planted in many private and botanical gardens. There are several examples of escapes from gardens and subsequent natural establishment some distance away. *L. clandestina* was first introduced into Britain sometime before 1888. A plant was presented to the Royal Botanic Gardens, Kew in May 1888 by Dr Schumann of the Berlin Herbarium (Hooker 1890), and this is usually cited as the date of introduction. However, Tallack (1889) states that in June 1888 he had sent the plant for naming and that it had already been established at Livermere Park, Bury St Edmunds for several years. The plant is now well established in many sites throughout Britain and Ireland, both in private and botanical gardens and uncultivated areas.

## THE BIOLOGY OF *LATHRAEA CLANDESTINA*

*Lathraea clandestina* is holoparasitic, obtaining all its requirements from the roots of its host (Kuijt 1969), usually species of *Salix* or *Populus*. Freely branched underground stems bear yellowish scale leaves. Erect flowers are borne, 4–8 in a raceme, on pedicels up to 3 cm long. The corolla, 4–5 cm, is usually dark purple. The flowers appear usually between March and May. Towards the end of this period the plant is typically very difficult to find, being hidden by other low growing vegetation and for most of the rest of the year there is no evidence of the plant at all. Pollination has been observed principally by long-tongued bumblebees both in Britain and Spain (Prŷs-Jones & Willmer 1992). The nectar is secreted in the base of the corolla in a chamber closed by a narrowing of the corolla tube and by a ring of hairs at its upper end. The nectar has an unusually high ammonia content, rendering it unpalatable to birds and ants (Prŷs-Jones & Willmer 1992).

The seeds of *L. clandestina* are unusually large for a parasitic plant, being approximately 5 mm in diameter, and four or five are contained in a capsule. The seeds are explosively ejected, and they

may be thrown for a considerable distance (Druce 1925; Ridley 1930). The plant is often associated with water and transport of seed or fragments of plant along watercourses may be one of its principal modes of dispersal. Examples of this are the Roman River valley near Colchester, N. Essex (v.c. 19) where several colonies have been found downstream from a garden where it was planted (Tarpey & Heath 1990); Mickleton, in E. Gloucestershire (v.c. 33) where it established from a colony 2 km upstream and a string of sites along the River Tamar in Devon and Cornwall (v.cc. 2 & 3). However, it is not always associated with water, as for example, at Warley Place, N. Essex (v.c. 18), where it was seen growing next to a hedge at a considerable distance from a pond and well above the water level. Kuijt (1969) alludes to the possible distribution of the seeds by ants and Salisbury (1961) to transport by birds.

Germination in *L. clandestina* normally occurs only when chemically stimulated by root exudates (Heinricher 1894), although the chemical stimulus does not cause the radicle to grow towards the host (Kuijt 1969). After contact with the host root a haustorium develops whose xylem connects with that of the host's root. This haustorium ramifies over a period of many years, and may grow for ten years before flowers emerge (Heinricher 1894). This accords with many observations that flowers usually appear at least three years after planting a cutting of *L. clandestina* on the roots of a tree, e.g. Lancaster (1990). Although most reports of *L. clandestina* state the host as *Salix* or *Populus*, many other trees can apparently act as hosts. Lancaster (1990) lists *Cercidiphyllum japonicum* Sieb. & Zucc., *Corylus avellana* L. and *Acer saccharinum* L. as hosts. I have seen it very close to a hawthorn hedge (Warley Place, S. Essex, v.c. 18) and Grenfell (1985) reports it in the vicinity of *Pinus*, *Betula* and *Ilex aquifolium* L. It has been recorded on *Fagus sylvatica* L. (Anon 1904). It has also been reported on gymnospermous hosts, such as *Metasequoia glyptostroboides* Hu & W. C. Cheng at Wisley, (Surrey, v.c. 17), *Taxus* at the Royal Botanic Garden, Edinburgh (Midlothian, v.c. 83) (Matthews 1995) and on a cypress (Tallack 1889). It has been seen growing amongst bamboo plants, by myself in the University Botanic Garden, Cambridge (v.c. 29) and in Abbotswood gardens, Stow-on-the-Wold (E. Gloucs., v.c. 33) (M. Caddick, in litt. 6 June 1991). It is of course difficult to determine the identity of roots parasitised without extensive excavation.

*Lathraea clandestina* has certainly been planted in many sites, either as seed or by placing pieces of the rhizome near the roots of a tree. However, several authors (Brunker 1950; Good 1969; Hall 1980; Walsh 1958) consider that in some cases, it may have been accidentally introduced with imported trees.

*L. clandestina* is occasionally found up to several metres above the ground in old willow trees, presumably having grown up through cracks from the ground. This has been observed in Shinfield Grange (Berks., v.c. 22) (C. J. Hora, in litt. 23 April 1991), at Birmingham Botanical Gardens (Warks., v.c. 38) (M. L. Grant, in litt. 19 December 1992) and by myself at Childswickham (Warks., v.c. 38).

There is a remarkable observation which has not to my knowledge been reported elsewhere, that in a meadow in the west of France, *L. clandestina* was growing on the roots of *Alnus* but that the *Alnus* existed only as the roots and had no above ground parts (André 1893).

## PRESENT DISTRIBUTION AND NATURALISATION

The most northerly site is in Main Argyll, v.c. 98 (Fig. 1). The distribution is centred around the south of England. I am only aware of four records from Ireland. The distribution of sites known to be in existence in or after 1990 is shown in Fig. 2.

Many, but by no means all plantings of *L. clandestina* have been made in gardens. There is a well documented example of a planting in the wild. In 1908 Mr Bernard Reynolds found a patch of *L. clandestina* in Coe Fen, Cambridge (v.c. 29) and sent it for naming (Anon 1908). A reply (Druce 1908) sparked a controversy which lasted until 1920 and included letters to *The Times*, on the desirability of the Cambridge Botanic Garden "to connive as it seems to have done in the establishing of a foreign plant 'in a wild-looking station'" (Anon 1910).

Several factors cause difficulties in determining whether a particular stand of *L. clandestina* is cultivated or naturalised.

1. Colonies are very long-lived and therefore persist long after planting in sites which may not be recognisable as gardens.

FIGURE 1. The distribution of *Lathraea clandestina*. All localised sites are recorded (o = considered naturalised).

2. Colonies can become established well away from existing colonies, usually but not exclusively downstream along watercourses. This is usually presumed to be by seed but the possibility of fragments of plant being carried downstream and establishing cannot be excluded.

According to the terminology of the B.S.B.I. Plant Status Working Group (Macpherson 1995), an alien can be considered naturalised if it has been in the wild "for (say) > five years and is regenerating vegetatively or producing viable seeds". In sites where *L. clandestina* has established itself, for example along watercourses, and has been there for five years or more, it can clearly be considered naturalised. If it was planted in a wild spot and has persisted for many years (e.g. Coe Fen, Cambridge) it can also be regarded as naturalised. If the garden in which it was planted is now

FIGURE 2. The distribution of *Lathraea clandestina*. All sites known to be in existence in or after 1990 are recorded (o = considered naturalised).

unattended (as for example at Warley Place in Essex), the status is slightly more ambiguous, but I would treat it as naturalised since the garden is no longer maintained.

The records listed below have been gathered from local Floras, from B.S.B.I journals, and from other literature, from herbaria (**BM** and **RNG**) and from many letters sent to me in response to requests for information in *B.S.B.I. news*, *The garden* (Royal Horticultural Society) and the *Newsletter of the Hardy Plant Society*. Colonies growing in gardens have been included as they may well give rise to self-established colonies in the future.

Sites appended with (N) are considered naturalised by the criteria discussed above, at the present time. Those appended with (H) are historical records which have not been reported for many years.

*V.c. 2, E. Cornwall*: A colony was found near Gunnislake Bridge (SX/4.7) (N) in 1980 (Margetts & David 1981), and refound in 1988 and 1991 (M. Atkinson, in litt. 7 May 1991). A cluster of sites in Wareham Wood on the River Tamar near Gunnislake, in an area which was owned and planted by the Duke of Bedford in the 19th century. First found in 1988 (Atkinson & Atkinson 1989; Margetts & Spurgin 1991) (SX/3.7) (N). All colonies are within a few metres of the river which is liable to flood most winters.

*V.c. 3, S. Devon*: On the River Tamar at Morwellham 1973 (SX/4.6) but it has not been reported since (M. Atkinson, in litt. 7 May 1991; Ivimey-Cook 1984) and at Horsebridge (SX/4.7) (Ivimey-Cook 1984).

*V.c. 4, N. Devon*: Sydenham House (SX/4.8). Recorded in 1938 (Keble-Martin & Fraser 1939) and confirmed there recently (Ivimey-Cook 1984). Budleigh Salterton, private garden (SY/0.8). Material was collected from there in 1973 (N. Jee, in litt. 22 April 1991). Stowford (SX/4.8). Extensive patches in wet woodland, recorded in 1989 (Heath 1990).

*V.c. 6, N. Somerset*: Lower Weston, Bath (ST/7.6) (N). Reported on an overgrown shrubbery by a stream in 1954 (Gilwhite 1954). It has been seen recently (I. P. Green, in litt. 30 March 1994). Bath Botanic Garden (ST/7.6). It was transferred here in 1967 from a nearby site, Lower Weston (Roe 1981) and was still growing in the Botanic Garden in 1994 (I. P. Green, in litt. 30 March 1994).

*V.c. 8, S. Wilts.*: Easterton (SU/0.5). On Aspen in the west Wood, 1992 (Gillam 1993).

*V.c. 9, Dorset*: Minterne Estate (ST/6.0). Recorded in 1961 (Good 1984) and known there at least until 1985 (D. Paul, in litt. 20 March 1991). Forde Abbey, Chard (ST/3.0). On willows in bog garden (R. Smith, in litt. 29 April 1992). Broadstone, near Poole (SZ/0.9) (N). This was recorded in 1968 in derelict garden (Good 1969; 1984) and several years later, at the base of a roadside hedge (Grenfell 1985). Ansty, Dorchester (ST/7.0), private garden. Planted in 1986 and growing well in 1991 (A. Stevens, in litt. 19 August 1991).

*V.c. 11, South Hants.*: Chandler's Ford (SU/4.2). Introduced to Hillier's former nursery from Cambridge Botanic Garden in about 1963 by R. Lancaster (in litt. 9 January 1991). Hillier Arboretum, Romsey (SU/3.2). Introduced from Chandler's Ford in the early 1970s again by R. Lancaster (in litt. 9 January 1991).

*V.c. 13, W. Sussex or v.c. 14, E. Sussex*: A considerable quantity of *L. clandestina* was reported in Sussex by Watson (1920) but no locality was given.

*V.c. 13, W. Sussex*: Near Hawkin's Pond, St Leonards Forest, near Horsham (TQ/2.2). 1920, *collector unknown* (**BM**). Near Horsham, 1930, *Miss N. Smart 1930* (**BM**). By Hawkins Pond near The Goldings, St Leonards Forest, 1953, *J. E. Lousley* (**RNG**). By pond in St Leonards Forest, 1964, *E. C. Wallace* (**RNG**). Manning's Heath (TQ/2.2) (N). Reported by Hall (1980). On a roadside bordering a pond. Seen in 1991 (A. Hoare, in litt. 5 August 1991).

*V.c. 14, E. Sussex*: Wakehurst Place (TQ/3.3). Found in 1969, when Wakehurst Place was acquired by the Royal Botanic Gardens, Kew. Seen in 1992 in several sites in the garden (A. Hoare, in litt. 5 August 1991; J. Chidell, in litt 26 March 1991). Great Dixter, near Northiam (TQ/8.2). Well established in garden (Lancaster 1990). Cox's Mill, Dallington, on planted willows in a swamp (TQ/6.2) (Hall *et al.* 1960; 1961, *J. E. Lousley* (**RNG**); Hall 1980). Turner's Hill near Crawley (TQ/3.3), 1958, *Mrs Harbridge* (**BM**).

*V.c. 16, W. Kent*: Mereworth (TW/6.5) (N). Naturalised on poplars (Philp 1982).

*V.c. 17, Surrey*: Lightwater (SU/9.6) (N). Naturalised along stream (Leslie 1986). Side of Hindhead Road, north of Shottermill (SU/8.3) (N). First recorded before 1962 (Howard 1962). Introduced by the former owner of Frensham Hall (Lousley 1976; L. Ponsonby, in litt. 17 August 1991). Royal Botanic Gardens, Kew (TQ/1.7). Presented in 1888 by Dr Schumann of the Berlin Herbarium (Hooker 1890) and grown on a "willow adjacent to the ornamental water in front of the Palm-house" (Anon 1889). Seen c. 1990(!) near the Princess of Wales House. Royal Horticultural Society Gardens, Wisley (TQ/0.5). Seen in 1991 near the pond (S. Berrett, in litt. undated). Canizzaro Park (TQ/2.7), relic of cultivation 1978 (Burton 1983; Leslie 1986). Egham. London University Botanic Garden (SU/9.7). A good number of plants in a wet area of the arboretum (A. Daly, in litt. 1991).

*V.c. 18, S. Essex*: Warley Place (TQ/5.9) (N). The former garden of Miss E. A. Willmott. It was recorded here by Shenstone (1912). The garden was subsequently abandoned in the 1930s and is now a nature reserve. It was noted in 1972 by Hollick (1973), Jermyn (1974) and subsequently by

D. Thomas (in litt. 20 April 1991). Several colonies were seen in 1991(!). It has spread to the hedge in Dark Lane, a lane on the western edge of the garden (1958, *B. T. Ward* (**RNG**); 1964, *J. E. Lousley* (**BM**); 1971, *Mrs A. M. Horowitch* (**BM**); Jermyn (1974)).

*V.c. 19, N. Essex*: Colchester, private garden (TL/9.2) (G. Edwards, in litt. 17 March 1991). Pye's Fruit Farm, Hounslow Green (TL/6.1) (Jermyn 1974). Chest Wood, Colchester (TL/9.2) (N). First observed in 1974. Presumed to have arrived from a site 5 km upstream where it was planted with French stock in the early 1970s. (Tarpey & Heath 1990; G. Edwards, in litt. 17 March 1991), 1991(!).

*V.c. 20, Herts.*: Whitney Wood, Stevenage (TL/2.2) (N). Recorded in 1954 (Dony 1967) and still present in 1991 (P. Harmes, pers. comm., 1991). Knebworth House (TL/2.2), recorded as naturalised in 1935 (Dony 1967). Bayfordbury Estate near Hertford (TL/3.1). It has probably been here for over 50 years. The estate used to be the site of the John Innes Institute. Seen in 1991 (G. Hanson, in litt. 25 April 1991). Broxbourne, private garden (TL/3.0). Arrived about 1983 but was not planted (D. Parsons, in litt. 5 March 1991).

*V.c. 21, Middlesex*: Myddleton House, Bulls Cross, Enfield (TQ/3.9). Formerly the home of the plantsman E. A. Bowles. Seen in 1991 (M. Laughton, in litt. 4 March 1991). Regents Park (H) (TQ/2.8). Growing in the garden of the Royal Botanic Society (Anon 1904).

*V.c. 22, Berks.*: Plentiful on bank of River Embourne (1964, *A. R. Hadden* (**BM**)). This record is unlocalised but a number of sites are close to the River Embourne; Inwood copse, Newbury (SU/5.6) (N). Locally abundant on poplars, in damp alder gullies (J. Norton, in litt. 20 April 1991); Crookham Common (SU/5.6) in an alder gully, 1966 (Bowen 1968), and Brimpton, private garden (SU/5.6) (C. J. Hora, in litt. 23 April 1991). Newbury (SU/4.6), 1961 (Bowen 1968). Prospect Park, Reading (SU/6.7). First recorded here in 1959 (Bowen 1968). Recorded in 1962, *collector unknown* (**RNG**) and 1986, *H. J. M. Bowen 4902* (**RNG**). Next to a pond (C. J. Hora, in litt. 23 April 1991). Savill Gardens, Windsor Park (SU/9.7) (C. J. Hora, in litt. 23 April 1991). Shinfield Grange, Reading (SU/7.6). Introduced in about 1980. Abundant in 1991 (C. J. Hora, in litt. 23 April 1991). Tidmarsh, private garden (SU/6.7) (C. J. Hora, in litt. 23 April 1991).

*V.c. 25, E. Suffolk or v.c. 26, W. Suffolk*: Livermere Park (H) (TL/8.7). Planted before 1888 (Tallack 1889) and last reported in 1910 (Druce 1910; 1910, *G. C. Druce* (**BM**)) (who reported that it was planted in 1894). Druce (1925) was unable to find it in June, 1925.

*V.c. 25, E. Suffolk*: Letheringham Mill, Woodbridge (TM/2.5). Two plants were introduced from the Pyrenees in the late 1970s (F. W. Simpson & E. M. Hyde, in litt. 1993), 1992(!) when both purple and white flowers were seen. White flowers were seen in 1978 (*loc. cit.*).

*V.c. 26, W. Suffolk*: Higham, private garden (TM/0.3). Planted in 1970s from Aveyron. Not reported since 1978 (L. Gooden, in litt. 28 February 1991).

*V.c. 29, Cambs.*: Coe Fen, Cambridge (TL/4.5) (N). Planted before 1908 from the Cambridge University Botanic Garden (Druce 1908). Subsequent records are: 1952, *D. P. Young* (**BM**); 1946, *J. E. Lousley* (**RNG**) and 1991(!). Cambridge University Botanic Garden (TL/4.5). It has clearly been here since the early years of the century, and has been taken from here to many other sites. It is currently to be found on the north side of the lake.

*V.c. 33, E. Gloucs*: Mickleton (SP/1.4) (N). Three colonies on *Salix*. First recorded in 1976 (Holland *et al.* 1986). Originated from Hidcote gardens about 2 km upstream, 1991 (M. Caddick, in litt. 6 June 1991; Dudley 1993). Bledington (SP/2.2) (N). On the southern bank of the Westcote Brook (J. Chapman, in litt. 22 April 1991). Sezincote Gardens (SP/1.3). Next to a stream, on *Cercidiphyllum*, 1991 (M. Caddick, in litt. 6 June 1991; J. Turner, in litt. 29 July 1991). Abbotswood gardens, Stow-on-the-Wold (SP/1.2). Reported in 1968 and in 1984 (Holland *et al.* 1986). Many hundreds of plants widely naturalised on various trees and bamboo (M. Caddick, in litt. 6 June 1991). Ampney Park, near Cirencester (SP/0.0) (Holland *et al.* 1986). Seen in 1991 (M. Caddick, in litt. 6 June 1991). Hidcote Manor Garden (SP/1.4), now a National Trust property. By the bridge in the Lower Stream Garden. Seen in 1990 (J. Briggs, in litt. 23 September 1991 & J. Turner, in litt. 29 July 1991). Near Cheltenham. In stone duct in bank, 1946 (H) (Riddelsdell *et al.* 1948). Near Moreton, 1944 (H) (Riddelsdell *et al.* 1948). Colesborne (SO/9.1) (H). In a saw yard, parasitic on Hazel, 1938 (Riddelsdell *et al.* 1948).

*V.c. 34, W. Gloucs.*: Hyde Hill, Chalford (near Stroud) (SO/8.0) (N), first recorded in 1964 (Holland *et al.* 1986). Seen in 1991. Plentiful by footpath, probably an escape from Hyde Lodge (M. Caddick, in litt. 6 June 1991). Brimscombe (SO/8.0), by footpath, first recorded in 1956

(Holland *et al.* 1986). Seen in 1991 (M. Caddick, in litt. 6 June 1991). Hyde Lodge (SO/8.0) where it was planted in about 1926. (M. Caddick, in litt. 6 June 1991).

*V.c. 35, Mons.*: Lydart (SO/5.0). Old Green Lane, recorded in 1987 (Harper 1990).

*V.c. 36, Herefs.*: Putley, nr Ledbury (SO/6.3). Imported from Birmingham around 1960 (F. Hadfield, in litt. 6 May 1991). Old Court Nursery, Colwall, (SO/7.4) (H), 1925–1935 (S. Thomson, in litt. 29 June 1995). Garway (SO/4.2). On the banks of the River Monnow, undated record (S. Thomson, in litt. 29 June 1995). Both records are given in less detail by Whitehead (1976).

*V.c. 37, Worcs.*: Beoley Hall, Redditch (SP/0.7). Of unknown date. The source of at least two plantings. Chaddesley Corbett, private garden (SO/8.7), derived from Beoley Hall. Hopwood, private garden (SP/0.7), derived from Chaddesley Corbett. Lydiate Ash, private garden (SO/9.7), derived from Beoley Hall (A. Ogden, in litt. 25 July 1991).

*V.c. 38, Warks.*: Birmingham Botanic Gardens (SP/0.8) (A. Gagg, in litt. 27 April 1991; M. L. Grant, in litt. 19 December 1992). It was introduced in c. 1974 from the Hillier Arboretum in Hampshire (Dudley 1984). University Botanical Garden, Birmingham (SP/0.8). Seen in 1988 (A. Gagg, in litt. 27 April 1991; M. L. Grant, in litt. 19 December 1992). Tanworth-in-Arden, private garden (A. Ogden, in litt. 25 July 1991). Childswickham (SP/0.3) (N). Seen in 1981 (A. Gagg, in litt. 27 April 1991), along a brook for c. 400 m, 1994(!).

*V.c. 39, Staffs.*: Albrighton, private garden (SJ/8.0), 1994(!), introduced from Birmingham Botanic Garden in 1983 (P. Edwards, in litt. 12 March 1991).

*V.c. 48, Merioneth*: Esgair-geiliog, N. of Machynlleth (SH/7.0) (N). On W. bank of Afon Dulas. Last recorded in 1990 (Grasse & Morton 1995). Llanfihangel-y-traethau (SH/5.3) (N). Growing outside a garden wall. Introduced c. 30 years ago and now well naturalised. Last recorded in 1993 (A. Daly, in litt. 1991; Hughes 1995).

*V.c. 57, Derbys.*: Egginton Hall (SK/2.2) (N). First recorded in 1974 (Clarke 1975). Seen in 1992 and reported as having been there for some 50 years (R. Smith, in litt. 29 April 1992). I was not able to find it in 1992, or 1995. Hilton Gravel pits (SK/2.3). Found in 1980. Probably a recent introduction. Not on the same watercourse as the nearby Eggington Hall population (R. Smith, in litt. 29 April 1992). I was not able to find this in 1995.

*V.c. 58, Cheshire*: Tarporley, private garden (SJ/5.6). Introduced from Ness Botanic Garden (A. Goulty, in litt. 6 March 1991). Irby, Wirral (SJ/2.8). On a willow in a small wood next to a right of way. Seen in 1991 (M. Wilson, in litt. 26 April 1991). University of Liverpool Botanic Garden at Ness (SJ/3.7).

*V.c. 61, S.E. Yorks*: Cottingham Botanic Garden, Hull University (TA/0.3). Seen in 1959 (Nelson 1959), probably from Cambridge.

*V.c. 62, N.E. Yorks.*: Grey Towers, Nunthorpe (NZ/5.1). Long established on the roots of *Salix* (Lawrence 1994).

*V.c. 63, S.W. Yorks.*: Sheffield Botanic Garden (SK/3.8). 1990(!). There are at least two colonies (D. Williams, in litt. 28 January 1991).

*V.c. 64, Mid-W. Yorks.*: Askham Richard (H) (SE/5.4), in Parson's Wood, behind the Vicarage. Brought from Bath in 1919 and last recorded by Nelson (1959). I was unable to find it in 1995. Adel Dam, near Bramhope, Leeds (SE/2.4), seen c. 1990 (Geoffrey Willmore, in litt. 27 July 1995; Lavin & Wilmore 1994).

*V.c. 66, Co. Durham*: Windlestone Hall grounds (NZ/2.2). Thirty plants seen in 1971 (Graham 1988).

*V.c. 74, Wigtowns.*: White Loch of Myrton (NX/3.4). Recorded in 1979 (Lang 1981).

*V.c. 81, Berwicks*: Duns Castle (NT/7.5) (N). On the edge of the loch. Naturalised since 1962 (Braithwaite & Long 1990). Reported by Beattie (1963). Seen in 1981 by C. O. Badenoch (in litt. 4 June 1991).

*V.c. 82, E. Lothian*: Haddington by River Tyne (NT/4.6) (N). Reported as having been present near the junction of Tyne Water and Birns water, but destroyed in the 1948 floods (Basden 1957; 1948, *E. B. Basden* (**BM**)). It was refound approximately 5 km downstream in 1971 (NT/4.7) (N) (Jones 1974) and in the same locality in 1991(!). A cluster of sites in this region is implied by Silverside & Jackson (1988), who remark that it is "very locally naturalised on the banks of the upper part of the River Tyne and its tributaries".

*V.c. 83, Midlothian*: Royal Botanic Garden, Edinburgh (NT/2.7). Known since at least 1967 by

D. R. McKean (in litt. 10 January 1992). Bush Estate, Penicuik (NT/2.6) (D. R. McKean, in litt. 10 January 1992; McKean (1988)). Logan House (NT/2.6) (Beattie 1961; McKean 1988; D. R. McKean, in litt. 10 January 1992).

*V.c. 98, Main Argyll*: Arduaine Gardens, Loch Melfort (NM/7.1). Present in considerable quantity (P. Wilberforce, in litt. 29 April 1991).

*V.c. S, Channel Islands, Guernsey*: private garden. Introduced in 1973 from Budleigh Salterton (N. Jee, in litt. 22 April 1991).

*V.c. H20, Co. Wicklow*: Marlton House, Wicklow (T/3.9) (H). In a copse in a wet hollow, 1940 (Brunker 1950).

*V.c. H21, Co. Dublin*: In the grounds of Holy Cross College, Clonliffe, Dublin (O/2.4) (H), seen in 1956 and 1957 (Walsh 1958). National Botanic Gardens, Glasnevin (O/2.4) where it was accidentally introduced with foreign plants. Still prolific. A herbarium specimen in **DBN** is dated 1943 (Walsh 1958).

*V.c. H38, Co. Down*: Helen's Bay, near Bangor (J/4.8), in a garden, 1990, Hackney (1992).

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# British species of *Rubus* L. (Rosaceae) in the Cotentin Peninsula of Normandy

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ABSTRACT

36 species of *Rubus* L. (Rosaceae) also known in Great Britain are accepted as present in the Cotentin Peninsula of dép. Manche, Normandy, France. 23 of these are additional to those judged to have been recorded reliably by local botanists before 1900. Eight are new to the European mainland, though four of those are known also in the adjacent Channel Islands. The British element, far outnumbered by non-British species, is more strongly evident in the west half of the Peninsula, the moister climate of which supports a *Rubus* florula with closer affinities with that of Devon and Cornwall than of the part of England directly opposite.

Keywords: brambles, Channel Islands, distribution.

## INTRODUCTION

Given that the part of the European mainland most closely adjacent to England tends to have soils too basic for a mainly calcifuge group like *Rubus*, it is surprising that more attention has not been paid by British batologists to that largely acid portion of Normandy that juts out into the wider stretch of the English Channel opposite the Isle of Wight and the Purbeck district of Dorset. This, the Cotentin Peninsula, occupies roughly the northern third of Manche, the westernmost of Normandy's five départements. Though its south-east quarter is predominantly clay, most of the rest is sandstone or granite. It still possesses substantial areas of unconiferised oak-beechwood, especially in its north-east corner, extensive tracts of heathland (mainly near the coasts) and that abundance of small hedged fields of considerable antiquity for which Normandy is famous – though the classic bocage country begins to the south. Together with a warm, moist climate it thus has a combination of features especially conducive to *Rubus* diversity.

## EARLIER WORK

Until the last few years, however, the area appears to have received not a single visit from anyone well-versed in *Rubus* in Britain. Though W. Moyle Rogers did go so far as to reconnoitre parts of Normandy and Brittany in 1897, he omitted the Cotentin (to judge from the localities of the specimens he collected on that occasion, now in **BM**). Though W. C. R. Watson, too, "spent a holiday on the *Rubus* ground of Normandy", according to a manuscript note by W. C. Barton in **BM**, I have found no evidence that he penetrated to the Cotentin either. In so far as investigation of the group in the area proceeded at all, it did so at the hands of local French botanists working in isolation and adhering to the over-broad species concept that prevailed in batology till around 1900. Foremost among these was L. Corbière (1894, 1896, 1898), a teacher at the Cherbourg lycée, who collected extensively around that city and distributed many specimens through the contemporary Association rubologique – on the whole with unhelpful results in response. Some of his material was subsequently re-examined and in part redetermined by Sudre (1908–13), along with a few specimens collected by two of his local predecessors, A. F. Le Jolis, a merchant in Cherbourg and founder, director and editor of its Société de Sciences naturelles, and J. E. Lebel, a physician in Valognes (Sudre 1902, 1906). Unfortunately, Sudre had no first-hand acquaintance with the Cotentin *Rubus* flora and, unaware of its high content of seeming endemics, put names over-confidently to single

specimens which, as he himself acknowledged, were also in many cases in poor condition. His determinations consequently are best treated with extreme reserve. A few records published by Morière (1879) complete the total of the earlier work.

## RESULTS OF RECENT COLLECTING

After several years investigating the group in the coastal counties of England directly opposite and, later, the Channel Islands, I made a two-day reconnaissance of Cherbourg and its southern environs in 1987. This was followed by more extended visits, each of a fortnight's duration, in 1991 and 1993, in the course of which most parts of the Peninsula were sampled and extensive collections made. As a result of the paucity of reliably-determined material from this region of France in British herbaria about three-quarters of these specimens, now in **BM**, remain unnamed. Many of them, including series of several widespread forms, are probably of species as yet undescribed. At some time in the future, when the study of the French *Rubus* flora is rescued from its present neglect, these collections may come more fully into their own.

Meanwhile, the extent to which British Isles named species also occur in the Cotentin seems worth placing on record. Though fewer of these have been found than expected, they include a number hitherto supposed to be endemic to these islands. No less unexpected has turned out to be the marked affinity with the *Rubus* florula of south-west England – rather than with that of the counties directly opposite. The Peninsula's protrusion into the English Channel evidently exposes it to a more maritime climate than the latter, while the influence of the Gulf Stream, so pronounced in the Channel Islands, extends as well to the Cotentin's west coast. Doubtless for this latter reason the west half of the Peninsula has a *Rubus* florula with a more noticeably British aspect. The north-east, by contrast, is decidedly richer in species and those few it shares with Britain include some, like *R. scaber* and *R. subinermoides*, with British ranges with a strong south-eastern trend. Even so the seeming absence from the Peninsula of so common a Wessex species as *R. asperidens* Sudre ex Bouvet (*R. milesii* A. Newton), which, moreover, is also widespread in the region of the Western Loire to the south, is striking, reinforcing the impression that the Cotentin, like the Cornish Peninsula, has been rendered by its specialised climate and relatively constricted geography substantially immune to penetration from outside and produced in compensation a *Rubus* florula that is autochthonous in origin in no small part.

In the list which follows earlier records are cited only in the case of species that seem likely to have been determined reliably. The spelling of place-names is in accordance with that of the 1 cm : 250 m maps of the Institut Géographique National in cases where there are disagreements with that of the 1 cm : 1 km ones. Species added to the flora of the European mainland as a result of the 1987–93 fieldwork are highlighted with an asterisk.

Subsect. *Rubus*

*R. bertramii* G. Braun Bois du Rabey, two bushes.

*R. nessensis* W. Hall Bois du Mont du Roc, Sideville (Corbière 1898).

*R. vigorosus* P. J. Müller & Wirtgen Lande St Nazaire Beaumont.

Subsect. *Hiemales* E. H. L. Krause

Ser. *Sylvatici* (P. J. Müller) Focke

*R. boulayi* (Sudre) W. C. R. Watson Widely but mostly very thinly scattered (in marked contrast to its abundance in the Bournemouth area). Scarce or absent in the larger woods and met with in quantity only in the plantations of Château Flamanville and in old gravel pits west of Quinéville. Not a species recognised in Corbière's time, but according to Watson (1958) found at Cherbourg by Le Jolis.

*R. couchii* Rilstone ex D. E. Allen Hedge near Le Maupas, Cherbourg, 1889 (Corbière, Assoc. rub. 893, as *R. obvallatus*: **G, P**). Otherwise known only in Jersey and south-east Cornwall (Allen 1994).

*R. imbricatus* Hort. Waste site at foot of Mont du Roule, Cherbourg, 1987 (since destroyed).

**R. purbeckensis* W. C. Barton & Riddelsdell Gorse scrub south of Le Becquet de Tourlaville, only the one clump seen. New to mainland Europe.

*R. questieri* Lef. & P. J. Müller Locally common, even in places abundant, in open woods and their adjoining hedges – except in the north-east, where it is scarce and apparently confined to newly-cleared areas, suggesting a recent colonization. This conflicts to some extent with the statement by Corbière (1894) that it is common in all the woods between Cherbourg and Valognes.

Ser. *Rhamnifolii* (Bab.) Focke

*R. cardiophyllus* Lef. & P. J. Müller Rare (as in the Channel Islands): Lande St Nazaire, Beaumont; Val de Bas, Biville, one bush; heathland, Forêt de Pirou, in plenty.

**R. dumnoniensis* Bab. Les Marequiers Bois, near Bricquebec, two patches. New to mainland Europe (but in the Channel Islands and plentiful in Alderney). Sudre (1908–13) claimed to have seen material of this from dép. Manche, but the species was not well understood at that period and the determination is unlikely to have been correct.

*R. polyanthemus* Lindeb. North-west corner only: Lande de Beaumont and nearby Lande St Nazaire.

*R. prolongatus* Boulay & Letendre Locally common in the west half, much scarcer in the east. Corbière (1894) called it "assez commun", without geographical distinction.

*R. rubritinctus* W. C. R. Watson Apparently very rare (as in the Channel Islands): Lande de Carneville, three patches along one path.

*R. subinermoides* Druce Bois du Rabey, a colony on a small clay outcrop on the east margin of the north section. New to France, but though described by Edees & Newton (1988) as endemic to Britain now known to be widespread in the Low Countries as well.

Ser. *Sprengeliani* Focke

*R. sprengelii* Weihe Lande St Nazaire, Beaumont. Lande Cadeau, Martinvast; Bois du Mont du Roc, Sideville; environs of Le Tronquet, Tourlaville (Corbière 1896). Near Cherbourg (Le Jolis: Sudre 1902).

Ser. *Discolores* (P. J. Müller) Focke

*R. ulmifolius* Schott Very common.

Ser. *Vestiti* (Focke) Focke

*R. adscitus* Genev. Surprisingly scarce (once again, as in the Channel Islands): wood 1 km north of Barneville, locally common; Bois du Rabey, colony on east edge. Environs of Cherbourg (Corbière 1896).

*R. boraeanus* Genev. Generally distributed and locally abundant, in woods, scrub and hedges. Unaccountably, Corbière recorded this only from one locality (Corbière 1898).

*R. corbieri* Boulay Common in the west half, especially by the coast, continuing south at least to Portbail Plage and a line eastwards, but conspicuous by its absence from the east half. Otherwise known only in the Channel Islands (in all four main ones) and the Purbeck district of Dorset, v.c. 9.

Ser. *Micantes* Sudre ex Bouvet

**R. fuscoviridis* Rilstone A solitary clump on a hedge-top on D120 by Le Moulin de Bernavast, 0·5 km west of Hameau Valognes, Val de Saire. New to mainland Europe. Otherwise known only from Devon and east Cornwall.

[*R. glareosus* Rogers A specimen collected at Greville-Hague by H. Vannerom in 1971 (duplicate in **BM**) has been determined by A. Newton as this, but it does not look entirely convincing and a fuller range of material is desirable before the species is accepted unequivocally as other than endemic to Britain.]

*R. leightonii* Lees ex Leighton Abundant on heathland, Forêt de Pirou (at the far south end of the Peninsula).

*R. melanodermis* Focke Bois de Pépinvast, frequent; heathy slope bordering Bois de Blanqueville; Bois de Pierreville, colony in felled area; heath west of La Pernelle. A specimen collected by

H. Vannerom in dép. Côtes-du-Nord in Brittany in 1971 has already added this species to the flora of the European mainland.

Ser. *Anisacanthi* H. E. Weber

*R. dentatifolius* (Briggs) W. C. R. Watson Gorse heath above Anse du Brick, in plenty; Mont du Roule, Cherbourg, one patch. Ought to be much commoner in view of its wide occurrence in the Channel Islands and especial abundance in Alderney.

**R. leyanus* Rogers Wood 1 km north of Barneville, locally frequent. New to the European mainland (though recently found in one place in Guernsey).

Ser. *Radula* (Focke) Focke

**R. bloxamii* (Bab.) Lees Bois de Pierreville, in plenty; otherwise single bushes or patches: wood margin, La Glacerie Église; Forêt de Pirou, beside D94; Bois de Pépinvast; Vallée des Moulins, Fermanville. New to the European mainland, though widespread in Jersey and Guernsey (Allen 1992).

**R. botryeros* (Focke ex Rogers) Rogers Shady farm lane off N13 west of La Glacerie Église. New to the European mainland.

*R. flexuosus* P. J. Müller & Lef. Les Marequiers Bois, near Bricquebec, in plenty; heathy margin of Bois de Blanqueville.

*R. insectifolius* Lef. & P. J. Müller Margin of Forêt du Mont Castre, a few bushes. Surprisingly rare in view of its profusion south of the New Forest.

*R. longithyrsiger* Lees ex Focke Widespread and abundant in many of the woods. The lack of any specimens or records of it by Corbière may indicate a great increase since his day; alternatively, he may have confused it with the similar species he described as *R. lejolisii*. Though believed endemic to Britain and Ireland by Edees & Newton (1988), this has subsequently been found in Brittany in dép. Finistère.

*R. multifidus* Boulay & Malbranche Forêt de St-Sauveur and nearby hedges, abundant; Bois de Pépinvast, occasional; hedges west of La Glacerie Église. Cherbourg and environs (Corbière 1894). Contrary to my earlier view (Allen 1992) that this is merely a red-styled variant of *R. bloxamii*, a population of the two growing intermixed in a forest in dép. Mayenne has subsequently convinced me that they are separate species after all. The characters distinguishing *R. multifidus* (including its different facies when growing) tend to be lost in dried material, which explains why its claims to distinctiveness have been repeatedly dismissed by batologists without the benefit of acquaintance with it in the field.

[*R. rufescens* Lef. & P. J. Müller Bois de Bricquebec, in damp shady places, 1892 (Corbière: Ass. rub. 1175). The specimen in G so named is not this species; it was redetermined by Sudre as *R. insericatus* P. J. Müller ex Wirtgen, another member of ser. *Radula*, unknown in Britain.]

Ser. *Hystrix* Focke

*R. thyrsigeriformis* (Sudre) D. E. Allen Widespread, but nowhere in quantity. Not confined to shade, it exhibits the same tolerance of dry, basic conditions evident in some of its localities in Hampshire (cf. Allen 1989). Corbière (1894), who knew this bramble under the erroneous name of *R. radula* subsp. *uncinatus*, found it to be "assez commun" in Cherbourg and environs.

**R. tumulorum* Rilstone Grounds of Château des Ravalets, Tourlaville, only the one bush seen. New to mainland Europe. Otherwise known only in Devon and east Cornwall (like *R. fuscoviridis*).

Ser. *Glandulosi* (Wimmer & Grab.) Focke

*R. scaber* Weihe Bois du Rabey, local.,

Sect. *Corylifolii* Lindley

*R. nemorosus* Hayne & Willd. Rare. Wood 1 km north of Barneville; Forêt de Pirou; Bois de Pierreville. Single bushes or clumps in each case. Lessay (Corbière 1898).

*R. pruinosus* Arrh. Wood 1 km north of Barneville, a patch; gorse scrub south of Le Becquet de Tourlaville, a colony.

**R. transmarinus* D. E. Allen Coastal heaths east of Cherbourg, at intervals, from south of Le Becquet de Tourlaville (in plenty) to Le Petit Bois, Château St Pierre-Église (Allen 1994).

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I am grateful to A. Newton for assistance with determinations. Material of most of the rarer species in the list has been seen by him. R. W. Gould kindly also examined the specimen of *R. tumulorum* and confirmed that it tallies with that species as he knows it in Devon. I owe a more general debt to Dr F. Rose for giving me the benefit of his wide knowledge of Cotentin habitats and directing me to the more promising ground at the outset.

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# Notes

## NEW COMBINATIONS IN BRITISH ALIEN GRASSES

During the course of preparation of a checklist of alien grasses in the British Isles, T.B.R. came across two species that lacked combinations in the genera to which they are currently assigned (in part following Clayton & Renvoize 1986). With the help of T.A.C., the appropriate generic affinities were confirmed and the required new combinations are set out below.

**Ceratochloa sitchensis** (Trin.) Cope & Ryves, **comb. nov.**
Basionym: *Bromus sitchensis* Trin., *Mémoires de l'Académie Impériale des Sciences de St.-Pétersbourg. Sixième série. Sciences mathématiques, physiques et naturelles* **2**: 173 (1832).
Holotypus: Alaska, *K. H. Mertens* (**LE**, n.v.).
Native of North America (Alaska to Oregon).

The generic name *Ceratochloa* is adopted here in order to conform to generic concepts in Stace (1991). Acceptance of the name at generic rank is, however, at variance with other modern treatments which either prefer the taxon at a lower rank (e.g. Hitchcock (1951) and Clayton & Renvoize (1986) who opt for a section of *Bromus*) or do not recognize it as distinct at all (Watson & Dallwitz 1992).

**Helictotrichon recurvatum** (Swallen) Cope & Ryves, **comb. nov.**
Basionym: *Amphibromus recurvatus* Swallen, *American journal of botany* **18**: 415 (1931).
Holotypus: Tasmania, *R. A. Black 1225* (**US**).
Native of Australia (Tasmania, Victoria and South Australia).

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## *CYSTOPTERIS DICKIEANA* R. SIM IN THE CENTRAL AND EASTERN SCOTTISH HIGHLANDS

*Cystopteris dickieana* R. Sim was reported in the last century from several inland Scottish localities but very few of these records have been confirmed. The only recent Scottish records have been from coastal sites very near the type locality in Kincardines., v.c. 91, although, based primarily or solely on the single character of its distinctive spore type, it has been reported recently from several localities on the Continent, in North America and China.

In July, 1992 I discovered *C. dickieana* in Mid Perth, v.c. 88, where it had been previously recorded (see below), and in July, 1993 in Easterness, v.c. 96, from which there were no previous

records. The Perthshire plants differed morphologically from *C. dickieana* from the type locality although they were also more distinct from typical *C. fragilis* (L.) Bernh. than many of the Continental specimens which have been referred to *C. dickieana*. In July, 1995 I discovered a second site for *C. dickieana* in Mid Perth, v.c. 88.

### SCOTTISH RECORDS OF *C. DICKIEANA*

The records of *C. dickieana* from coastal sites in Kincardines., v.c. 91, including those from the type locality, have been well described by Marren (1984). Dickie's Bladder-fern was first discovered there by Professor William Knight prior to 1838 and shown by him to George Dickie. The first published reference to its locality appeared in G. Dickie's *Flora Abredonensis* (1838) and the type gatherings, made by Dickie in 1842, are in **BM** and **K**. Many of the old records from other parts of Scotland are less certain as several of the specimens have not been traced and only a few of the old specimens have been confirmed recently, but they include the following:

*Mid Perth, v.c. 88* (Herbarium specimens)

Ben Lawers, *R. Brown*, August 1794, **BM**

Ben Lawers, "Sent to W. Wilson" July 1827, **MANCH**. Confirmed A. C. Jermy.

Ben Lawers, Collector not known, 1842, **E**. Determined D.J.T.

Above Loch Tay, GR NN/6.3, *D. J. Tennant*, 18 July 1992, **herb. D.J.T., E, BM**. ~~Determined~~ A. C. Jermy.

Glen Lyon, west of Aberfeldy, GR NN/7.4, *D. J. Tennant*, 24 July 1995, **herb. D.J.T., E, BM**. Confirmed R. H. Roberts.

*Mid or East Perth, v.c. (?) 88 or 89* (References in literature and herbarium)

West of Dunkeld, G. Dickie, pre 1860 (Dickie 1860: 229). Unconfirmed.

North of Dunkeld, G. Dickie, pre 1882 (Boswell-Syme 1886: 105). Unconfirmed.

Near Dunkeld, J. H. Balfour, pre 1860 (Lowe 1876: 430). Unconfirmed.

Dunkeld, *C. McIntosh*, undated (1838–1922) **PTH**. (?) Unconfirmed.

*Easterness, v.c. 96*

Western foot of Cairngorms, GR NH/8.0., *D. J. Tennant*, 19 July 1993, **herb. D.J.T., E, BM**, determined D.J.T., confirmed R. H. Roberts.

There are two additional unconfirmed references. The first occurs in the correspondence of Charles Cardale Babington dated 1876 (Babington 1897) where, in referring to specimens sent to him by James Backhouse junior, he suggests that Backhouse had collected *C. dickieana* in a native mountain locality (presumably Scottish). However, he does not give the location. The spore characters were mentioned by Babington, therefore his determination would almost certainly have been correct. If Backhouse's correspondence for this additional record can be traced this would reveal the location. Secondly, Moore (1860: 266) states that specimens from "the Great Isle of Arran, Galway" in Ireland, collected by D. Moore, "appeared to be identical with" (plants from the type locality). No further references or specimens for either of these reports have been traced. However, Page (1988: 334) states that plants which may be *C. dickieana* occur "in at least one current alpine site on Skye," v.c. 104.

As *C. dickieana* had not been recognised at the time of the earliest Perthshire gathering (1794), coupled with the fact that the Perthshire plants differ morphologically from the type form, there is no possibility that it had been deliberately introduced there. Specimens of *Cystopteris* which I gathered near Dunkeld in E. Perth, v.c. 89, in 1991 and near Tomintoul in both Banffs., v.c. 94, and Elgin, Moray, v.c. 95, in 1993 had a similar frond morphology to *C. dickieana* from Loch Tay but had the echinate spores of *C. fragilis* (Fig. 1).

### HABITAT OF *C. DICKIEANA*

In Mid Perth, v.c. 88, *C. dickieana* was found in good quantity extending for about 2 kms throughout a rocky stream-gorge between altitudes of about 140 and 380 m, often beneath overhanging rocks in deep shade. No detailed geological examinations were made but both Loch Tay limestone and basic schistose rocks occurred in the immediate area. Few other plants were present, but locally *C. dickieana* was accompanied by *Asplenium adiantum–nigrum* and *Polystic-*


FIGURE 1. *Cystopteris dickieana*: a. Loch Tay, Mid Perth (v.c. 88); b. Cairngorms, Easterness (v.c. 96). Unusual *C. fragilis*: c. Dunkeld, E. Perth (v.c. 89); d. Near Tomintoul, Banffs. (v.c. 94).

*hum aculeatum*; however, in close proximity and probably in more acidic conditions, *Gymnocarpium dryopteris*, *Phegopteris connectilis*, *Athyrium filix-femina*, *Dryopteris filix-mas* agg., *D. dilatata* and *Blechnum spicant* were present.

In Easterness, v.c. 96, *C. dickieana* also occurred in a rocky stream-gorge, and was here growing on hard schistose rock with other calcicole species occurring nearby. It was also present on an old wall in the same area, in both cases in small quantity.

## MORPHOLOGY AND SPORE CHARACTERS

The plants in the Loch Tay populations of *C. dickieana* differ from those from the type locality in their pinnae which were not crowded and did not overlap, neither were the margins crisped nor was the stipe short. However, in comparison with *C. fragilis*, the pinnule segments were broader, more rounded and much less dissected than is usual, all characters found in the type *C. dickieana*. Fig. 1 shows the silhouettes of specimens of *C. dickieana* and also the somewhat untypical forms of *C. fragilis* from Dunkeld and near Tomintoul. Another feature of some of the plants in the Loch Tay population which occurred in the deepest shade was the thin texture of their fronds which were pale in colour and sometimes almost semi-translucent.

A further character which the Perthshire and Easterness populations share with *C. dickieana* from the type locality is that the majority of the veins of the pinnule segments terminate in a sinus, notch or shallow depression, whereas in *C. fragilis* the veins nearly always terminate at the pointed apex of the teeth. Babington (1904) used this character to separate *C. dickieana* and *C. fragilis* var. *alpina* Desv. (var. *alpina* Hook.) from other forms of *C. fragilis*, and it was also used similarly by Boswell-Syme (1886). I have found, however, that this character is not always reliable in that certain forms of *C. fragilis* which, even though fully fertile, can exhibit this character when the fronds have not attained their full size.

Spores were examined from over 20 individual plants gathered throughout the entire range of the Loch Tay locality, including a few plants which appeared to be closer to typical *C. fragilis*, and without exception they were found to match those of the type *C. dickieana*. R. H. Roberts commented that they were exactly like those of that species, without any doubt, and later made the same comment following his examination of specimens from the Easterness population. However, some specimens collected more recently from a selected area within the Loch Tay locality have been shown to have echinate spores, confirming that *C. fragilis* is also present there (S. Lindsay, pers. comm.). R. H. Roberts commented that the surface of the perispore had no spiny projections, only low ridges, possibly caused by folds in the perispore, and that the perispore fitted loosely around the exine. Spore samples from the Loch Tay population were measured by R. H. Roberts and compared with those of *C. dickieana* from the type locality and with several varieties of *C. fragilis*. The mean spore lengths (exospore) of the *C. dickieana* samples were very similar (Loch Tay 43$\mu$m: Type locality 44$\mu$m). Full details of these measurements and the method used has been published elsewhere (Tennant 1995).

The discovery of *C. dickieana* in three localities in the Scottish Highlands in two widely separated areas in such a short period of time strongly suggests that it will be found in additional localities there once a more routine check is carried out on spores following fieldwork. *C. dickieana* occurs in good quantity in the Loch Tay locality and is generally not under threat there. At the Cairngorms locality in Easterness it is very local and in rather small quantity and therefore is more vulnerable here. Details of records and localities have been deliberately abbreviated for conservation reasons, although *C. dickieana* is a fully protected species under the *Wildlife and Countryside Act* (1981). After its identity had been established, some of the specimens used during the preparation of this paper and others which were donated to **BM**, **E** and the University of Edinburgh were collected under a special permit kindly provided by Scottish Natural Heritage.

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# Book Reviews

*Flora of North America north of Mexico*. Volume 2: *Pteridophytes and gymnosperms*. Edited by the Flora of North America Editorial Committee. Pp. xvi + 475. Oxford University Press, New York and Oxford. 1993. Price £55.00. ISBN 0–19–508242–7 [v2].

This is the Flora we have all been waiting for: to set standards and to be a definitive account of the plants of a very large and significant area of the globe. Keys, generic and species descriptions are concise, and hybrids and diagnostic points discussed. There is a small continental map with each species showing its range. Most genera get a composite figure which gives a good idea of what the plant looks like.

The pteridophytes of North America, which take up 342 pages of this book, have much in common with the boreal areas of the Old World, and especially with Eurasia as far east as the Urals. We know a lot about the evolutionary history of ferns, much of this knowledge gained by scientists at Leeds University under the leadership of Professor Irene Manton (1904–1988). There is much speculation as to whether some alloploids arose in North America before the continent parted, or in Europe, after the break. On the whole, North America has a richer fern flora as it has had infiltration from the tropical south of a much older Gondwanaland stock, coming up via South America.

Anyone interested in the relationships of these fern floras will want to compare the *Flora Europaea* (vol. 1, ed. 2, 1993) with this definitive account of what is found in North America north of Mexico. For the most part, concepts of taxa are similar. Where they vary (such as in giving subspecies of *Diphasiastrum* full species rank in North America), it is the rank that varies and not the taxonomy. On the other hand there are good morphological and geographical reasons for giving *Equisetum braunii* A. Braun specific rank rather than making it a subspecies of *E. telmateia*. There is also plenty of evidence from fossil material to support *Hippochaete* as a genus rather than a subgenus of *Equisetum*; no one as yet has had the courage to do this. I am sorry that Richard Hauke has introduced confusion by using *Equisetum mackaii* (Newman) Brichan (Nov. 1842) to replace the legitimate *E. trachyodon* A. Braun (1839; in *Flora* **22**: 305).

Fifty-five authors have contributed to this book and the reviewing process has been severe. One could expect that generic concepts might vary with different botanists being involved, but I think editors and reviewers have set some very good standards (e.g. *Lycopodium* sens. lat. being split into segregate genera and *Thelypteris* species treated at subgeneric level). I am pleased to see that Herb Wagner accepts *Diphasiastrum* × *issleri* (Rouy) J. Holub as the hybrid *D. alpinum* × *tristachyum*, a concept I agree with, having seen Issler's specimens from the Vosges mountains where the two species, and the hybrid, grow together. This means the plant often quoted under that name in Britain and western Europe (e.g. in *Flora Europaea* and Stace's *New Flora*) and "morphotype *decipiens*" in *The illustrated field guide to ferns* by Jermy & Camus, and which is undoubtedly *D. alpinum* × *complanatum*, needs a new name.

The fact that there are 30 species of *Botrychium*, of which twelve are recently described by the author (W. H. Wagner) does not surprise the reviewer but raises some eyebrows and also the question as to whether we have more than seven species in Europe. Other big genera are *Cystopteris*, *Dryopteris*, *Polypodium* and *Polystichum*, all of which have been studied to some extent by modern techniques (isoenzymes and DNA) to reveal possible relationships. However, cytologists in North America have never had the patience that Irene Manton instilled in her students to carry out hybridization between cytotypes. This fundamental work still needs to be done with North American ferns.

Of the Gymnosperms, *Pinus* stands out with 39 species, most of which are of a restricted range and "are of conservational concern". In fact most of the 147 species of gymnosperms (in 17 genera) are restricted, an aspect I did not see mentioned in the ferns, even in narrow endemics.

European botanists can only wait for further volumes, and for those who live to see them they will be worth having.

A. C. Jermy

*Alien plants of the British Isles: a provisional catalogue of vascular plants (excluding grasses)*. E. J. Clement & M. C. Foster. Pp. xviii + 590. Botanical Society of the British Isles, London. 1994. Price £15.00. ISBN 0–901158–23–2.

In his introduction to *New Flora of the British Isles* Stace (1991) set out the criteria by which plants known not to be native were to be considered as meriting inclusion in a descriptive Flora of wild species. Species of casual occurrence were excluded unless they recur frequently, so as to be findable, somewhere, with luck, most years, as too were many species introduced for ornament which have no effect on wild habitats. In the selection of species for inclusion, Stace acknowledged the enormous help he had received from many correspondents, first among which was Eric Clement. It was Mr Clement who started the "Adventive News" series in the eighth issue of *B.S.B.I. news* (November 1974). When handing over the series to Adrian Grenfell eight years later, he wrote in a note: "Henceforth, my own energies will be directed into compiling, with Mrs M. C. Foster, a comprehensive catalogue of our alien and adventive plants, wherein all information that we have gathered together will be summarised." Here it is, and it was worth waiting another twelve years for.

The reader whose initial reaction is disappointment at the lack of descriptive material will soon come to accept that there is not space for it in a small (and extremely low priced) volume cataloguing about 4000 entities. Instead, the use of the work depends on following up references to entries in the extremely comprehensive bibliography, which is divided among major references for records, major references for descriptions and illustrations, local Floras, etc. Taking the first accepted species *Selaginella kraussiana* as an example, the main body of the text will give you a summary of its occurrence in the British Isles and a statement of its native range elsewhere, then a list of herbaria where specimens of it have been located, followed by a list of numbers: 7, 20, 50*, 73*, 137, 546a*, 1168*. These tell you that it was first mentioned as a British plant in Druce's *British plant list* (1928) and that there are descriptions of it in Stace (1991) and other works, four of which, shown by the asterisks, illustrate the plant. The usefulness of the work depends, therefore, entirely on the bibliography, which gives a very clear indication of the authors' wide reading, including books for gardeners where these give useful illustrations. Ready accessibility has been an important criterion in suggesting the sources of description and illustration cited. It would have been useful to know which volumes of the *European garden Flora* had been available by the time of going to press.

Plants which are native anywhere in the British Isles are excluded, so no opinion can be offered about the means of introduction of such species as *Trifolium glomeratum*, *Lithospermum purpureocaeruleum* and *Torilis nodosa* outside their native range. There can be no end to debate about the status of species. I would have included *Myrrhis odorata* and *Foeniculum vulgare* in a catalogue of aliens, but excluded *Centaurea calcitrapa*, but have to accept that the authors must make their own judgment.

It will be seen from the fact that *Selaginella* comes first that the arrangement is systematic (though within each genus it is alphabetical). This results in a heavy reliance needing to be placed on the index. This has been compiled by R. G. Ellis, after the setting of the body of the work, and is totally reliable. The systematic arrangement gives the book a further use: it allows the curators of herbaria of British and Irish specimens to put into their rightful place material in genera and families not represented in Kent's *List of vascular plants of the British Isles* (1992).

Where appropriate closely related taxa have been treated together in informal groups, e.g. the *Davallia bullata* group comprising three species of ferns, one of which was for a while established on a wall in Surrey. This sensible arrangement allows the inclusion of records which cannot safely be identified to the same degree of accuracy as native plants. If *Aster novi-belgii* and its hybrids had been treated in the same way, the authors could not be drawn into an argument about whether it is the species or its hybrid *A.* × *salignus* which is the commonest representative.

Large numbers of the plants included have not been seen in the British Isles since 1930, and the number recorded only since is probably far greater. An adequate introduction makes clear most of the ways in which alien plants have been brought in (in their language, the vectors) have changed over the years, but does not explain "esparto casual" and "tan-bark casual" used on page 166. It could be expanded by reference to the changing pattern of horticulture, which has added enormously to the variety of woody plants escaped from cultivation in the last two to three decades. With such a rapidly changing topic, it is to be expected that the book will soon be out of date.

Nevertheless, it may be felt that the authors have offered up unnecessary hostages to fortune by referring to plants as still established, when some at least were likely to disappear while the work was in press. There will be also no doubt be changes in the relative frequency of occurrence of different aliens, represented in the book by a system of •s, ranging from • for a taxon in 1–4 localities since 1930 to ••••• for one in more than 500.

The challenge presented by this book is to find an accidental omission. I have not been able to, and even minor errors are very few. *Polygonum orientale* has got stranded in the neuter gender after transfer to *Persicaria* and the name offered in lieu of *Cleome hassleriana* (it is not clear why, none of the references cited uses it) should surely be spelt *C. sesquiorgyalis*. Some of the authors' comments picked up from their reading, e.g. many under *Solanum*, are of obscure relevance. The companion volume on alien grasses, being compiled in collaboration with T. B. Ryves, is eagerly awaited.

R. M. Burton

*Plants and their names. A concise dictionary*. R. Hyam & R. Pankhurst. Pp. x + 545. Oxford University Press, Oxford. 1995. Price £14.99. ISBN 0–19–866189–4.

Following only three years after *Stearn's dictionary of plant names for gardeners*, reviewed in *Watsonia* **20**: 80, this new book is bound to be compared with it. The format is smaller, but there are 537 pages of dictionary proper as against 320; the print is also small and in two columns per page. The dust jacket claims that the dictionary contains over 500 family entries, over 2000 genus entries, over 5000 species entries, over 2000 of the more commonly occurring specific epithets and over 6000 common names (within the main listing). Professor Stearn's book "gives the meaning and origin of some 6,000 botanical names" (genera and specific epithets only) and lists separately "3,000 of the most widely accepted vernacular names". As well as explaining the derivation of names, the new dictionary provides descriptions of families, genera and one or more species under each genus and gives geographical distributions. Both books give the family name at the end of each generic entry.

Hyam & Pankhurst's attractive dust jacket stresses that, as well as being "a reference source", "the dictionary offers a host of unusual facts and beliefs.". This may prove a good sales ploy, and certainly I did not know that the tubers of *Cyclamen hederifolium* were "formerly considered a cure for baldness when used as snuff", but I think Stearn's reference to their being "regarded as a favourite food for swine" is more relevant to an understanding of the name "sowbread". The new authors say that ivy is reported to have medicinal properties against the effects of alcohol, Stearn that it "was held sacred to Dionysus (Bacchus)" (perhaps for that reason?). I like the nine vernacular names for *Arctostaphylos uva-ursi*, including "creashak" and "kinnikinick", for which Stearn has only "bearberry". But Hyam & Pankhurst fight shy of explaining the meaning of *Onopordum* (donkey's fart); and I found nothing in their book to match Stearn's entry for *Guaiacum* (lignum vitae), a genus not actually included there, or as touching as "the great tragedy of Boissier's life", the death of his young wife Lucille, after whom he named *Chionodoxa luciliae*.

Unfortunately Hyam & Pankhurst do not indicate the stressed syllable in scientific names as Stearn does. It is a pity too that they did not find a competent etymologist to help them. The Latin for "flowers" is not *florum*, for "black" not *nigrus*, for "tender, delicate" not *tenerus*; and *andros* does not mean "male" in Greek! In the derivations, verbs are sometimes given in the infinitive and sometimes in the present tense, occasionally differently for the same word in adjacent entries. Specific adjectives are sometimes given in all three genders, sometimes not: thus *pulcher* is not declined (despite an entry for *Hypericum pulchrum*), *glaber* and *glabra* have separate entries, *apennina* and *tetraquetra* are made feminine only, and *apetalon* and *tephropeplum* neuter only. There is no question that specific epithets can be nouns, and explanations of the meanings of these are few and far between; but *monticola* and *saxicola* are correct. *Caprifolium* is one of these too, not from an adjective *caprifolius*, and it is derived from *caper* rather than *capra*. The epithets *veris* (of spring) and *sepium* (of hedges) are correctly made genitives, but *nemorum* (of woods) and *officinarum* (of herbalists' shops) are turned into adjectives; and *columnae* (like *Columnea*) commemorates Fabio Colonna rather than meaning plural columns!

Irritatingly, there seems no logic in the indexing of vernacular names of two or more words, sword plant being under s but sword lily under l, screw pine under s but stone pine under p. (Oddly for a

book written in Scotland, Scots pine does not appear at all!) There are faults too in the cross-referencing. *Pseudofumaria* is one of the genera listed under Papaveraceae but does not have its own entry, and *P. lutea* appears only under *Corydalis*. The entries for *chamaedrifolius* and *chamaedrioides* refer to "the genus *Chamaedrys*", but there is no entry for this word either as a genus (which was only pre-Linnaean) or as a specific epithet, and the only explanation of its meaning appears under *Teucrium*. The proof-reading was not as careful as one might expect in a book from Oxford University Press, with *Plantago* and plantain confused, muddled entries such as canyon (with oak missing) for *Quercus chrysolepis*, and simple literals like cuckoo plant (for pint), fuelder rose and Saxifroge family.

Botanists looking for a reliable explanation of the names of vascular plants would be well advised to spend £3.00 extra and obtain Stearn's book and those wanting a portable but remarkably comprehensive dictionary concentrating on their taxonomy and distribution should buy D. J. Mabberley's *The plant-book*, reviewed in *Watsonia* **17**: 205–6.

P. H. Oswald

*Atlas Florae Europaeae*. Volume 10: *Cruciferae (*Sisymbrium *to* Aubrieta*)*. Edited by J. Jalas & J. Suominen. Pp. 224, with 323 maps. Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanamo, Helsinki, Finland. 1994. Price £69.00. ISBN 951–9108–09–2.

Too few botanists in Britain use *Flora Europaea* and fewer still seem aware of this other important international project. Once again, the indefatigable Jalas & Suominen, their team in Helsinki and their network of European botanists are to be congratulated on such a detailed compendium of plant records and literature references. The latter sometimes appear a bit out of hand, covering up to half a page between the marvellous 50-km square maps, but do provide a valuable source of reference to works that it was not practical to mention in *Flora Europaea*.

When David Webb and I were preparing the second edition of *Flora Europaea* Volume 1 at Reading in the 1980s, we were very grateful to have the existing *Atlas* fascicles to hand. It is now most satisfying to see our own work cited, albeit with a degree of reservation here and there! I am certainly prepared to eat humble pie over our omissions, although I think we can be forgiven *Descurainia sophioides*, reported in 1990 from a single 50-km square on the furthest hyperboreal fringe of N.E. Europe.

Sometimes the two projects depart on taxonomy, mostly though on the basis of rank. My own gut feeling (it was David's too) is that the *Atlas* tends towards an over-narrow species concept – a growing trend in contemporary European taxonomy. *Erysimum* is a case in point: the *Atlas* has treated many of the taxa in Peter Ball's account in *Flora Europaea* at specific rather than subspecific rank. I am the greatest admirer of Spanish botanical colleagues, many of them young and enthusiastic, and the hive of taxonomic activity in Spain which stands in sharp contrast to our own degenerate academic scene. However, perhaps *Flora Iberica* does not take a wide enough view of the overall European picture.

The *Atlas* team have coped manfully with the profound political changes in Europe since 1990. Several new territories and abbreviations have appeared in this latest volume (summarized on page 11). The editors recognize that we may not have seen the end of the changes. David Webb, with his formidable grasp of history and geography, was using these territories in *Flora Europaea* as geographical descriptors; thus preparing the ground for the rest of us to assimilate the emergence of the Baltic Republics, Belarus, Kazakhstan and Ukraine from the sometime Soviet Union, also the two halves of Czechoslovakia and the disputed lands that formerly comprised Jugoslavia. Moldova has been included in Ukraine, but Krym [Crimea] remains in Russia. Hopefully though, botanists will continue their traditional collaboration in the face of political differences, but it all adds to the editors' difficulties in the production of the *Atlas*. I wish them well.

J. R. Akeroyd

*England's National Nature Reserves*. P. Marren. Pp. xxii + 272. T. & A. D. Poyser for English Nature, London. 1994. Price £20.00. ISBN 0–85661–083–6.

I don't normally read books except when on holiday. This is because the nature of my work has driven me to become the ultimate scanner – taking in a large quantity of general information so as not to cram the brain with minutiae. It was therefore with some trepidation that I undertook to review Peter Marren's book. I would *have* to read this one! Having got in the holiday mood and with Arthur C. Clarke's *2010 Odyssey Two* successfully read (it's good to know that planet Earth has a future, this means all this conservation lark is worthwhile), *England's National Nature Reserves* proved to be an interesting contrast.

The first point about this book is that it is very readable. You almost feel the author is chatting to you as the story unfolds. The text is littered with words that, if they weren't invented by Peter Marren (e.g. the "lubberly" natterjack), I could imagine should have been. (For more examples of his flowery text I refer readers to his humorous column "Twitcher in the swamp", regularly featured in *British wildlife*). There are also many amusing anecdotes in this book (did you know that Studland's nudist colony has an "astonishing record for bravery in fire fighting". Do any B.S.B.I. members have any personal experience of this?) The readability of the book is also helped by the liberal scattering of Ruth Handley's excellent line drawings throughout the text (but no illustrations of those brave Studland fire-fighters).

The second point is that if you want a gazetteer of N.N.R.s, there is one, but it forms an appendix rather than being the centrepiece. Neither is this book a scientific treatise but a well-presented story with a myriad of sub-stories. As a colleague put it: it's a ripping yarn! The book covers a wealth of subjects, including the historical background, politics, people and conservation. However, some of the rather more sensitive politics concerning N.N.R.s are avoided, I suspect as a result of editing instructions from English Nature. Neither is there much on the cost of managing and running N.N.R.s – this would have been useful but I suspect would have entailed a ten-year research project in order to collate the historical information. At least the information is now more readily accessible in English Nature's annual N.N.R. reports.

To some extent the story as a whole is depressing, as are most stories about nature conservation in England during the post-1945 era. The fact is that N.N.R.s make up a very small piece of England's natural heritage – little bits of "old England" – which have survived while the rest of the countryside was ravaged by intensive agriculture and forestry. As well as their role in biodiversity conservation there is no doubt about the very positive role that N.N.R.s have also played in providing fertile grounds for ecological research and as important bases for long-term ecological monitoring. Consequently they have been at the forefront in the development of new techniques to restore important habitats and species which are now being more widely applied elsewhere. Of particular note has been the knowledge gained on the management of grazing stock for grassland conservation. This has assisted the conservation of both grassland animals and plants, and the book gives examples of a number of species which have benefited, including the Early Spider Orchid. Long may this good work continue.

The book finishes on the subject of English Nature's current review on the role of N.N.R.s. With national policies on agriculture and forestry swinging into reverse, and the improved protection now afforded to Sites of Special Scientific Interest, the Reserves will continue to have an important role to play as demonstration sites for conservation management and restoration of habitats of relevance to the wider countryside. Their future appears assured. However, even though Nicholas Ridley's hopes for N.N.R. privatisation were soundly squashed, the current focus by government on releasing assets (particularly handing them over to someone else to look after without sufficient resourcing) means that we must all remain vigilant.

For the convinced conservationist and naturalist, this book is an obvious "must" for those creaking bookshelves. It is only a pity that it wasn't a book about *Britain's* National Nature Reserves. An unfortunate sign of the times.

S. Everett

*Heimans, Heinsius en Thijsse's Geïllustreedre Flora van Nederland, België en Luxemburg en aangrenzend Duitsland en Frankrijk*, 23rd ed. J. Mennema. Pp. viii + 1080. Uitgeverij Versluys, Baarn, The Netherlands. 1994. Price Dfl 77.50 [c. £29.00]. ISBN 90–249–1083–0.

For the Dutch this extensively revised edition by Dr J. Mennema is the latest in a long line, from the first edition by Heimans & Thijsse in 1899, but here it may well be regarded as something new. The book is unusual in its landscape format but the value of this becomes clear on opening the book – at each stage in identification the reader is guided by line drawings that illustrate key points. While the drawings are generally very good the quality is variable and a few of the drawings are frankly disappointing since they are little more than rough sketches – compare for example *Primula veris* on p. 517 with *Glaux maritima* on p. 520. It would have been helpful if the scale of the drawings could have been indicated as very different scales have been used for different illustrations. However, the sizes are given in the text accompanied by due warnings in the introduction. On the whole the various levels of keys are reasonably easy to use if the user is familiar with flowering plants and their parts. There is a problem here as the book is clearly aimed at the amateur botanist and yet it contains no glossary of botanical terms. In many ways this would have been more use to the amateur than the pages on plant phytosociology. I have to compare this book with what is probably the standard work for the Dutch professional botanist, Heukels & van Ooststroom's *Flora van Nederland*. The page layout of Mennema's book is better, but *Flora van Nederland* costs only 1 guilder more and has much more to recommend it; notably better drawings, more concise descriptions and a glossary of botanical terms. Mennema suffers from its thickness at 52 mm compared with 25 mm and its weight compared with *Flora van Nederland* despite a similar number of pages. I can see that, despite its size, Mennema's *Flora* will be attractive to the Dutch-speaking amateur botanist on account of the more readable descriptions. However, despite the attractive page layout the lack of a glossary will limit its use by non-Dutch.

L. A. Boorman

*Rare plants of Shropshire, a Red Data Book of vascular plants*. A. J. Lockton & S. J. Whild. Pp. 40. Shrewsbury Museums Service, Shrewsbury. 1995. Price £4.50. ISBN 0–9500122–7–0.

The concept of a register of rare plants for a particular county seems to have been a long time in getting underway. I see no problem with the concept. It should not be a guide to the locations, but merely a statement of fact so that everybody, in particular the conservation organisations and the planning authorities, know clearly what is rare and, if possible, why. This avoids the weakening of the conservation effort by the knee-jerk reaction of, say, the pro-orchid brigade, and thus confronts developers with hard facts rather than emotion.

So far as I am aware this is only the second county publication dealing solely with plants. *The Leicestershire Red Data Book, vascular plants* was published two years ago (M. B. Jeeves, 1993) but the only other publications encompassing rare plants of a county are *Endangered wildlife in Lincolnshire and South Humberside* (A. E. Smith, 1988) and *Endangered wildlife in Dorset* (A. Mahon & D. Pearman, 1993) where other animal and plant groups are covered as well.

The B.S.B.I., through Franklyn Perring and Lynne Farrell, have compiled guidelines for producers of local plant red data books, and I'm delighted that this excellent booklet from Shropshire uses these, namely all plants which are in the national Red Data Book and Scarce categories, plus those that occur in three or fewer sites in the county. If these same criteria are used by other counties then the whole conservation movement is strengthened. A plethora of systems only confuses.

The Shropshire publication covers each of the defined species in detail, with a history, and occasionally a map of their distribution in the county. I say "county" but I am not sure whether the coverage is for the political county or the botanical vice-county 40; I suspect the former. Most of the records reflect the period covered for the last Flora (1970–1983), but there are more recent records shown when available.

There is a summary list of all these plants, and an interesting map showing the clustering of records in particular areas. There is a list of extinct species, and a further tentative list of species that

fall just outside the criteria; in this case from 4–10 sites in the county. These last are confusingly called "Scarce Plants", and should have been given some other designation.

A list of references and a sample rare plant recording card complete this publication. Personally I prefer A5 to the ubiquitous A4 but that, and the couple of anomalies above, do not detract from this model publication, available at a very modest price.

D. A. Pearman

*British plant communities*. Volume 4: *Aquatic communities, swamps and tall-herb fens*. Edited by J. S. Rodwell. Pp. xii + 283. Cambridge University Press, Cambridge. 1995. Price £60.00. ISBN 0–521–39168–7.

Before I go on to comment on this specific volume it should be said that this five volume series represents the work of many learned academics working within the National Vegetation Classification (N.V.C.) scheme for nearly 20 years. A critique of the scheme is inappropriate here but I will comment on this volume as a user.

The book clearly separates details of aquatic communities from those of swamp and tall-herb fen communities; thus explaining the rather awkward title. The book begins with a short Preface and Acknowledgements followed by a General Introduction (common to all volumes) covering phytosociology, the N.V.C., data collection, analysis and presentation of results.

Then follows the two main sections; firstly, aquatic communities then swamp and tall-herb fen communities. Each section has its own detailed Introduction which covers data collection, analysis, presentation of results and an overview of each classification. This is followed by a key to the communities. However, the key to aquatic communities is simply a table which lists species and their occurrence in each aquatic community!

This is followed by descriptions of each community. The N.V.C. recognises 24 aquatic communities coded A1 to A24 with some having up to four sub-communities. Twenty-eight swamp and tall-herb fen communities are recognised, coded S1 to S28. Again most communities have up to four described sub-communities except *Phragmites australis-Peucedanum palustre* fens (S24) with seven. A few divisions of sub-communities (variants) are described but only within the *Atriplex prostrata* sub-community (S4d) of the *Phragmites australis* community (S4) is this taken into floristic detail.

Each community description starts with the community code, normally followed by an N.V.C. name based on the Latin name of one or two of the most frequent species. This is followed by a Latin community synonym with the authority and date, if an undisputed one already existed.

Each description is divided into Synonymy, Constant species, Rare species, Physiognomy, Sub-communities (where appropriate), Habitat, Zonation and succession, Distribution, Affinities and finally a Floristic table. The latter gives percentage frequency range and abundance range (Domin scale) for all species found in more than 5% of the community or sub-community sampled. For swamp and tall-herb fen communities this is followed by a map of all the samples.

The book ends with three useful sections; firstly, a list of phytosociological synonyms to these N.V.C. communities; secondly, an index of all species in the floristic tables; and finally, a bibliography with over 300 references.

The sampling of aquatic communities is a very important issue for users. The text implies that floating and free-floating vegetation was sampled separately from submerged vegetation and a diagram showing this is provided. However, most communities contain both floating and submerged vegetation, e.g. *Lemna gibba* community (A1) contains *Elodea canadensis*. This is very confusing.

Emergent vegetation was also sampled separately (and included in the swamp section). However, emergent taxa appear in several aquatic communities, e.g. *Equisetum fluviatile* appears in five. This highlights the problem of distinguishing between emergent and aquatic taxa. Many species have emergent and aquatic forms, for example, *Hippuris vulgaris*, which appears in both sets of communities. Did (or does) its growth form matter? Some guidance should have been provided on this subject.

The lack of maps for aquatic communities is disappointing. The contention that the patchy cover could give misleading impressions could have been dealt with by a simple note. This contention does

not hold up when it comes to a map of all aquatic samples, which is not provided although there is a corresponding map for swamps and tall-herb fens.

The problem of a lack of coverage for the aquatics is acknowledged and some probably common communities are defined by very few samples e.g. eight for the *Ranunculus aquatilis* community (A19). The absence of a *Sparganium emersum* dominated community may be due to the particular paucity of lotic samples.

Considering that this is a very visual subject the book suffers from the absence of photographs (apart from the cover). Also there are only 16 line figures, mainly concerned with zonation patterns.

This book draws together lots of information from a wide range of sources, including unpublished reports and foreign language papers. There are particularly interesting sections on *Phragmites australis-Peucedanum palustre* fens (S24) and *Phragmites australis* swamps (S4).

Superficially this book can appear simple but it is not. No one should feel competent to use the N.V.C. system to survey and assign vegetation, including using the keys, without training. This can be illustrated by co-dominant stands of *Scirpus lacustris* subsp. *lacustris* and *Phragmites australis*. This vegetation does not readily fit into the N.V.C. scheme and would probably be considered an ecotone between *Scirpus lacustris* subsp. *lacustris* community (S8) and *Phragmites australis* community (S4). Its absence from the scheme suggests that the user is expected to avoid sampling it in the first place.

This book will be absorbing to anyone interested in British vegetation. For those specifically interested in swamp and aquatic vegetation this book is a must-have. It will no doubt inform, challenge, perplex and drive ecologists in this area for many years.

S. J. Smith

*The habitats and vegetation of Sussex*. F. Rose. Pp. 27. Booth Museum of Natural History, Brighton. 1995. Price £4.00. ISBN 0–948723–24–6.

This slim booklet is a revised off-print of the introduction to *The atlas of Sussex mosses, liverworts and lichens* by F. Rose, R. C. Stern, H. W. Matcham & B. J. Coppins, published by the Booth Museum in 1991. It was felt that the general review of the main Sussex habitats and their flora would be of sufficient interest to a wider readership to merit publication in its own right.

In essence, this book describes the main habitats of Sussex, with detail of sites and the species (both vascular and lower plants) of interest which grow there. An enormous amount of information on the geology, soils, climate, vegetation and history has been integrated and summarized in a very readable form by Francis Rose. The best accounts are of the woodland and heathlands which he knows especially well, but details of grasslands or the wetlands of areas such as Pevensey and Amberley are more scantily covered. It has been collated mainly from field work since the 1940s and is now thus occasionally out of date, and lacks references to other sources of information which would have been useful, but is fascinating, and the historical perspective on change is invaluable. There are a few minor editorial errors and inconsistencies (e.g. Site of Scientific Importance for S.S.S.I.).

This booklet achieves its aim, and is recommended whole-heartedly to anyone with an interest in Sussex plants who has not already got *The atlas of Sussex mosses, liverworts and lichens*.

T. C. G. Rich

*Flora of Radnorshire*. R. G. Woods. Pp. 292. National Museum of Wales in association with the Bentham-Moxon Trust, Cardiff. 1993. Price £20.00. ISBN 0–7200–0386–5.

This is a rich period in Welsh field botany with Floras of Flintshire, Glamorgan and Radnorshire all published within two years and with Montgomeryshire soon to come: and what fine Floras they are or promise to be. Radnor may be the second smallest vice-county in Wales but in Ray Woods it has been fortunate to have attracted an author with the talents to cover not just the flowering plants and

ferns but lower plants as well including charophytes, bryophytes, lichens, and rust and smut fungi. He has created one of the largest and most comprehensive local Floras yet published.

The introductory sections occupy almost a quarter of the book. They begin with accounts of the geology and climate, which are an essential basis for understanding the detailed account of the plant communities which follow. Ray Woods' main reason for writing the *Flora* was the need he had for the information as an Assistant Regional Officer of the Nature Conservancy Council. It was N.C.C. which commissioned Lancaster University to devise the National Vegetation Classification and Ray was able to have access to their results before they were all published. This enabled him to produce the first description of the vegetation of a vice-county which can be set in a national context. Each plant community has its own code letter and number and it will come as no surprise that M25 in Radnor is not a six-lane highway but a *Molinia caerulea/Potentilla erecta* mire over which vehicles of any kind would have difficulty in proceeding. But, having this excellent and economic coding system, it is a little disappointing to find that they are not used in the systematic section of the *Flora*: it would have been invaluable to have had this information at least for the species of natural and semi-natural vegetation. Access to this information is further hindered because references to species in the vegetation classification are not indexed.

A similar problem is created in the fascinating section on the vascular plant biogeography where a comparison is made between the elements in the Radnorshire flora and adjacent Shropshire, the whole of Wales and the British Isles. Here, not only are the species not indexed but, within their elements, English names only are used and they are in neither systematic nor alphabetical order. The similar, and possibly unique, sections on bryophyte and lichen biogeography are easier to follow with Latin names in alphabetical order for both groups.

The comprehensive account of changes in the vascular flora over the last 100 years and the conservation implications are a feature which should be welcomed in any modern Flora and will undoubtedly be referred to widely. Though Radnorshire is a small county the account lists eight nationally rare species, and 43 scarce plants of which 15 are probably extinct, many of them arable weeds such as corn buttercup and shepherd's-needle.

The traditional Flora is divided into vascular and non-vascular plants and gives habitat information and detailed localities, to the 1-km square for species in six or fewer localities in the county – and maps showing distribution in the 63 'quadrants' (5 × 5-km squares) for the commoner species. Though vascular plant botanists may feel that a smaller unit in a county of this size would have been desirable the fact that lichens and bryophytes are covered in equal detail is a bonus which should be warmly welcomed. A minor disappointment is that none of the physical maps in the introduction carries the 5 × 5-km grid, so that interpretation is less easy than it might have been. But this is a minor blemish when there are so many bonuses, including a list of Welsh place names in Radnorshire with a botanical connotation which will surely be of value throughout the Principality.

The *Flora* is handsomely produced with colour plates of the major vegetation types and a pleasing two or three column layout with the maps inserted in the text, and occasional line drawings to enliven the pages. The cover carries a handsome photo of the "Radnor Lily", *Gagea bohemica*, which may have been the main botanical inducement for visiting the county in recent years. Ray Woods has now given us 100 more reasons why we should explore this previously unsung corner of Wales.

F. H. Perring

# Report

## ANNUAL GENERAL MEETING, 13 MAY 1995

The Annual General Meeting of the Society was held at the National Botanic Gardens, Glasnevin, Dublin, Ireland by kind invitation of the Director Mr D. Synnott, at 11.30 a.m. Dr F. H. Perring, retiring President, opened the meeting in the Chair and 92 members were present.

Apologies for absence were read and Minutes of the 1994 Annual General Meeting, published in *Watsonia* **20**: 327–328 (1995), were accepted as correct, approved and signed by the Chairman.

### REPORT OF COUNCIL

The Chairman took members through the Report of Council, commenting on the main achievements of the Society during the year. The adoption of the Report was proposed by Mr R. G. Ellis, seconded by Dr J. S. Faulkner and accepted unanimously.

### HON. TREASURER'S REPORT AND ACCOUNTS

Mr M. Walpole, Hon. Treasurer, taking members through the Accounts, invited queries. Dr J. White asked if a credit card system could be introduced for the payment of subscriptions; this would greatly assist members in the Republic of Ireland, and other overseas members. The Treasurer agreed to look into this possibility. He then proposed the adoption of his Report, this was seconded by Mrs M. D. Perring and carried unanimously.

The Treasurer then explained the need for the increase in subscriptions as proposed by Council and set out on the A.G.M. Agenda. Mr Walpole put the proposal to the meeting, it was seconded by Mrs M. Lindop and carried unanimously.

The new rates from October 1995 for members in Britain and Ireland are:

| | |
|---|---|
| Ordinary and subscriber members | £18.00 |
| Junior | £9.00 |
| Senior | £12.00 |
| Family | £2.00 |
| For other overseas members | £20.00 |

### ELECTION OF PRESIDENT

From the Chair Dr F. H. Perring proposed the election of Mr D. A. Pearman as President. Following the custom of alternating amateur and professional Presidents, Dr Perring warmly commended Mr Pearman as being in the best amateur tradition but thoroughly professional in his botanical approach. He was also a splendid organiser, as for *Scarce plants in Britain* and so a fitting President to lead the Society into the new *Atlas of the British Flora*. The election was unanimous with applause.

The new President then took the Chair, thanking Dr Perring for his ideas, energy and work for the Society during his term as President, and saying that for him it would be hard to follow such a well-known and respected President.

### ELECTION OF VICE-PRESIDENTS

The President spoke appreciatively of the enormous benefit to the Society of having the experience of the Vice Presidents. There were two nominations, Mr R. G. Ellis and Mr C. D. Preston, for these vacancies. Their election was proposed by Mrs C. J. Hora, seconded by Mr P. H. Oswald, and carried unanimously.

### RE-ELECTION OF HON. GENERAL SECRETARY AND HON. TREASURER

The President, thanking Mrs Briggs and Mr Walpole, said that he was bowled over by the amount of work for the Society accomplished by these voluntary officers. Their re-election was proposed by Dr E. C. Nelson, seconded by Mr R. G. Ellis and carried unanimously with warm applause.

The President here also warmly thanked the Editors of *Watsonia*, *B.S.B.I. news* and *B.S.B.I. Abstracts* all of whom gave many hours of work to the Society as voluntary editors. The Editors were thanked with applause.

### ELECTION OF COUNCIL MEMBERS

In accordance with Rule 11 nominations had been received for Mr M. E. Braithwaite, Mr R. M. Burton and Mr D. E. Green. Profiles had been published; election of these members was proposed by Mr C. D. Preston, seconded by Mrs M. Lindop and they were elected unanimously.

### ELECTION OF HONORARY MEMBERS

Miss M. J. P. Scannell's nomination by Council had been widely supported from both sides of the Irish Sea and the President said that it was an entire pleasure to bring this nomination to the meeting, and extraordinarily apt that the election should be at this first B.S.B.I. A.G.M. to be held in Dublin. Dr J. White then introduced Miss Scannell, and the election was carried unanimously with warm applause. Dr White's appreciation, part of which was delivered in Irish was published in *B.S.B.I. news* **70**.

### RE-ELECTION OF HONORARY AUDITORS

The Hon. Treasurer proposing the re-election of Grant Thornton, West Walk, Leicester, reported that they were willing to continue as Hon. Auditors. The Society is very appreciative of this and their re-election was proposed by Mrs M. Lindop, seconded by Mrs C. Kitchen and carried unanimously.

### ANY OTHER BUSINESS

The President gave a brief report on the plans for the new Atlas, for which the financial contract had been temporarily delayed, but the methods and procedure for recording were progressing with enthusiasm. The new Irish recording cards were printed and available at the meeting.

Finally, on behalf of all present the President thanked Mr D. Synnott for his invitation to the Society to hold the meeting at the National Botanic Gardens, Glasnevin, with our congratulations to the Gardens on their bi-centenary this year. He also thanked Mr Synnott and his team of helpers and the B.S.B.I. Committee for Ireland for the excellent arrangements, and for the interesting

programme provided for the A.G.M. and the extended week-end. B.S.B.I. members from across the water had particularly appreciated the warm welcome to this meeting.

There being no other business, the meeting closed at 12.38 p.m.

MARY BRIGGS

## FIELD EXCURSION HELD IN CONJUNCTION WITH THE A.G.M.

THE BURREN, COS CLARE AND S. E. GALWAY (V.CC. H9 & H15). 15TH–17TH MAY 1995

An odyssey usually involves a long journey, and a tantalizing goal. The B.S.B.I. odyssey began with the long drive across Ireland from Dublin, following the most enjoyable conference at the National Botanic Gardens, Glasnevin. On time, our party gathered in Corrofin, and the field meeting began.

Dr Enda Mooney, Superintendent of The Burren National Park, welcomed members and led the party to Mullach Mór, the centrepiece of the 1600 ha national park. At the site of the now halted interpretative centre he explained the Irish national park system, based on state-owned lands managed in similar manner to American national parks.

We dandered on, slowly, absorbed in the place. One by one, B.S.B.I. members could be seen to kneel on the pavement and bow before an unseen deity, which proved merely to be a solitary *Neotinea maculata* (Dense-flowered Orchid). This plant was photographed and rephotographed by everyone, and thereafter (*pace* Murphy's law) many more spikes were seen, and passed by without attention. Members wandered in informal clusters across the grey limestone pavement, enjoying the warm, albeit dull afternoon, avoiding the innumerable tiny frogs that jumped from every clump of grass, and in many cases seeing for the first time plants that they had only known the names of before. *Potentilla fruticosa* (Shrubby Cinquefoil) was in bud. *Taraxacum palustre* (Turlough Dandelion) was in splendid blossom. On the eastern shore of Lough Gealáin, *Dryas octopetala* (Mountain Avens) carpeted a hummock of glacial till, and again *Neotinea maculata* was plentiful – the 'classic' Burren combination, an Arctic-alpine species cohabiting with a Mediterranean one. A few members, intent on scaling greater heights, reached the slopes of Mullach Mór, but most were content to meander around, enthralled by the extraordinary place. Of course there were Spring Gentians (*Gentiana verna*), Blue Moor-grass (*Sesleria caerulea*), and Bloody Crane's-bills (*Geranium sanguineum*) too, but there was another day to come, and pints to be savoured.

The second day dawned, damp and grey. The first port-of-call was on the coast at Poll Salach and the quarry was *Ajuga pyramidalis* (Pyramidal Bugle). Within a short time the sight of multifarious bottoms in the air signalled that this plant had been spotted and due obeisance was being proffered. Again there was a gradual scattering across the pavement and again the familiar and the unfamiliar enthralled – *Saxifraga rosacea* (Irish Saxifrage), *Primula vulgaris* (Primrose), *Adiantum capillus-veneris* (Maidenhair Fern), *Orchis mascula* (Early-purple Orchid), and so on. A diligent search of the pools in the cavities in the pavement eventually yielded three minuscule plants of *Limosella aquatica* (Mudwort). Wandering on, there was the rare and diminutive Western Sea-lavender with the long name *Limonium recurvum* subsp. *pseudotranswallianum*. After a pub lunch, the group split into two, one contingent taking the high road, the "green road" from Formoyle chapel, and on to the hill overlooking Fanore, and the other going to the Fanore sand dunes and then on to the slopes above Black Head. Both had rewarding treks in somewhat blustery weather, and saw inter alia another of The Burren's enigmas at first hand, the extraordinary profusion of calcifuge species growing on limestone. The abundant *Calluna vulgaris* (Heather) and *Erica cinerea* (Bell Heather) were not in blossom, but *Arctostaphylos uva-ursi* (Bearberry) and *Vaccinium myrtillus* (Bilberry) were in flower. Members returned contented to their lodgings and in the evening assembled for an Irish coffee reception at Sheedy's Spa View Hotel, Lisdoonvarna, hosted by Shannon Development. Michael Roberts (Tourism Manager, Shannon Development, and incidentally a member of the B.S.B.I.) welcomed the B.S.B.I. to County Clare and The Burren.

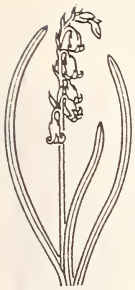
The final day was spent in the eastern Burren, beginning at Slieve Carran Nature Reserve (Eagle's Rock). A rough pilgrim track led to Tobar MacDuach where the moss-carpeted hazel wood, enveloping the ruined church, was carpeted with *Allium ursinum* (Ramsons) and *Oxalis acetosella* (Wood Sorrel). The party travelled on to Gort, and visited Coole Park. Guided by Tim O'Connell,

we were conducted to see the turlough (= vanishing lake) and other parts of the demesne. The turlough margin was a trifle disappointing because the water had been late in receding, and there was no sign of *Viola persicifolia* (Turlough (or Fen) Violet). Both here and at the turloughs in Garryland Woods nearby, there was animated discussion of the likely consequences of the past winter's extraordinary, persistently high water-levels in the turloughs. And many valiant attempts were made to transmogrify the leaves of undistinguishable dog-violets into those of the Turlough Violet, but the sceptics seemed always to have the upper hand.

This was not a square-bashing meet, although David Nash and Philip Oswald did not waste the opportunity. Rather the three days were occupied in a gentle series of rambles through a landscape which many knew only as a tantalizing name on a map or as a locality in a Flora. They came, they saw and, as ever, were entranced.

And so ended the B.S.B.I.'s Irish odyssey. To borrow an appropriate line from William Butler Yeats, "They came like swallows and like swallows went . . .".

E. C. Nelson

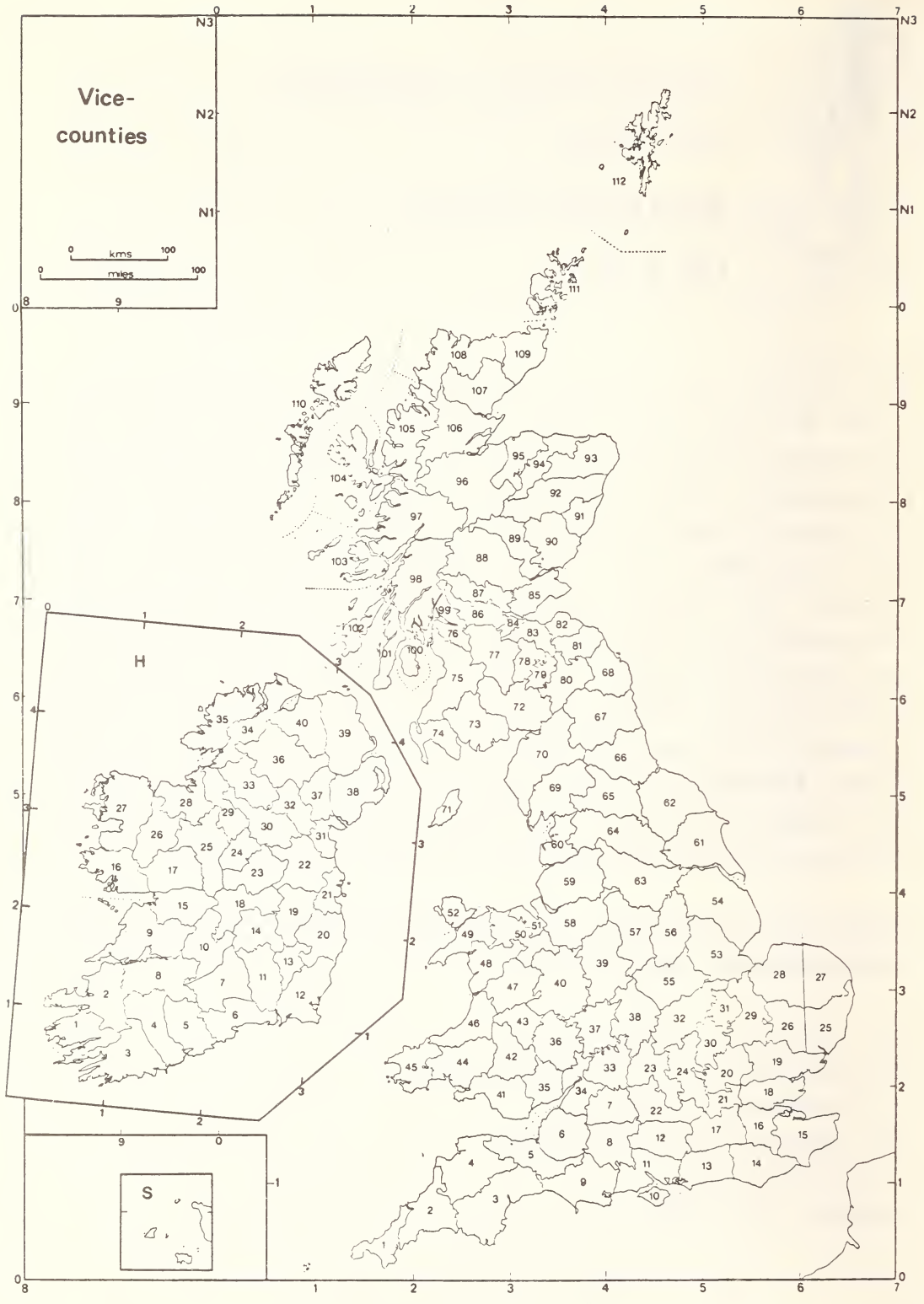



# *BOTANICAL SOCIETY OF THE BRITISH ISLES (B.S.B.I.)*

The B.S.B.I. was founded in 1836 and has a membership of 2,700. It is the major source of information on the status and distribution of British and Irish flowering plants and ferns. This information, which is gathered through a network of county recorders, is vital to their conservation and is the basis of the *Red Data Books* for vascular plants in Great Britain and Ireland. The Society arranges conferences and field meetings throughout the British Isles and, occasionally, abroad. It organises plant distribution surveys and publishes plant atlases and handbooks on difficult groups such as sedges and willows. It has a panel of referees available to members to name problem plants. Through its Conservation Committee it plays an active part in the protection of our threatened plants. It welcomes all botanists, professional and amateur alike, as members.

**Details of membership and any other information about the Society may be obtained from:**

The Hon. General Secretary,
Botanical Society of the British Isles,
c/o Department of Botany,
The Natural History Museum,
Cromwell Road,
London, SW7 5BD.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## NAMES OF VICE-COUNTIES IN *WATSONIA*

### ENGLAND, WALES AND SCOTLAND

1. W. Cornwall
1b. Scilly
2. E. Cornwall
3. S. Devon
4. N. Devon
5. S. Somerset
6. N. Somerset
7. N. Wilts.
8. S. Wilts.
9. Dorset
10. Wight
11. S. Hants.
12. N. Hants.
13. W. Sussex
14. E. Sussex
15. E. Kent
16. W. Kent
17. Surrey
18. S. Essex
19. N. Essex
20. Herts.
21. Middlesex
22. Berks.
23. Oxon
24. Bucks.
25. E. Suffolk
26. W. Suffolk
27. E. Norfolk
28. W. Norfolk
29. Cambs.
30. Beds.
31. Hunts.
32. Northants.
33. E. Gloucs.
34. W. Gloucs.
35. Mons.
36. Herefs.
37. Worcs.
38. Warks.
39. Staffs.
40. Salop
41. Glam.
42. Brecs.
43. Rads.
44. Carms.
45. Pembs.
46. Cards.
47. Monts.
48. Merioneth
49. Caerns.
50. Denbs.
51. Flints.
52. Anglesey
53. S. Lincs.
54. N. Lincs.
55. Leics.
55b. Rutland
56. Notts.
57. Derbys.
58. Cheshire
59. S. Lancs.
60. W. Lancs.
61. S.E. Yorks.
62. N.E. Yorks.
63. S.W. Yorks.
64. Mid-W. Yorks.
65. N.W. Yorks.
66. Co. Durham
67. S. Northumb.
68. Cheviot
69. Westmorland
69b. Furness
70. Cumberland
71. Man
72. Dumfriess.
73. Kirkcudbrights.
74. Wigtowns.
75. Ayrs.
76. Renfrews.
77. Lanarks.
78. Peebless.
79. Selkirks.
80. Roxburghs.
81. Berwicks.
82. E. Lothian
83. Midlothian
84. W. Lothian
85. Fife
86. Stirlings.
87. W. Perth
88. Mid Perth
89. E. Perth
90. Angus
91. Kincardines.
92. S. Aberdeen
93. N. Aberdeen
94. Banffs.
95. Moray
96. Easterness
96b. Nairns.
97. Westerness
98. Main Argyll
99. Dunbarton
100. Clyde Is.
101. Kintyre
102. S. Ebudes
103. Mid Ebudes
104. N. Ebudes
105. W. Ross
106. E. Ross
107. E. Sutherland
108. W. Sutherland
109. Caithness
110. Outer Hebrides
111. Orkney
112. Shetland

### IRELAND

H1. S. Kerry
H2. N. Kerry
H3. W. Cork
H4. Mid Cork
H5. E. Cork
H6. Co. Waterford
H7. S. Tipperary
H8. Co. Limerick
H9. Co. Clare
H10. N. Tipperary
H11. Co. Kilkenny
H12. Co. Wexford
H13. Co. Carlow
H14. Laois
H15. S.E. Galway
H16. W. Galway
H17. N.E. Galway
H18. Offaly
H19. Co. Kildare
H20. Co. Wicklow
H21. Co. Dublin
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H23. Westmeath
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H28. Co. Sligo
H29. Co. Leitrim
H30. Co. Cavan
H31. Co. Louth
H32. Co. Monaghan
H33. Fermanagh
H34. E. Donegal
H35. W. Donegal
H36. Tyrone
H37. Co. Armagh
H38. Co. Down
H39. Co. Antrim
H40. Co. Londonderry

# B.S.B.I. PUBLICATIONS

## HANDBOOKS

Each handbook deals in depth with one or more difficult groups of British and Irish plants.

No. 1 SEDGES OF THE BRITISH ISLES
A. C. Jermy, A. O. Chater and R. W. David. 1982. 268 pages, with a line drawing and distribution map for every species. Paperback. ISBN 0 901158 05 4.

No. 2 UMBELLIFERS OF THE BRITISH ISLES
T. G. Tutin. 1980. 197 pages, with a line drawing for each species. Paperback. ISBN 0 901158 02 X. Out of print: new edition in preparation.

No. 3 DOCKS AND KNOTWEEDS OF THE BRITISH ISLES
J. E. Lousley and D. H. Kent. 1981. 205 pages, with many line drawings of British native and alien taxa. Paperback. ISBN 0 901158 04 6. Out of print: new edition in preparation.

No. 4 WILLOWS AND POPLARS OF GREAT BRITAIN AND IRELAND
R. D. Meikle. 1984. 198 pages, with 63 line drawings of all species, subspecies, varieties and hybrids. Paperback. ISBN 0 901158 07 0.

No. 5 CHAROPHYTES OF GREAT BRITAIN AND IRELAND
J. A. Moore. 1986. 144 pages, with line drawings of 39 species and 17 distribution maps. Paperback. ISBN 0 901158 16 X.

No. 6 CRUCIFERS OF GREAT BRITAIN AND IRELAND
T. C. G. Rich. 1991. 336 pages, with descriptions of 140 taxa, most illustrated with line drawings and 60 with distribution maps. Paperback. ISBN 0 901158 20 8.

No. 7 ROSES OF GREAT BRITAIN AND IRELAND
G. G. Graham and A. L. Primavesi. 1993. 208 pages, with descriptions and illustrations of twelve native and eight introduced species, and descriptions of 83 hybrids. Distribution maps are included of 31 native species and hybrids. Paperback. ISBN 0 901158 22 4.

No. 8 PONDWEEDS OF GREAT BRITAIN AND IRELAND
C. D. Preston. 1995. 352 pages. 50 full page illustrations and distribution maps. Paperback. ISBN 0 901158 24 0.

## OTHER PUBLICATIONS

LIST OF VASCULAR PLANTS OF THE BRITISH ISLES
D. H. Kent, 1992. 400 pages. Nomenclature and sequence followed by Stace in *New Flora of the British Isles*. Paperback. ISBN 0 901158 21 6.

ATLAS OF THE BRITISH FLORA
F. H. Perring and S. M. Walters, 1990. Reprint of 3rd ed, 1982. 468 pages. Distribution maps of over 1700 species including updated maps for 321 *Red Data Book* species. New bibliography of updated distribution maps published elsewhere since 1st ed, 1962. Paperback. ISBN 0 901158 19 4.

ALIEN PLANTS OF THE BRITISH ISLES
E. J. Clement and M. C. Foster, 1994. 590 pages. Lists 3586 species found growing wild and includes frequency of occurrence, areas of origin, means of introduction, references to descriptions and illustrations and location of herbarium material. Excludes grasses, to come in Vol. 2. Paperback. ISBN 0 901158 23 2.

SCARCE PLANTS IN BRITAIN
D. A. Pearman, C. D. Preston and A. Stewart, 1994. 516 pages. Covers distribution of 325 species which occur in 16-100 10-km squares with maps showing records before and after 1970 and text giving details of habitat and associated species. Of vital importance to all conservationists. ISBN 1 873701 66 7.

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# INSTRUCTIONS TO CONTRIBUTORS

**Scope.** Authors are invited to submit Papers and Notes concerning British and Irish vascular plants, their taxonomy, biosystematics, ecology, distribution and conservation, as well as topics of a more general or historical nature. Authors should consult the Hon. Receiving Editor for advice on suitability or any other matter relating to submission of manuscripts.

**Papers and Notes** must be submitted *in duplicate*, typewritten on one side of the paper, with wide margins and double-spaced throughout. Submission of copy on computer discs is acceptable but must also be accompanied by two hard copies of the text, double spaced throughout.

**Format** should follow that used in recent issues of *Watsonia*. Underline where italics are required. Names of periodicals should be given in full, and herbaria abbreviated as in *British and Irish herbaria* (Kent & Allen 1984). The Latin names and English names of plants should follow the *New Flora of the British Isles* (Stace 1991). Further details on format can be obtained from the Hon. Receiving Editor.

**Tables, figure legends & appendices** should be typed on separate sheets and attached at the end of the typescript.

**Figures** should be drawn in black ink or be laser-printed and identified in pencil on the back with their number and the author's name. They should be no more than three times final size, bearing in mind they will normally be reduced to occupy the full width of a page. Scale-bars are essential on plant illustrations and maps. Lettering should be of high-quality and may be done in pencil and left to the printer. Black and white photographs can be accepted if they assist in the understanding of the article.

**Contributors** must sign a copyright declaration prior to publication which assigns the copyright of their material to the Botanical Society of the British Isles. Twenty-five offprints are given free to authors of Papers, Notes and Obituaries; further copies may be purchased in multiples of 25 at the current price. The Society takes no responsibility for the views expressed by authors of Papers, Notes, Book Reviews or Obituaries.

**Submission of manuscripts**

Papers and Notes: Dr B. S. Rushton, School of Applied Biological and Chemical Sciences, University of Ulster, Coleraine, Co. Londonderry, N. Ireland, BT52 1SA.

Books for Review: C. D. Preston, Biological Records Centre, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS.

Plant Records: the appropriate vice-county recorder, who should then send them to C. D. Preston, Biological Records Centre, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS.

Obituaries: Dr J. R. Akeroyd, Lawn Cottage, Fonthill Gifford, Tisbury, Wiltshire, SP3 6SG.

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Watsonia

February 1996 Volume twenty one Part one

# David A. Webb Memorial Issue

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