FLORA OF GREAT BRITAIN AND IRELAND

Planned in five volumes, this critical flora provides a definitive account of the native species, naturalised species, frequent garden escapes and casuals found in the British Isles. Full keys and descriptions will enable the user to name all plants occurring in the wild, plus some ornamental trees and shrubs. For the first time detailed accounts of all the large apomictic genera are given and many infraspecific variants included. Each species entry begins with the accepted Latin name, synonyms and the common English name. A detailed description follows, including information on flowering period, pollination and chromosome number. Separate descriptions are given for infraspecific taxa. Information on the status, ecology and distribution (including worldwide distribution) of the species and infraspecific taxa is also given. Clear black-and-white line drawings illustrate an extensive glossary and also illuminate the diagnostic features in a number of groups of plants.

PETER SELL joined the Herbarium in the University of Cambridge’s Department of Plant Sciences in 1944, holding the post of Assistant Curator from 1972 until his retirement in 1997. His work there on this flora continues unabated, together with almost daily visits to the University’s Botanic Garden throughout the flowering and fruiting seasons. He is co-author of Flora of Cambridgeshire (1964) and Flora of the Maltese Islands (1977), and was involved in the whole of the Flora Europaea project, also published in five volumes (1964–80).

GINA MURRELL is Assistant Curator of the Herbarium in the University of Cambridge’s Department of Plant Sciences, having previously held the post of Herbarium Technician there. She has worked with Peter Sell over a period of 30 years, and they have together collected a quarter of the British Herbarium’s 200,000 specimens.
To our Mentors

Edred John Henry Corner
James Edgar Dandy
Humphrey Gilbert Carter
Harry Godwin
William Thomas Stearn
Stuart Max Walters
Alexander Stuart Watt
Cyril West
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Foreword to volume 4

by S. M. Walters ScD V.M.H.

It has been one of the continuing satisfactions of my academic career in Cambridge that the University Herbarium, of which I was Curator from 1948 to 1973, has provided an academic base for all my specialist interest in angiosperm taxonomy to develop. Indeed, I count myself doubly fortunate that, 12 years after my retirement from academic life, the Herbarium, with its staff and visitors, still provides such a base where scholarship can be pursued for its own sake. With great pleasure I welcome this volume, the first of a set of five promised to us by Peter Sell and Gina Murrell. My association with Peter goes back more than half a century: though I was ‘senior partner’ in our happy collaboration in the post-war Herbarium, ours was a symbiotic relationship from which we both greatly benefited, and I was delighted when Gina, who had been part of the team in the 1960s and 1970s, returned to the fold as Herbarium Technician in 1991.

As explained in the Preface, this project to write an entirely new critical flora of the British Isles comes to fruition some 20 years after an earlier scheme, in which the late Professor David Valentine took a leading part, had failed to find any financial support. Both Clive Stace to whose New Flora of the British Isles (1997) Peter pays tribute in the Preface, and Peter himself, were enthusiastic supporters of the Valentine project, and were prepared to play major parts in writing the Flora. It is fitting that both these eminent British taxonomists should separately carry on the tradition that David Valentine so enthusiastically advocated. Two aspects of this new critical Flora seem to be especially important. One concerns the acceptance, long overdue, of the ‘alien element’ in our flora as being equally worthy of taxonomic study: in this respect Stace’s Flora represents a real change in attitude, which is to my mind unreservedly to be welcomed. The other, interestingly linked to the first by many examples, concerns the taxonomic recognition and treatment of hybrids and infraspecific variants. British botany lacks any single reference work from which the basic information about the variation of British vascular plants can be found, yet this information is increasingly needed by ecologists, conservationists, molecular biologists and biochemists, who will, as the century closes, determine the shape of much botanical study in universities and specialised institutions.

The authors of this impressive work have set themselves a colossal task. They have made an excellent start, and we can only wish them a successful conclusion. It is for me a very real pleasure to add a further word to welcome this, the second volume of ‘Sell & Murrell’, as this remarkable Flora is now widely known among British botanists. Of course, this new volume, containing in particular the genus Hieracium, must rank as Peter’s very own ‘labour of love’. One of the very special links that has grown up between Peter and me over our long-standing acquaintance in the pursuit of taxonomic botany must be our steady, persistent enthusiasm for critical apomictic genera. We do not have to explain or justify to each other our passions for, in my case, Alchemilla, and his for Hieracium. I have to admit, however, that his task, with 412 named and described species of Hieracium in this volume, casts my puny efforts with British Alchemilla into the shade! Talking to Peter and Gina about the progress of this remarkable Flora, I am encouraged by what I hear. I really believe that both Peter and I will live to see its completion, in spite of the fact that we both ‘creak a little at the joints’ – to use one of the common euphemisms we find ourselves using from time to time to describe our state of health!

One final observation. How fortunate Peter is to have such a remarkable fellow-author in Gina! Writing and publishing books involves much more than producing a draft text. Some of the skill is straightforward, if laborious; but some requires real understanding at the level of human relations, and both these skills are possessed in abundance by Gina. So I conclude by saying to both Peter and Gina: keep up the good work to a successful conclusion.
Preface

For over 50 years I have worked in the herbarium at Cambridge University on the British and European floras. I have collected about 30,000 numbers consisting of some 50,000 specimens from most parts of the British Isles and made many visits to Continental Europe. Particular attention has been given to most critical genera: 

- Cerastium
- Conyza
- Crepis
- Dactylorhiza
- Euphrasia
- Fumaria
- Hieracium
- Limonium
- Pilosella
- Prunus
- Rhinanthus
- Salicornia
- Salix
- Scleranthus
- Sorbus
- Ulmus;

and in helping friends in various ways I have considered the taxonomy of

- Alchemilla
- Batrachian Ranunculi
- Chenopodium
- Potamogeton
- Rubus
- Taraxacum.

I have also spent much time studying ecotypic and geographical variation, in particular a comparison of those variants which occur on the coasts in dunes, shingle and salt-marsh with those growing as arable weeds, and those in mountains. Special attention has also been given to trees and shrubs.

It has long been my wish to publish this information in a critical flora of Great Britain and Ireland. In the 1970s a group of us tried to get a grant to carry this out, but we were unsuccessful. Clive Stace then started work on his New Flora of the British Isles, which was first published in 1991, with a second edition in 1997. In it he gives only abbreviated descriptions and omits most of the species in the large apomictic genera and many of the infraspecific variants. Numerous introduced species are included by Stace in a British and Irish flora for the first time, detailed descriptions and specimens of many of which are difficult to find.

Stace’s flora is to my mind an excellent field guide, which it would be difficult to better, but it does not give the detailed descriptions that are needed to confirm the identification of a plant which is new to you. A good description in my opinion is one in which a picture of the plant unfolds before you as you read it.

I considered it was possible for me to write a flora in five volumes which gave a full description of all the species in Stace’s flora and to add all the apomicts and many of the infraspecific variants, but it was too large a task to attempt to include all the biological information envisaged by the group in the 1970s. It was necessary, however, to have the help of another author, who lived in Cambridge, to deal with the large amount of work involved. My eye fell upon Gina Murrell who had worked with me in the 1960s and 1970s, when writing accounts for Flora Europaea, Flora of Turkey and Flora of the Maltese Islands. The work of one had complemented the work of the other and we were able to criticise one another without antagonism. We started field work on this flora on 13 May 1987, by describing Ceratocapnos claviculata, which was flowering on Dunwich Heath in Suffolk, in a snowstorm. Since then we have as far as possible spent one day a week working in the field or at the Botanic Garden, Cambridge. We started writing Volume 5 in 1992, and completed it by Easter 1994. It was published on 1 April 1997, not 1996 as stated in the volume itself.

I have done most of the writing and made the taxonomic and nomenclatural decisions, while Gina has done most of the measuring, sometimes sitting at the microscope dictating the description while I, surrounded by a pile of books, wrote it down, and she has set out and put the whole onto a computer. Gina has also done all the illustrations and organised our field work. Volume 4, probably the largest of the five, has taken longer than we thought due to my moving house and retiring and having to vacate my room in the Department of Plant Sciences in which I had accumulated much over 50 years. Major alterations to the whole Department have added to the difficulties. Volume 5 contained 28 families, 233 genera, 769 species, 93 subspecies, 148 varieties, 22 formae and 182 hybrids. This volume contains an introduction and full accounts of seven families, 146 genera, 1,098 species, 130 subspecies, 162 varieties, 27 formae and 51 hybrids. It deals with a whole range of taxa from very variable species which we feel cannot be further divided, to species with geographical races, ecotypes, forms and cultivars. The taxa may be outbreeding, inbreeding, apomictic or spreading vegetatively.

Peter Sell
Acknowledgements

In contrast to Volume 5, the specialised knowledge that P. D. S. has of the Asteraceae has not necessitated so much outside help as regards the taxonomy, but the account would be nowhere near as complete without the very special help given by John Richards and the late Andrew Dulan in Taraxacum. They made available their first draft of the Botanical Society of the British Isles’ Handbook of Dandelions of Great Britain and Ireland and we were able to keep up to date via Philip Oswald as he was editing the final version.

To the late Cyril West is also owed a very great debt. He spent the whole of his retirement working on Hieracium and came up to Cambridge regularly for over 30 years to study the large Cambridge collection. Our thanks also to the late Archie Kenneth and Mary McCallum Webster who gave almost all their numerous new collections of Hieracium to Cambridge, as have many other British and Irish botanists, particularly Allan McG. Stirling and Walter Scott. David McCosh has read and commented on the final version of Hieracium. Another special debt is due to David Tennant who wrote the very detailed account of Hieracium section Alpina. As well as growing nearly all the species of this section in his own garden he has seen them all in the field.

Philip Oswald has not only translated into Latin all the new taxa in this volume, but has answered many general questions concerning Greek and Latin, and the layout of the flora. Max Walters has translated much Swedish, German and French as well as discussing many problems of taxonomy. Chris Preston has read the whole of the text and as well as much improving the accounts of the distribution of the taxa, has added their geographical classification which is set out and explained in Preston, C. D. and Hill, M. O., The geographical relationships of British and Irish vascular plants in Botanical Journal of the Linnean Society 124: 1–120 (1997).

Arthur Chater has acted as a very special sort of adjudicator. Whenever we worked out infraspecific variants which were likely to occur in Cardiganshire, we telephoned him to give him the information, and he would either comment immediately or search for them at the first opportunity. His paper in Watsonia 24: 281–286 (2003) sets out the difficulties in finding information on infraspecific taxa. Charlie Jarvis has helped us while working on the Hortus Cliffortianus at the British Museum and Gina Douglas while working on the Linnean collection at Burlington House.

Barry Goddard has advised us on computer techniques. To Mrs J. E. Dandy we owe a special debt for giving us the second copy of her husband’s manuscript of his detailed work on the nomenclature of the British flora. Doug Kent continued to answer nomenclatural questions up until the time of his death. His contributions to British botany will be greatly missed. Harold Whitehouse read parts of the text and David Briggs has given us advice on breeding mechanisms. Bob Finch has helped with the account of Leontodon. To Bill and Joan Robinson we are grateful for letting us frequently raid their garden and for allowing some of their vegetables to go to flower and seed so that we were able to collect complete plant specimens. P. D. S. owes a very special debt to Brian and Rosemary Chapman. Every Friday afternoon they have led him over unfamiliar ground at Histon in Cambridgeshire and he has tried to name every plant he has come across down to forma. This has enabled him to keep his eye in with plants in the field as well as in the herbarium.

In the library of the Department of Plant Sciences Richard Savage has gone out of his way to get hold of rare and obscure publications for us and somehow to keep the library going during major alterations. At the Botanic Garden, Cambridge, Professor John Parker has allowed P. D. S. to continue after his retirement to have a free run of the Garden, its library and herbarium and has endeavoured to answer some of the difficult genetical and biological questions we have put to him. Also at the Garden, James Cullen, Alexander Goodall, Caroline Hotine, Huw Jones, Peter Kerley, Clive King, Pete Michna, Sally Petit, Ann Schindler, David Stone, Tim Upson, Norman Villis and Peter Yeo have given us much help. It has been particularly helpful to know from James Cullen what was going on while Asteraceae was being written for the Garden Flora. For many years the late Jack Symons looked after the large collection of cultivated Hieracium we had in the garden.

Professor Enid McRobbie and Professor Roger Leigh have allowed P. D. S. to continue to have full use of the herbarium and library after his retirement.

To Clive Stace we owe a very special debt. Had he not written his New Flora of the British Isles our task would have been insurmountable. In this volume he has even saved us the onerous task of searching through the literature to sort out the correct names of the Hieracium sections.
HISTORICAL BACKGROUND

The first real flora of these islands was John Ray’s *Catalogus Plantarum Angliae et Insularum Adjacentium* in 1670. The first flora to use the Linnaean binomial system of nomenclature was William Hudson’s *Flora Anglica* nearly a hundred years later in 1762. This was followed by William Withering’s *Botanical Arrangement of all the Vegetables naturally growing in Great Britain* in 1776–92, the first of many floras written primarily for the amateur.

James Sowerby’s *English Botany*, whose text was written by J. E. Smith, was first published between 1790 and 1820. It presented for the first time a complete set of coloured illustrations of our plants, illustrations which are still unsurpassed for line and colour. The third edition, published between 1863 and 1872, has inferior illustrations, but its text, rewritten by James Boswell Syme, is still important for its nomenclature and infraspecific taxa.

Three especially famous floras were produced in the nineteenth century. George Bentham’s *Handbook of the British Flora* in 1858 was written as a before-breakfast relaxation. In it keys appeared for the first time in a British flora. It was revised by J. D. Hooker in 1886.

J. D. Hooker’s *Student’s Flora of the British Islands*, first published in 1870 and finally revised in 1884, had very clear and concise descriptions and was the main flora used by many generations of botanists up until the 1950s. It is also important in that Hooker was one of the first authors to make frequent use of the category of subspecies.

Charles Cardale Babington’s *Manual of British Botany* first appeared in 1843 and the tenth edition, revised by A. J. Wilmott, was published in 1922. It contains many critical species and varieties not in other floras, but the descriptions are not clear and without keys it is difficult to use.

C. E. Moss’s *Cambridge British Flora* (1914–20), was very detailed and would have supplied a much needed critical flora, but alas only two volumes were published.

The arrival of ‘C. T. & W.’, A. R. Clapham, T. G. Tutin and E. F. Warburg’s *Flora of the British Isles*, in 1952, heralded the beginning of a new era in the study of British plants. It was the first up-to-date treatment in the twentieth century. A much revised second edition appeared in 1962 and a third in 1987 when D. M. Moore replaced E. F. Warburg. This last edition included the information in Tutin et al., *Flora Europaea* 1–5 (1964–80). The nomenclature had been brought up to date by J. E. Dandy in his *List of British Vascular Plants* in 1958, and the work he did on this for *Flora Europaea*. Thus for the first time taxonomy and nomenclature had been brought in line with those of Continental Europe.

The Botanical Society of the British Isles’ publication of the *Atlas of the British Flora* in 1962, edited by F. H. Perring and S. M. Walters, and the *Critical Supplement to the Atlas of the British Flora* in 1968, edited by F. H. Perring, gave us a much better idea of the distribution of our plants. The new edition of the *Atlas* arrived when most of this volume had been prepared for press, but the fact that Chris Preston had checked most of our distributions meant they were not much out of date.

The arrival of Clive Stace’s *New Flora of the British Isles* in 1991 with a second edition in 1997, and D. H. Kent’s *List of Vascular Plants of the British Isles* in 1992 has brought about the end of the C. T. & W. era and given us a completely up-to-date account of our flora. Major changes included the moving over of the main classification to A. Cronquist’s *An integrated system of classification of flowering plants* (1981) and the inclusion of almost as many alien species as native ones.

The aim of our Flora is to supply full descriptions of all the species in Stace’s flora, to include all the large apomictic genera and as many infraspecific variants as practicable, and to add more information about hybrids for which extensive use has been made of Stace’s *Hybridization and the flora of the British Isles* (1975).

THE CONTENTS OF THE FLORA

The Flora includes all the vascular plants, Lycopodiophyta (Clubmosses), Equisetophyta (Horsetails), Pteridophyta (Ferns), Pinophyta (Conifers) and Magnoliophyta (Flowering plants). The list of plants is made up of all our native species, including apomicts, and all the introduced plants given in Stace (1991), with some more added, particularly planted trees. E. J. Clement’s and M. C. Foster’s *Alien plants of the British Isles* arrived in 1994 after we had completed Volume 5, but we went through it and added as much information as possible. It has been used continually while preparing this volume. These alien taxa may be found to be more widespread when full attention is given to them. In his coverage of alien taxa Stace considers inclusion is merited when an alien is either naturalised (i.e. permanent and competing with other vegetation, or self-perpetuating) or, if a casual, frequently recurrent so that it can be found in most years. These criteria were applied as much to garden escapes or throw-outs as to the unintentionally introduced plants, and rarity was not taken into consideration for any of them. Cultivated species were included if they are field crops or forestry crops, or in the case of trees only, ornamentals grown on a large scale. Stace’s aim has been to include...
all taxa that the botanist might reasonably be able to find in the wild in any one year. To these we have added some ornamental trees and shrubs that are planted along streets and roadsides and in parks and estates and which we consider to be part of the landscape. Usually plants in gardens are not mentioned at all, but some species, which seed freely and spread over areas of garden and lawn where they are not planted, are included. Most of the species which Stace has mentioned, but not numbered or included in the keys, are here included, while a few have been left out altogether. We started with Volume 5 because The European Garden Flora had already covered the Monocotyledons, which has Flora Nomenclature according to the latest for many years and it is here made as accurate as possible. The Cambridge Cyclopedia of Life Sciences Taxon W. Zimmermann, On the higher taxa of embryobionta, in Fungi Alexopoulos and T. Deleveryas, and the second groups Classes following H. C. Bold, C. Kent (1992) which is taken from A. Cronquist, The classification follows that of Stace (1991 and 1997). little from those in Stace (1991 and 1997) and Kent (1992). Recent changes in the code of nomenclature have been used to get rid of some names which have been a long-standing source of confusion. New taxa and such changes in nomenclature and taxonomy which do occur are published at the end of the volume. No rules have been made about the number of synonyms given, as many as possible being included, but an attempt has been made to include all names used in British and Irish floras. The abbreviation auct. following a name means only that the name has not been accepted for the plant, it does not mean the type has been checked and the name rejected. Only in the case of a later homonym, which has been checked, does the word non and an author follow the name and author. This including of numerous synonyms often shows how a species has moved from one genus to another over the years, especially in the Asteraceae. The English name for the species follows Stace (1991 and 1997) as far as possible, and where they are missing from new species they have been created by us.

This volume contains some very large keys. Such keys are not very easy to use. The modern idea is to break up these keys into a number of smaller ones. This is purely psychological, giving the impression it makes things easier. It does not. The initial breaks, whether in one large key or an introductory key, are the most difficult. The more one knows about the genus the more useful the key becomes and often enables one to take a short cut. Where natural groups appear in these respects it follows Stace (1991 and 1997).

The smallest geographical area usually referred to is the county. This sometimes includes more than one botanical vice-county. For Great Britain we have used the boundaries adopted by H. C. Watson in 1873 in Topographical Botany and in Ireland by R. L. Prager in 1901 in Irish Topographical Botany. These are the vice-counties used by botanists, which have the benefit of not changing at regular intervals as do the political counties. With rare or local species the actual place or area may be given. The extra-limital distributions are those given in Clapham, Tutin and Moore (1987) with as much correcting as we and Chris Preston can give them. Russia and Yugoslavia have been used in the sense of the old U.S.S.R. and Yugoslavia before recent political disruptions.

GEOGRAPHICAL AREA

The Flora deals with the British Isles and includes England, Scotland and Wales, collectively known as Great Britain, Northern Ireland and Eire together forming Ireland, the Isle of Man, and the Channel Islands which include Jersey, Guernsey, Alderney, Sark, Herm and various small islands. In these respects it follows Stace (1991 and 1997).

The smallest geographical area usually referred to is the county. This sometimes includes more than one botanical vice-county. For Great Britain we have used the boundaries adopted by H. C. Watson in 1873 in Topographical Botany and in Ireland by R. L. Prager in 1901 in Irish Topographical Botany. These are the vice-counties used by botanists, which have the benefit of not changing at regular intervals as do the political counties. With rare or local species the actual place or area may be given. The extra-limital distributions are those given in Clapham, Tutin and Moore (1987) with as much correcting as we and Chris Preston can give them. Russia and Yugoslavia have been used in the sense of the old U.S.S.R. and Yugoslavia before recent political disruptions.

CLASSIFICATION AND NOMENCLATURE


One of us (P. D. S.) has specialised in nomenclature for many years and it is here made as accurate as possible according to the latest International Code of Botanical Nomenclature. The names of genera and species differ

Introduction
## ENGLAND, WALES, SCOTLAND, ISLE OF MAN

| 1. West Cornwall | 39. Staffordshire | 77. Lanarkshire |
| 2. East Cornwall | 40. Shropshire | 78. Peebles-shire |
| 4. North Devon | 42. Breconshire | 80. Roxburghshire |
| 5. South Somerset | 43. Radnorshire | 81. Berwickshire |
| 6. North Somerset | 44. Carmarthenshire | 82. East Lothian |
| 7. North Wiltshire | 45. Pembrokeshire | 83. Midlothian |
| 8. South Wiltshire | 46. Cardiganshire | 84. West Lothian |
| 9. Dorset | 47. Montgomeryshire | 85. Fifeshire |
| 10. Isle of Wight | 48. Merionethshire | 86. Stirlingshire |
| 11. South Hampshire | 49. Caernarvonshire | 87. West Perthshire |
| 13. West Sussex | 51. Flintshire | 89. East Perthshire |
| 14. East Sussex | 52. Anglesey | 90. Forfarshire |
| 15. East Kent | 53. South Lincolnshire | 91. Kincardineshire |
| 22. Berkshire | 60. West Lancashire | 98. Main Argyllshire |
| 26. West Suffolk | 64. Middle-west Yorkshire | 102. South Ebuldes |
| 27. East Norfolk | 65. North-west Yorkshire | 103. Middle Ebuldes |
| 31. Huntingdonshire | 69. Westmorland | 107. East Sutherland |
| 32. Northamptonshire | 70. Cumberland | 108. West Sutherland |
| 33. East Gloucestershire | 71. Isle of Man | 109. Caithness |
| 34. West Gloucestershire | 72. Dumfries-shire | 110. Outer Hebrides |
| 35. Monmouthshire | 73. Kirkcudbrightshire | 111. Orkney Islands |
| 36. Herefordshire | 74. Wigtownshire | 112. Shetland Islands |
| 37. Worcestershire | 75. Ayrshire |  |
| 38. Warwickshire | 76. Renfrewshire |  |

## IRELAND

| H13. Co. Carlow | H27. West Mayo |  |
VARIATION

The recording of variation is most important for both ecology and conservation, and even more important for gardeners who go out of their way to both create and conserve prominent variants. Intraspecific variation is usually recorded by the recognition of subspecies, varieties, forms and cultivars. These taxa differ chiefly in ecology and distribution. A *form* is a plant with a one- or two-gene difference which occurs with one or more other forms in a mixed population for most or all of its range. A *variety* is when one of these *forms* becomes more or less dominant in a particular ecological area, that is an *ecotype*. A *subspecies* is when one of these *forms* becomes dominant in a geographical area, that is a *race*. A *cultivar* is a form which is selected by horticulturalists and perpetuated, usually vegetatively. Because ecotypes and races have become adapted morphologically to different conditions over a long period, it is likely that their physiology and biochemistry, and indeed their whole biology, is different. Also, as they often flower at different periods their pollinators may be different and, if climatic conditions alter, one ecotype may be better able to survive than another. Variation thus becomes very important in conservation. Because the *Biological Flora of the British Isles* has lumped all its information under species it can be highly misleading when applied to individual populations. It is unfortunate that many botanists tend to ignore variation completely, and they will certainly ignore it if it has no name at all; subspecies are usually more often recognised than varieties. Sometimes it is more important to conserve one variety rather than another, e.g. the Chilterns *Orchis militaris* var. *tenafrons* is endemic, while the Suffolk var. *militaris* occurs in Continental Europe; *Liparis loeselii* var. *ovata* is rare in distribution, but frequent where it occurs, whereas var. *loeselii* is rare in Britain but occurs on the continent. Sometimes the variant will tell us whether the plant is native or not; e.g. *Leucojum aestivum* subsp. *aestivum* is native, subsp. *pulchellum* is a naturalised garden escape. Escaped cultivars are named wherever they can be easily recognised and are considered important. All apomicts, where possible, are treated as species, long escapes. Escaped cultivars are named wherever they have an interesting ecology or distribution. Hybrids are dealt with as fully as possible, especially those that spread having an interesting ecology or distribution. Hybrids are dealt with as fully as possible, especially those that spread vegetatively. No serious attempt has been made to decide on the correct infraspecific rank as taxa are often both ecological and geographical. Uniformity of infraspecific rank is often produced in a species or genus, but usually the only important thing considered is that a morphological recognisable infraspecific taxon has a name.

Where species grade gradually into one another over large distances, as the species of *Larix* do round the northern hemisphere, and at given points the whole population is uniformly intermediate it is regarded as a *cline*. Where two populations of ecotypes grow adjacent as in *Geum rivale* and *arumnum* there is often an area in which variable intermediates occur. This is also often called a cline, but it is really only so statistically, and we prefer to call it a **variable hybrid zone**. If you look for these things you will be surprised how often they exist, and clear-cut species, even apomicts, are not so clear-cut as we are made to believe.

Dick Brummitt and Arthur Chater writing in *Watsonia* 23: 161 (2000) about the genus *Calystegia* say:

The whole genus, in which some 25 species world-wide may conveniently be recognised, is taxonomically difficult, and few if any of the species are morphologically clear-cut. They mostly vary considerably over their ranges and merge geographically one into another, and division into species and subspecies is of necessity somewhat arbitrary.

We find this true of many groups when their whole range is considered.

If the origin of taxa is considered there are even more difficult problems. During the Quaternary cold stages massive glaciation from the north caused forests to retreat southwards and come up against other different floras and in some cases to hybridise with them. On climatic amelioration the forests advanced north again, often perhaps by a different path by which they went south, bringing a fresh variety of plants to join those species which survived in refugia in the cold areas. Richard West in *Plant Life of the Quaternary Cold Stages: Evidence from the British Isles* (2001, p. 263) writes:

This overall view shows the cold stage stadial flora to have a long and complex history, originating in the latest Tertiary, occupying a major part of Quaternary time in our area, and surviving short periods of forest dominance at times of climatic amelioration. It is not surprising that the taxonomy of the species concerned is very complex.

Following the forest clearances of the Neolithic about 5,000 years ago and the agricultural revolution which followed, some of the species of open habitats, particularly coastal areas, developed ecotypes which became agricultural weeds, or were actually brought in by early Man himself. Indeed, the weeds of Cornwall, East Anglia and Scotland may have been brought in by different races of *Man*, at different times, from entirely different areas.

To add to this state of affairs Man has brought plants from all over the world into gardens. Sometimes two species which never occur together in nature are grown together in gardens and hybridise, and may even backcross to one or both parents. These plants often escape into the countryside and sometimes our garden plants will hybridise with our native species. To confuse the issue even further Continental races of our native species are introduced to our countryside in packets of wild flower seed or are planted as trees and shrubs in our woodlands.

It can thus be seen that many of our species are far from uniform genetically. Apomictic species and many ecotypic varieties are probably more uniform.

DNA may help us to understand these problems, but will we ever have time and money to look in detail at all our flora?
During the writing of the Flora the following books were consulted for every species:

(This contains a large number of segregate species of A. Jordan, which he grew in cultivation for many years, and which are now recognised as infraspecific taxa or apomictic species.)


(This book carries an enormous amount of information and may well have been used more often than any other tome.)


Many other books and journals were consulted, mainly in the Cambridge Department of Plant Sciences, including the N. D. Simpson collection of local floras, and the Cory Library at the Botanic Garden. Where these references were considered to be important for particular plants, we have cited them under the family or genus concerned.

The University herbaria at Cambridge, on which the Flora is mainly based, are ideal for the study of the British flora for the following reasons:

1. The large British collection contains specimens from most of the main collectors of British plants from 1800 onwards, including sets of published exsiccatae and specimens sent through the Botanical Exchange Clubs. Most of the critical species have been named by experts.

2. The British herbarium contains some 50,000 specimens collected by us in the last 50 years. The specimens are accompanied by detailed field notes and are often of critical species or infraspecific taxa. Often a gathering may consist of more than one sheet, particularly of trees which may have been visited three or four times.

3. There is a good herbarium of Continental European plants with which to compare the British plants.

4. The world collection contains over 50,000 sheets of John Lindley’s herbarium made when he was secretary of the Royal Horticultural Society, when plants were coming into the country from all parts of the world; and the C. M. Lemann collection, named by George Bentham, and put together at the same time. These collections are very important as regards the alien species when considered in conjunction with the Botanic Garden herbarium and recent gatherings of alien specimens.

5. The Botanic Garden herbarium contains a large collection of cultivated plants.

Thus, the libraries, herbaria, our own field notes and plants grown in the Botanic Garden have enabled us to do most of the work in Cambridge. Over many years books and specimens elsewhere have been consulted.
Conspectus of families

Kingdom PLANTAE

Volume 1.

Division 1. LYCOPODIOPHYTA

1. LYCOPODIACEAE

Order 1. LYCOPODIALES

Order 2. SELAGINELLALES

Order 3. ISOETALES

Division 2. EQUISETOPHYTA

1. LYCOPODIACEAE

Order 1. LYCOPODIALES

Order 2. SELAGINELLALES

Order 3. ISOETALES

Division 3. PTERIDIOPHYTA

1. LYCOPODIACEAE

Order 1. LYCOPODIALES

Order 2. SELAGINELLALES

Order 3. ISOETALES

Order 4. OPHIOGLOSSALES

Order 5. HYMENOPHYLLALES
Conspicuous of families

Order 6. POLYPODIALES

11. POLYPODIACEAE

Order 7. DICKSONIALES

12. CYATHEACEAE

13. DICKSONIACEAE

Order 8. DENNSTAEDTIALES

14. DENNSTAEDTIACEAE

15. THELYPTERIDACEAE

16. ASPLENIACEAE

17. WOODSIACEAE (ATHYRIACEAE)

Order 9. SALVINIALES

21. AZOLLACEAE

Division 4. PINOPHYTA

Class 1. PINOPSIDA

Order 1. PINALES

22. PINACEAE

23. TAXODIACEAE

24. CUPRESSACEAE

25. ARAUCARIACEAE

Order 2. TAXOPSIDA

26. TAXACEAE

Division 5. MAGNOLIOPHYTA

Class 1. MAGNOLIOPSIDA

Subclass 1. MAGNOLIIDAE (DICOTYLEDONES)

Order 1. MAGNOLIALES

27. MAGNOLIACEAE

Order 2. LAURALES

28. LAURACEAE

Order 3. ARISTOLOCHIALES

29. ARISTOLOCHIACEAE
Conspectus of families

Order 4. NYMPHAEALES

30. NYMPHACEAE

31. CERATOPHYLLACEAE

Order 5. RANUNCULALES

32. RANUNCULACEAE

33. BERBERIDACEAE

Order 6. PAPAVERALES

34. PAPAVERACEAE

35. FUMARIACEAE

Subclass 2. HAMAMELIDAE

Order 1. HAMAMELIDALES

36. PLATANACEAE

Order 2. URTICALES

37. ULMACEAE

39. MORACEAE

38. CANNABACEAE

40. URTICACEAE

Order 3. JUGLANDALES

41. JUGLANDACEAE

Order 4. MYRICALES

42. MYRICACEAE

Order 5. FAGALES

43. FAGACEAE

45. CORYLACEAE

44. BETULACEAE

Subclass 3. CARYOPHYLLIDAE

Order 1. CARYOPHYLLALES

46. PHYTOLACCACEAE

47. AIZOACEAE

50. PORTULACACEAE

48. CHENOPODIACEAE

51. BASELLACEAE

49. AMARANTACEAE

52. CARYOPHYLLACEAE

(Order Illecebraceae)

Order 2. Polygonales

53. Polygonaceae

Order 3. PLUMBAGINALES

54. PLUMBAGINACEAE
Conspectus of families

Subclass 4. DILLENIIDAE
Order 1. DILLENIALES

55. PAEOIACEAE

Order 2. THEALES

56. ELATINACEAE
  57. CLUSIACEAE (GUTTIFERAE; HYPERICACEAE)

Order 3. MALVALES

58. TILIACEAE
  59. MALVACEAE

Order 4. NEPENTHALES

60. SARRACENIAEAE
  61. DROSERACEAE

Order 5. VIOLALES

62. CISTACEAE
  63. VIOLACEAE
  64. TAMARICACEAE

Order 6. SALICALES

65. FRANKENIAEAE
  66. CUCURBITACEAE

Order 7. CAPPARALAE

68. CAPPARACEAE
  69. BRASSICACEAE (CRUCIFERAE)

Order 8. ERICALES

71. CLETHRACEAE
  72. EMPETRACEAE
  73. ERICACEAE

Order 9. DIAPENSIALES

76. DIAPENSIACEAE

Order 10. PRIMULALAE

77. MYRSINACEAE
  78. PRIMULACEAE
<table>
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<tr>
<th>Subclass</th>
<th>Rosidae</th>
<th>Order 1</th>
<th>Rosales</th>
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<tbody>
<tr>
<td>79. Pittosporaceae</td>
<td>83. Crassulaceae</td>
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<td>80. Hydrangeaceae</td>
<td>84. Saxifragaceae</td>
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<td>81. Escalloniaceae</td>
<td>85. Rosaceae</td>
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<td>82. Grossulariaceae</td>
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**Volume 3.**

<table>
<thead>
<tr>
<th>Order 2</th>
<th>Fabales</th>
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<tr>
<td>86. Mimosaceae</td>
<td>88. Fabaceae</td>
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<td>87. Caesalpiniaceae</td>
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<th>Order 3</th>
<th>Proteales</th>
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<td>89. Elaeagnaceae</td>
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<thead>
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<th>Order 4</th>
<th>Haloragales</th>
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<tr>
<td>90. Haloragaceae</td>
<td>91. Gunneraceae</td>
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<tr>
<td>92. Lythraceae</td>
<td>94. Myrtaceae</td>
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<td>93. Thymelaeaceae</td>
<td>95. Onagraceae</td>
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<th>Order 5</th>
<th>Myrtales</th>
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<td>96. Cornaceae</td>
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<th>Order 6</th>
<th>Cornales</th>
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<tr>
<td>97. Santalaceae</td>
<td>98. Viscaceae</td>
</tr>
<tr>
<td>99. Celastraceae</td>
<td>100. Aquifoliaceae</td>
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<td>101. Buxaceae</td>
<td>102. Euphorbiaceae</td>
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<td>103. Rhamnaceae</td>
<td>104. Vitaceae</td>
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Conспектus of families

Order 11. LINALES

105. LINACEAE

Order 12. POLYGALALES

106. POLYGALACEAE

Order 13. SAPINDALES

107. STAPHYLEACEAE  111. ANACARDIACEAE
108. SAPINDACEAE   112. SIMAROUBACEAE
109. HIPPOCASTANACEAE  113. RUTACEAE
110. ACERACEAE

Order 14. GERANIALES

114. OXALIDACEAE  117. TROPAEOLACEAE
115. GERANIACEAE  118. BALSAMINACEAE
116. LIMNANTHACEAE

Order 15. APIALES

119. ARALIACEAE  120. APIACEAE (UMBELLIFERAE)

Subclass 6. ASTERIDAE

Order 1. GENTIANALES

121. GENTIANACEAE  122. APOCYNACEAE

Order 2. SOLANALES

123. SOLANACEAE  126. MENYANTHACEAE
124. CONVOLVULACEAE  127. POLEMONIACEAE
125. CUSCUTACEAE  128. HYDROPHYLLACEAE

Order 3. LAMIALES

129. BORAGINACEAE  131. LAMIACEAE (LABIATAE)
130. VERBENACEAE

Order 4. CALLITRICALES

132. HIPPURIDACEAE  133. CALLITRICHACEAE

Order 5. PLANTAGINACEAE
Conspectus of families xxvii

Order 6. SCROPHULARIALES

135. BUDDLEJACEAE 139. GESNERACEAE
136. OLEACEAE 140. ACANTHACEAE
137. SCROPHULARIACEAE 141. LENTIBULARIACEAE
138. OROBANCHACEAE

Volume 4.

Order 7. CAMPANULALES

142. CAMPANULACEAE

Order 8. RUBIALES

143. RUBIACEAE

Order 9. DIPSACALES

144. CAPRIFOLIACEAE 146. VALERIANACEAE
145. ADoxACEAE 147. DIPSACACEAE

Order 10. ASTERALES

148. ASTERACEAE (COMPOSITAE)

Volume 5.

Class 2. LILIOPSIDA (MONOCOTYLEDONES)

Subclass 1. ALISMATIDAE

Order 1. ALISMATALES

149. BUTOMACEAE 150. ALISMATACEAE

Order 2. HYDROCHARITALES

151. HYDROCHARITACEAE

Order 3. NAJADALES

152. APONOGETONACEAE 156. RUPIACEAE
153. SCHEUCHZERIACEAE 157. NAJADAECES
154. JUNCAGINACEAE 158. ZANNICHELLIACEAE
155. POTAMOGETONACEAE 159. ZOSTERACEAE
xxviii Conspectus of families

Subclass 2. ARECICAE

Order 1. ARECALES

160. ARECACEAE (*PALMAE*)

Order 2. ARACELES

161. ARACEAE

162. LEMNACEAE

Subclass 3. COMMELINIDAE

Order 1. COMMELINALES

163. COMMELINACEAE

Order 2. ERIOCAULONACEAE

164. ERIOCAULONACEAE

Order 3. JUNCALES

165. JUNCACEAE

Order 4. CYPERALES

166. CYPERACEAE

167. POACEAE (*GRAMINEAE*)

Order 5. TYPHALES

168. SPARGANIACEAE

169. TYPHACEAE

Subclass 4. ZINGIBERIDAE

Order 1. BROMELIALES

170. BROMELIACEAE

Subclass 5. LILIIDAE

Order 1. LILIALES

171. PONTEDERIACEAE

172. LILIACEAE (*ALLIACEAE*; *AMARYLLIDACEAE*; *TRILLIACEAE*)

173. IRIDACEAE

174. AGAVACEAE

175. DIOSCOREACEAE

Order 2. ORCHIDALES

176. ORCHIDACEAE