

Since its first publication in 1991, *New Flora of the British Isles* has become established as the standard work on the identification of the wild vascular plants of the British Isles. The Flora remains unique in many features, including its full coverage of all British wild plants, its user-friendly organisation, and its specially compiled keys and descriptions. All native, naturalised and crop plants, and all casual plants recorded five or more times since 1930, are included.

In the twelve years since the appearance of the Second Edition, many new data and ideas relating to British wild flora have become available. More than 160 species have been added to the text, so that 4800 taxa are now covered in varying degrees of detail. This is the first British Flora to incorporate the new molecular system of classification based on DNA sequences, a scheme that is expected to endure for centuries to come. The whole text has been updated and new features have been introduced. All the line-drawings and half-tones have been re-assessed and enhanced, and new ones have been added, so that now over 1600 species are illustrated on 180 pages. The distributions of all the taxa have been rewritten and there has been an overhaul of the designation of degrees of rarity, with the introduction of a third, less rare, category.

These revisions should ensure that this Third Edition remains the essential reference source for all taxonomists, ecologists, conservationists, plant hunters and biogeographers, whether they be researchers, teachers, students or amateurs.

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Clive Stace
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To MARGARET, RICHARD and MARTIN
with love and gratitude

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NEW FLORA
OF THE
BRITISH
ISLES
THIRD EDITION
CLIVE STACE

with illustrations mainly
by
HILLI THOMPSON
enhancement of illustrations and desk-top publishing
by
MARGARET STACE



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FOREWORD

A NOTE FROM AN ITINERANT BOTANIST

by DAVID BELLAMY

In my student days I was privileged to walk with some of the best field botanists in Britain, carrying a dented vasculum, a x20 lens, notebooks and a well-worn copy of the then newly available 'CTW'.

A student colleague of mine was Clive Stace, who has now just completed the third edition of his *New Flora of the British Isles*. How time flies when you can talk with flowers using their proper names. CTW (Clapham *et al.* 1952, 1962, 1987) has been superseded by the *New Flora*, one of the most important features of which is an enormously increased coverage of the alien species that are sadly arriving on our shores in ever-larger numbers. CTW included a very modest number of aliens, but this element in our flora now needs our full attention and it is vital that we are able to identify these invaders correctly. Many of them are making themselves at home, altering our wild habitats in many ways, some with catastrophic results. Vast amounts of money are already being spent on the control of Japanese Knotweed and Himalayan Balsam, so what about the host of more recent arrivals, such as Guernsey Fleabane, which is now abundant on waste land in much of England?

When it appeared in 1952 CTW had an enormous impact, supplying readily available information, generating enthusiasm, and pinpointing gaps in our knowledge. In those halcyon days a grounding in natural history was commonplace in schools, with scouts, guides, ramblers, natural history societies, WI and the Mothers Union also participating. Potential medics had to matriculate in Botany, and science students could read Honours Botany at most Universities.

The *New Flora* has become the key authority in this field of endeavour, sadly at a time when extremely few Universities now offer courses in field botany or taxonomy, because the expertise to teach it no longer exists and because it is not a subject that generates much research income. The result is that our Universities are not training specialists in these fields, so new school teachers are also lacking in the requisite skills. This downward spiral must be stopped.

The good news is that in this edition of the *New Flora* all the botanical data have been meticulously revised and brought up to date, adopting the new molecular system of classification at the family and genus levels. The molecular (DNA) classification contains many new and as yet unfamiliar features, but we all need to make the effort of getting to grips with it because it will undoubtedly endure for centuries to come, and it does indicate the true affinities of our plants. Although this is the first major work in this country to utilise the molecular system, Floras incorporating it are now appearing all over the world, so that it is becoming a real focus for a consensus in our taxonomic framework. To assist us in the transition the *Synopsis of Families* compares the old and new classifications.

Those, like me, who find that line drawings are a boon when keying out species, will not be disappointed by this work of painstaking scholarship concerning all the plants that now grace these well botanised Isles. Over 1600 species are illustrated. Today there are many flower books containing super coloured pictures of our plants that form excellent companions to the *New Flora*, but sadly they are not reliable when used as the only method of identification.

The *New Flora* covers over 4800 species and other lesser ranks. With it you will be able to put the correct Latin and English name to every weed you might encounter from the top of Ben Nevis down to the depths of the littoral zone of Britain, while learning of their virtues, jizz, distribution and rarity. Jizz is of great importance and is, despite *New Flora*, best learnt on a walk with fellow Field Botanists. So if you want to be counted among the real Botanists of the 21st Century this superb work of practical taxonomy is a must for your working library and your rucksack.

I also hope that it will provide a wake up call to our education gurus to get our schools and universities to urgently train more field botanists and professional taxonomists. Without enough such practitioners in the field it will be impossible to understand the changes in the solar ecology that feeds the terrestrial food chains that include us.

Bedburn, Co. Durham
September 2009

DAVID J. BELLAMY, OBE, DSc, Hon. FLS

PREFACE TO THIRD EDITION

In the twelve years (to June 2009) since the appearance of the second edition, many new data and ideas relating to our wild flora have become available, and the third edition makes full use of these. Its main features are:

- inclusion of more than 160 additional numbered species, mostly aliens but some natives such as *Callitriche palustris* and *Cystopteris diaphana*, plus many infraspecific taxa, hybrids and marginally wild taxa, producing a new total of about 4800 taxa covered in one way or other
- re-assessment and detailed enhancement by Margaret Stace of all the line-drawings and half-tones, producing much improved images
- review of the whole text, leading to innumerable corrections, clarifications and updates and the introduction of further improved features
- addition of several new half-tones and line-drawings, the latter executed by Rosemary Wise; over 1600 taxa are now illustrated on 180 pages
- rewritten distributions of all taxa, especially utilising information in *New Atlas of the British and Irish Flora*, including all the unprinted data on the CD-ROM that accompanies it, and in Reynolds (2002) for the Irish aliens
- complete overhaul of the designation of degrees of rarity (**R**, **RR**, **RRR**), using post-1987 data, with the introduction of a third, less rare, category
- indication of extinct native taxa (**E**), i.e. those not seen since 1980
- thorough revision of the classification and nomenclature, both by the continued application of the *International Code of Botanical Nomenclature* and, for the first time in a Flora of this region, the incorporation of the new molecular system of classification (APG III) primarily at family and genus levels
- use of desk-top publishing software, enabling copy to be delivered to the publisher in the form of PDFs rather than camera ready copy.

The number of additional aliens arriving in our area and requiring treatment in a comprehensive Flora shows no signs of abating. Horticultural species that become naturalised here are often originally planted under the name of a native species, but they originate from foreign seed and many in fact represent a different but closely related species (e.g. *Crataegus rhipidophylla*), or, if they are referable to one of our native species, they might represent a range of its variation which is not naturally found here (e.g. *Cornus sanguinea* ssp. *australis*, *Lotus corniculatus* var. *sativus*). Such plants present major problems of identification, and their numbers look set to rise steeply in the future, especially in such places as new roadsides or conservation and amenity areas.

I have received the same level of help and support in preparing this third edition as I enjoyed when writing the first two. Special thanks are due to Arthur Chater for valuable discussions and sound help and advice over many years, to Jeanette Fryer and Tim Rich concerning the genera *Cotoneaster* and *Sorbus* respectively for making available to me their unpublished data and for providing me with leaves for illustrations of the extra taxa (by chance 18 in each genus), to Eric Clement for continued expert advice on alien plants, to Gwynn Ellis for again compiling the very full index and for exhaustively proof-reading most of the text, and to my wife Margaret for spending many hours painstakingly enhancing all of the figures and

preparing the PDFs. Rosemary Wise kindly prepared the additional line-drawings, as Hilli Thompson was unable to undertake this task. I am especially indebted to David Bellamy, my friend for more than 50 years, for kindly writing the Foreword in his own inimitable style.

Many of those previously listed have continued to be of much assistance by answering queries, sending specimens, or pointing out errors or anomalies. I offer my sincere thanks to the following additional correspondents: Pat Acock, Henry Arnold, Hilary Ash, Pat Batty, Ian Bennallick, Fred Bos, Margaret Bradshaw, Stephen Bungard, Karl Peter Buttler, Pilar Catalán, Katherine Challis, Martin Cheek, Knud Ib Christensen, Paul Cobb, Arthur Copping, Mick Crawley, Philip Cribb, Jane Croft, Helen Crouch, Christopher Davis, Graham Day, John Day, Mary Dean, Ian Denholm, Graham Easy, Bob Ellis, Aljos Farjon, Carl Farmer, John Faulkner, Rosemary FitzGerald, E. Foerster, Michael Foley, Theo Gadella, Kanchi Gandhi, Alistair Godfrey, Mike Grant, Ian Green, Thomas Gregor, Werner Greuter, Richard Gulliver, Henning Haeupler, Elspeth Haston, David Hawker, John Hawksford, Marco Hoffman, David Holyoak, Chris Humphries, Matthew Jebb, Richard Jinks, Zdenek Kaplan, Daniel Kelly, Sally Kington, Jan Kirschner, Ingrid de Kort, Franta Krahulec, Richard Lansdown, Simon Leach, Bob Leaney, Graham Le Tissier, Alex Lockton, Mike Lush, Roger Maskew, Heather McHaffie, Catriona Murray, Gina Murrell, Gonzalo Nieto Feliner, Tony O'Mahony, Clare O'Reilly, Michael O'Sullivan, Philip Oswald, Bridget Ozanne, Chris Page, Barrie Phillips, Sharon Pilkington, John Poland, Mike Porter, Edward Pratt, Martin Rand, Jeremy Roberts, Ashley Robertson, Norman Robson, Clive Schofield, Pete Selby, Andy Smith, Mike Smith, Roger Smith, Mark Spencer, Paul Stanley, Malcolm Storey, Trevor Taylor, Ken Trewren, Pertti Uotila, Jan Frits Veldkamp, Rob Waterman, James Wearn, Jeanne Webb, John Wiersema, Sarah Whild, Michael Wilcox and Felicity Woodhead. The grand total is nearly 400.

As always, I would be pleased to receive comments and criticisms from readers.

Ullesthorpe, Leicestershire
 June 2009

CLIVE A. STACE

NOTE ON COVER PHOTOGRAPHS

- Edition 1 (1991): Riverside meadow, Yorkshire Dales (Agency photograph)
(Ranunculus acris, R. bulbosus)
 Edition 2 (1997): Cliff-top open woodland, Guernsey (C.A. Stace) *(Digitalis purpurea,*
Leucanthemum vulgare, Senecio sylvaticus)
 Edition 3 (2010): Maritime heathland, Pembrokeshire (C.A. Stace) *(Erica cinerea, Ulex*
gallii)

PREFACE TO FIRST EDITION

In writing this book I have attempted to produce exactly the kind of Flora that for twenty to thirty years I have wanted for my own use. Such a Flora would be as complete, up-to-date and user-friendly as possible, would be selectively illustrated, and would be available at a reasonable price.

No doubt many people will find camera-ready-copy of the sort utilised here less attractive than traditional type-setting, but the costs of the latter would have increased the price of the book very steeply without, in my opinion, increasing its utility in any way. Others might well decry the consistent use of English names (albeit completely subsidiary to the scientific Latin names), but I strongly believe that the study of wild plants by many more people with very diverse backgrounds is important if we are to convince the politicians that we must effectively conserve our native plant genetic diversity. For the same reason I have used fewer technical terms and fewer abbreviations of them than is usual in Floras; indeed, with hindsight I believe I should have used even fewer.

None of the above, however, is to be seen in any way as compromising or diminishing the need for absolute accuracy. When it is necessary to use a greater magnification than a hand-lens, or to cut sections of an organ, in order to see the diagnostic features, I have never pretended otherwise. The lack of a means of magnifying objects above $\times 20$ in good illumination, or of the ability to measure accurately to within 0.1mm, not only prevents one from obtaining certain data but, more seriously, is a frequent cause of misinterpretation or mismeasurement of plants. The remedy is obvious, and no more expensive than are the essential tools of a photographer, ornithologist or golfer.

The Flora is designed to enable field-botanists and those working with herbarium specimens to identify plants that are found **in the wild** in the British Isles. This is, I believe, a new criterion; more usually the origin and performance of plants are given higher significance when deciding where to draw the line between those to be included and those to be excluded. However, when one encounters a plant it is often not possible to know whether it is native or alien, or whether it has arrived accidentally or been planted, and one cannot know whether it will still be there next year! Hence a pragmatic approach has been adopted. The list of species included, as well as the data provided for each of them (especially their nomenclature and distribution), are as up-to-date as the information I possessed in October 1990 would allow.

The decision to write this Flora was made in 1983, and the actual preparation of the text took almost seven years. This decision was made due to the collapse of plans by a group of taxonomists to write a multi-volume definitive or critical Flora of Great Britain and Ireland, which had been discussed over the period December 1973 to January 1985. In the early 1980s it became clear that this project would founder (just as a similar one did in the 1930s), and it is regrettably the case that the British Isles still lack a truly complete Flora. Much information (especially concerning aliens) used in writing the present book was originally obtained by me for the abandoned floristic project in the late 1970s. However, this Flora in no way replaces the latter.

In the Acknowledgements I have tried to convey my indebtedness to all those who have helped me over the past 40 or more years and during the writing of this

book. Despite all their help I am aware that many imperfections remain, and doubtless errors will be uncovered as well. I should be very grateful to hear of those encountered by readers. If this Flora helps others to achieve anything approaching the degree of enjoyment and satisfaction that I have gained from the study of our wild plants, then it will have succeeded in its main aim.

Ullesthorpe, Leicestershire
 March 1991

CLIVE A. STACE

ACKNOWLEDGEMENTS

This book certainly could not have been written without the assistance so readily given me by over 200 friends and correspondents over the past twelve years, quite apart from the help and encouragement I received for many years prior to that. Rather than make lame reference to people 'too numerous to mention', I have attempted to list all of those who have directly helped me. Their participation has ranged from essentially one-word answers to questions such as 'Is the *Phyteuma spicatum* naturalised in your area blue- or yellow-flowered?', to detailed advice on taxonomic problems, the provision of specimens, or careful proof-reading or factual checking of draft accounts. Others, mentioned elsewhere, have assisted in more specific ways, such as by preparing drawings.

As well as thanking those who have directly helped in the preparation of this Flora, I wish to pay tribute to a number of people who have been instrumental in guiding me along the road to becoming a botanist. From the age of about 8 my parents actively encouraged my interest in natural history and helped to develop contacts with the local museum and societies in Tunbridge Wells, Kent. In my teens I received a tremendous amount of tuition and stimulation from Aline Grasemann (Tunbridge Wells Natural History Society) and Dik Shaw (my biology master). Our 'regional expert', Francis Rose, was also very influential, especially after the formation of the Kent Field Club in 1955. My first post-card from Miss Grasemann (dated 13th September 1953) reads: "If you are not doing anything else next Saturday what about coming over to the Dykes from Tonbridge Castle and seeing the Orange Balsam? And if you want to come and look anything up in 'Clapham' afterwards do." 'Clapham' (Clapham, Tutin & Warburg 1952) was to be a Christmas present from her three months later!

In all my years at University, as both student and lecturer, I have been fortunate in working with many very clever and helpful people. I should especially mention my postgraduate supervisor, Arthur Exell, and one of my professors at Manchester, David Valentine. The other great source of inspiration to me has been the Botanical Society of the British Isles. In the fifties and sixties those of its members who were of particular help to me, both on excursions and by post, were Joan and Peter Hall, Douglas Kent, Ted Lousley, David McClintock and Ted Bangerter.

Finally, my wife Margaret and sons Richard and Martin deserve special thanks. To someone who is totally addicted to field botany encouragement is both unnecessary and inappropriate, but their understanding and support have been crucial.

Of all those who have assisted me during the writing of this book, a few demand particular mention. This project has been very much a joint project with my wife and it has absorbed much of her spare time over the past five years. She played a major role in the planning of the format and in proof-reading, and carried out all the inputting and the preparation of camera-ready copy. Douglas Kent, who has been preparing a new checklist of vascular plants of the British Isles in parallel with

my work, has given me the benefit of his vast knowledge of alien as well as native plants and of nomenclatural matters. He has corrected many nomenclatural errors in my drafts. Hilli Thompson has skilfully prepared the great majority of the line-drawings, patiently taking account of all my demanding and pernicky criticisms and requests for alterations. Peter Hall has painstakingly proof-read all the text, ensuring that there are many fewer mistakes and inconsistencies than would otherwise have been the case, and has helped in numerous places by drawing on his (and his wife Joan's) long field experience. Many people have advised me on alien plants, particularly on those that should and those that should not be treated by me, but by far the most help has been received from David McClintock and Eric Clement. Their knowledge of British alien plants is unparalleled, and they shared it freely with me. I am more indebted than I can adequately express to all the above for their generous co-operation.

The long list of others to whom I offer my sincere thanks follows: Kenneth Adams, John Akeroyd, Abdul-Karim Al-Bermani, David Allen, Mark Atkinson, John Bailey, Peter Ball, G.H. Ballantyne, Bernard Baum, E.P. Beattie, Stan Beasley, Peter Benoit, E.M. Booth, Humphry Bowen, Paul Bowman, John Bowra, Eileen Bray, Anne Brewis, Mary Briggs, Dick Brummitt, Elaine Bullard, John Burlison, Rodney Burton, Andrew Byfield, Mary Caddick, Douglas Chalk, Arthur Chater, Eric Chicken, Tony Church, Peter Clough, P.R. Colegate, Ann Conolly, Tom Cope, Pam Copson, Roderick Corner, Eva Crackles, Diana Crichton, Gigi Crompton, David Curry, Tom Curtis, Kery Dalby, Dick David, John Day, David Dow, Ursula Duncan, Trevor Elkington, Gwynn Ellis, Trevor Evans, Lynne Farrell, F. Fincher, Bryan Fowler, Christopher Fraser-Jenkins, Jeanette Fryer, Gill Gent, Joan Gibbons, Vera Gordon, Richard Gornall, Gordon Graham, Florence Gravestock, Peter Green, Eric Greenwood, Adrian Grenfell, Paul Hackney, G. Haldimann, Joan Hall, Geoffrey Halliday, Gordon Hanson, Ray Harley, Gerald Harrison, John Harron, Clare Harvey, Chris Haworth, Stan Heyward, Sonia Holland, Kathleen Hollick, Florence Houseman, Enid Hyde, Bertil Hylmö, Ruth Ingram, Martin Ingrouille, Charlie Jarvis, Charles Jeffrey, Clive Jermy, John Jobling, Bengt Jonsell, Stephen Jury, Joachim Kadereit, John Kelcey, Archie Kenneth, Michel Kerguélén, Mary Kertland, Mohammed Khalaf, Peter Knipe, Doreen Lambert, Jacques Lambinon, Meredith Lane, David Lang, Peter Langley, Ailsa Lee, Alan Leslie, Frances Le Sueur, Richard Libbey, David Long, David Mabblerley, Hugh McAllister, David McCosh, Len Margetts, Mary Martin, John Mason, Brian Mathew, C.T.F. Medd, Desmond Meikle, Ronald Melville, Guy Messenger, J.M. Milner, Alan Mitchell, M. Morris, Mike Mullin, A.R.G. Mundell, Michael Nelhams, Charles Nelson, Alan Newton, Hans den Nijs, Tycho Norlindh, Elizabeth Norman, John Palmer, Richard Palmer, Richard Pankhurst, Rosemary Parslow, James Partridge, Ron Payne, Franklyn Perring, Ted Phenna, Eric Philp, Ann Powell, Chris Preston, Tony Primavesi, Cecil Prime, Jim Ratter, John Richards, Dick Roberts, A.W. Robson, R.G.B. Roe, Francis Rose, Krzysztof Rostanski, Fred Rumsey, Jocelyn Russell, Alison Rutherford, Patience Ryan, Bruno Ryves, Margaret Sanderson, Maura Scannell, H.D. Schotsman, Walter Scott, Peter Sell, Ted Shaw, B. Shepard, Alan Silverside, B. Simpson, David Simpson, W.A. Sledge, Philip Smith, Sven Snogerup, Keith Spurgin, Rod Stern, Olga Stewart, Allan Stirling, Lawrence Storer, David Streeter, Barbara Sturdy, George Swan, Joan Swanborough, Eric Swann, Pierre Taschereau, Michael Taylor, Nigel Taylor, David Tennant, Richard Thomas, Stephanie Thomson, Göran Thor, John Trist, Ian Trueman, Bill Tucker, Maureen Turner, Tom Tutin, David Valentine, Ted Wallace, Geoffrey Watts, David Webb, Mary McCallum Webster, Sarah Webster, David Welch, Derek Wells, Terry Wells, Christopher Westall, Ann Westcott, Mike Wilkinson, Arthur Willis, Chris Wilmot-Dear, Stan Woodell, Brian Wurzell, Goronwy Wynne, Peter Yeo, Jerzy Zygmunt.

PREFACE TO SECOND EDITION

This second edition of *New Flora of the British Isles* incorporates the new information that has arrived in the six years (to September 1996) since the first edition was completed, corrects errors and ambiguities detected in the latter, and introduces a number of improved features. The most important changes are:

- inclusion of c.320 additional taxa, including 129 fully treated at species level, so that now over 4600 taxa are covered in one way or another
- use of superior computer ware and laser-printing to produce higher quality camera-ready-copy, resulting in fewer pages despite the increase in text
- citation of chromosome numbers for all taxa where known
- standardisation of authority abbreviations with those listed in Brummitt & Powell (1992)
- provision of a full index down to subspecies level, including author citations and English names.

In addition, nomenclatural changes have been made where they have been shown to be necessary, but have been kept to a minimum; a slightly fuller treatment of *Rubus*, *Euphrasia*, *Taraxacum* and *Hieracium* has been provided; a number of extra figures have been added and others modified; the R/RR/RRR classification of rare plants has been updated; and the number of technical terms used throughout the book has been slightly reduced.

Of the 129 extra species treated, one is a suspected native (*Sorbus domestica*), one results from a new monograph raising a subspecies to species rank (*Arctium nemorosum*), and the other 127 are aliens, both those now considered to be naturalised and those that now seem frequent enough as casuals. Many of these extra aliens were formerly included as 'other spp.' in the first edition, but their removal from that category has been more than compensated for by the addition of others. The reappraisal of the status of alien plants has been made possible by two recent publications (Clement & Foster 1994; Ryves, Clement & Foster 1996). As a result of this I believe that all currently naturalised plants are included in the *Flora*, and that at least a mention is made of all other aliens that have been recorded from more than 4 localities since 1930.

I have received the same level of help and support in preparing the second edition that I enjoyed when writing the first. Duggie Kent, Peter Hall and Hilli Thompson deserve particular mention for their continuing roles, and I should also like to thank Gwynn Ellis for preparing the index to the second edition. Additions to the many correspondents that I previously listed and to whom I offer my sincere thanks are Phyllis Abbott, Dick Barrett, Richard Bateman, Gillian Beckett, John Benson, Jim Bevan, John Blame, Brian Bonnard, Chris Boon, Michael Braithwaite, John Bruinsma, Alec Bull, John Bullock, David Coombe, Allen Coombes, Jim Dickson, Philip Drazin, Andrew Dudman, Leni Duistermaat, J. Edelsten, Ian Evans, S.B. Evans, Larch Garrad, Peter Gateley, John Gibson, Jean Green, Paul Green, Chris Hall, David Hambler, Eric Hardy, Paul Harmes, Edith Hesselgreaves, Ellen Heywood-Waddington, Nick Hodgetts, George Hutchinson, Ann Hutchison, James Iliff, Helen Jackson, Michael Wyse Jackson, Peter Wyse Jackson, Sylvia Jay, Nejc Jogan, Graeme Kay, Quentin Kay, John Killick, Mark Kitchen, Geoffrey Kitchener, Adrian Knowles, Richard Lester, Len Livermore, Douglas McKean, Peter

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The aims of this second edition remain exactly the same as those expressed in the first, and again I would be glad to hear the comments and criticism of readers.

Ullesthorpe, Leicestershire
September 1996

CLIVE A. STACE

INTRODUCTION

The following paragraphs are intended to explain the contents and arrangement of the Flora and the reasons for the various conventions adopted and decisions taken.

TAXONOMIC SCOPE

All vascular plants (pteridophytes, gymnosperms and angiosperms) are included, as is traditional in British Floras. The families (Lycopodiaceae, etc.) in which these are currently placed are listed in the *Synopsis*, and for the angiosperms the families are also grouped into orders (Nymphaeales, etc.). No formal taxa are given above the level of order, only informal ones (Lycophytes, etc.), due to the fluid nature of higher rank classification at the present time. Below the family level, genera, species, subspecies and sometimes varieties are recognised; subfamilies or tribes (both in the case of Fabaceae, Asteraceae and Poaceae) are defined only for those families with 20 or more genera. Below the genus level, subgenera or sections are defined only for those genera with at least 20 species.

Apomictic microspecies are covered in full in most genera, but not for the three notorious genera *Rubus*, *Taraxacum* and *Hieracium*, for which specialist accounts already exist. In these genera a separation into relatively easily recognised groups of microspecies (here called sections) is provided instead. A full account of these genera would have greatly exceeded my own abilities and the scope of one volume. In addition to the above three problem genera, *Ranunculus auricomus* is an apomictic complex in which probably over 100 microspecies could be segregated; however, this complex has not been sufficiently researched in the British Isles to permit such a detailed treatment.

The coverage of alien taxa has been as thorough and consistent as possible. Many more aliens are included than in any previous British Flora, yet a considerable number of aliens traditionally to be found in other Floras have been omitted. To merit inclusion here, an alien must be 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. All this applies as much to garden-escapes and throwouts as to unintentionally introduced plants. Rarity, and the requirement of a highly specialised habitat, have not been taken into consideration (any more than is the case with natives). Extinct aliens are not treated. Cultivated species have been included if they are field-crops or forestry-crops or, in the case of trees only, ornamentals planted on a large scale. Exclusively garden plants, however abundant, whether crops or ornamentals, have not been covered, but most of the commoner taxa are included anyway because of their occurrence as escapes or throwouts. Also excluded are non-tree ornamentals planted en masse on new roadsides or in parks, etc. The aim of this re-vamped and expanded set of criteria is to include **all taxa that the plant-hunter might reasonably be able to find 'in the wild' in any one year**. Any such plant, whether native, accidentally introduced or planted, affects wild habitats and is part of the ecosystem, and botanists and others might be expected to need or want to identify it. Ornamental trees (but not shrubs or herbs) have been included because they are long-lived and frequently persist decades after all other signs of planting have disappeared from the area, so that the finder could not be expected to know that they were once planted. Doubtless, some additions to and removals from the list finally adopted are justified, but the

selection of taxa is as judicious as it is largely due to the enormous help I have received from the many correspondents who have made alien plants their special study and who have generously given me the benefit of their advice.

As well as the taxa treated 'fully' (i.e. keyed out, and provided with a numbered entry), other taxa that narrowly miss qualification, or fall far short of qualification despite their frequent inclusion in other Floras (often having become extinct), or have been erroneously included in the past, are also briefly mentioned. These are covered under families with a number followed by a letter (e.g. 11A), or under the headings 'Other genera' or 'Other spp.' that follow the keys to genera or species.

All interspecific and intergeneric hybrids are included, but their level of treatment varies. Hybrids that have attained distributions no longer tied to those of their parents (i.e. those that occur at least sometimes in the absence of both parents) are treated exactly like species, except that the multiplication sign is inserted between the generic name and the specific epithet (e.g. *Salix x rubens*) and the parental formula is given (e.g. *S. alba x S. fragilis*). This has been normal procedure for some genera (e.g. *Circaea*, *Mentha*) in the past, but a consistent application of the criterion has resulted in many more such taxa being similarly treated. Other hybrids are placed in their appropriate systematic position, but are not keyed and are not provided with their own number; they always occur with at least one parent and their identity can usually be deduced because of this. They are provided with as much information as their situation appears to warrant. The only exception to the above is that some highly fertile hybrids that can occur in the absence of both parents (e.g. *Geum*, *Hyacinthoides*) are not treated as separate entities, since they form a spectrum of variation linking that of their parents.

Reference must be made to the impressive *Flora of Great Britain and Ireland* being produced by Sell & Murrell (1996-2009) in five volumes, of which three have so far appeared (vols 3-5). This Flora, like the present one, is a project arising from the failure of the Critical Flora project of 1973-1985 referred to in the *Preface to First Edition*, but these two Floras even together do not amount to the Critical Flora originally planned. Sell & Murrell's Flora provides long valuable descriptions of all the taxa, including all microspecies. In the first volume (5), published in 1996, the species covered were more or less the same as those in the relevant part of *New Flora*, but in the two successive volumes (4 in 2006, 3 in 2009) an increasing number of additional alien species has been included. These extra species nearly all fall into one of three categories: extinct aliens; rare or very rare casuals; and cultivated plants (especially trees and shrubs) that have not been found in the wild in the British Isles, or are very marginal. They all fall outside the criteria used for inclusion in *New Flora*. It is useful for herbarium workers to have access to data on extinct or very rare aliens, and for field workers to be aware of additional garden plants that they might encounter, but the criteria that were originally devised by me for *New Flora* have been carefully adhered to in all three editions, the last of which stands as an account of the species found in the wild in the British Isles at the start of the twenty-first century.

GEOGRAPHICAL SCOPE

This Flora deals with the British Isles, comprising Great Britain (England, Scotland and Wales), Ireland (Northern Ireland and Eire), the Isle of Man, and the Channel Islands (Bailiwicks of Jersey and Guernsey). The Bailiwick of Guernsey includes Guernsey, Alderney, Sark, Herm and various lesser islands. The above are always referred to in their correct, strict senses, rather than loosely, except that a distinction between Great Britain and the Isle of Man is made only where necessitated by particular patterns of distribution. The United Kingdom (Great Britain and Northern Ireland) is not referred to in the text.

The smallest geographical unit utilised is usually the vice-county. There are 111 of

these in Great Britain and 40 in Ireland, with the Isle of Man and Channel Islands representing two others. All 153 are mapped and listed on the end-papers. The Isles of Scilly (Scilly) are part of West Cornwall, but they have a distinctive flora and are therefore frequently referred to separately.

STATUS AND DISTRIBUTION

The status of each of the taxa in the British Isles is defined by one of the three categories *Native*, *Archaeophyte*, or *Introduced*, and in the last case three sub-categories are recognised: *Naturalised*, *Casual*, or *Survivor*. All these terms are defined in the *Glossary*, and only archaeophyte requires further explanation. Archaeophytes are plants that are mostly associated with man's activities (e.g. weeds of cultivated ground) and have existed in the British Isles since at least medieval times, i.e. since before 1500 AD. Frequently it is uncertain whether the taxon concerned is actually native or introduced, and in many cases the use of the term largely expresses our ignorance in this respect. In this Flora I have slightly differed from some other works in the application of the term, because where a plant is *known* to have been introduced by man before 1500 (e.g. *Castanea*) I have treated it as introduced.

Obviously many taxa that are native here are not native in every place in which they occur, and taxa that are naturalised somewhere in the British Isles are often not so in all of their locations; in such cases only the 'higher' category is given.

The sign E is placed in the right-hand margin for those native or archaeophyte taxa that are considered extinct in the British Isles (i.e. not seen since 1980), except that some of them still occur as introduced or casual examples.

Distributions in the British Isles have been taken primarily from *New Atlas of the British and Irish Flora* (Preston et al. 2002), but a wide range of supplementary sources, notably including Reynolds (2002), has also been utilised. Endemic or extinct taxa are indicated in the text. The distributions are given in as concise a form as possible, with strict adherence to the definitions of the politico-geographical units referred to in the previous paragraph. Foreign distributions are given for introduced species, but these statements do not necessarily cover the entire range of a taxon, but rather those areas from which our plants most likely originated.

CLASSIFICATION

The classification of vascular plants most widely accepted at any one time has changed radically over the past two centuries, as the amount and nature of available data have increased. During the nineteenth century the system of Bentham & Hooker was most favoured. During the twentieth century this became increasingly modified to produce a less artificial, more natural, system, that of Cronquist (1981) ultimately being most widely championed and the one that was followed in the first two editions of this Flora. From the late 1990s onwards, however, our ideas on plant relationships (and therefore classification) have been revolutionised by the use of molecular data, mostly the base sequences of certain regions of DNA. Whilst this has largely confirmed previous ideas on the *circumscription* of most families, some unexpected novel features have emerged (e.g. the dismemberment of the Scrophulariaceae), and there are even more divergences in family *relationships* from those expressed in the pre-molecular systems, which demand a re-sequencing of the families. Many changes at the generic level are also indicated, e.g. the separation of *Ficaria* from *Ranunculus*. A radically new classification should not be adopted lightly, but the nature of the data now being utilised is such that it seems that classifications based on them will robustly stand the test of time. The need for all botanists to come to terms with the new classification, set out in Angiosperm Phylogeny Group (2009) as the third (and current) edition of the APG classification (known as APG III), is surely evident.

The angiosperm family circumscriptions and sequence adopted in this third edition are based on those in APG III and LAPG III respectively, the latter being the linear sequence of families derived from the former phylogenetic analysis (Haston et al. 2009). The few divergences from these that I have adopted are aimed at maintaining families that are recognisable morphologically, and at producing a system that remains as familiar as possible with its users. Such conservative measures, however, have been pursued only to a degree that falls short of transgressing the fundamental principles of molecular taxonomy. In terms of taxon circumscription, the vast majority of the taxa are monophyletic (see *Glossary*), and no known polyphyletic taxa are recognised, but a few paraphyletic taxa (Araceae, Caprifoliaceae, Plantaginaceae) are tolerated where the segregate taxa (e.g. Lemnaceae, Valerianaceae, Callitrichaceae) are very distinctive and do not easily fit in with the paraphyletic taxon from which they are separated. I consider this interpretation to be theoretically sound (Stace 2009). Some probably polyphyletic taxa remain, especially at genus level (e.g. *Anemone*, *Lysimachia*, *Senecio*), but these have been left intact pending the acquisition of more conclusive evidence. In terms of family sequence, the monocotyledons have been placed at the end of the dicotyledons, not between two groups of the latter as in the current APG schemes, because this much more familiar arrangement is no less correct on theoretical grounds (Hawthorne & Hughes 2008).

The new sequence of families is presented in the *Synopsis*. In order to put the recent changes into perspective, changes from the system adopted in editions 1 & 2, and deviations from the APG system, are summarised in the right-hand column.

The family sequence adopted for the pteridophytes is taken from Smith et al. (2006).

NOMENCLATURE

The articles of the *International Code of Botanical Nomenclature* have been applied rigorously. The writing of the first edition of this book coincided with the preparation by Douglas Kent (Kent 1992) of a new standard list of vascular plants of the British Isles, replacing that of Dandy (1958). Similarly, preparation of the second edition coincided with that of the first supplement to Kent's *List* (Kent 1997). I benefited greatly from my colleague's nomenclatural expertise and from the results of his research during that time, and have greatly missed our continued collaboration since his death in 1998.

A limited list of synonyms is provided. These are the accepted names used in Dandy (1958), Clapham *et al.* (1962, 1987, but not 1952), and Tutin *et al.* (1964-1980, 1993), and those used in the post-1970 British literature (including editions 1 & 2 of the present work, Kent's *List* and its Supplements, and Sell & Murrell (1996-2009)) and in Walters *et al.* (1984-2000). This selection should enable the reader to equate the names used in this work with those in virtually any standard modern reference.

The abbreviations of authors used are those in Brummitt & Powell (1992), a standard now universally adopted.

English names are given for all the species. I am quite convinced that the provision of English names is important in increasing the numbers of people with an interest in and knowledge of wild plants. Despite the fact that the Latin names are scientifically more meaningful and in my view always preferable, English names, if consistently and logically applied, can be no less accurate and their use by those who find them easier to remember should not be too strongly disparaged. In all but a few cases I have used the names adopted in Dony *et al.* (1986), but well over 1000 species that I have included are not listed in that work. Many sources have been consulted in order to find suitable English names for these other species; the American, Australasian, South African and horticultural literature was especially helpful. However, about 400 names have been, of necessity, coined anew.

DESCRIPTIONS

The descriptions of all the taxa are brief diagnoses providing what I consider to be the most important characters, and they have been made as consistent and comparable as possible. The data provided in the family descriptions cover all the genera treated as well as 'Other genera', and the data in the generic descriptions likewise cover 'Other spp.' as well as the fully treated species. However, it is important to note that no account of variation outside the British Isles is taken; indeed, it is specifically excluded, and the reader must beware of using the descriptions as definitions of the taxa on a world-wide or even European scale.

In order to compile a description of a genus, the generic diagnosis should be read in conjunction with the family diagnosis. Species and subspecies descriptions should likewise be supplemented by the family and the generic diagnoses and the key to species (where provided). For reasons stated later on, however, it could be misleading to use the family and generic keys in order to compile descriptions.

No generic description is given if there is only one genus included in the family, subfamily or tribe, as in these cases the description of the latter would be the same as that of the former.

In compiling the descriptions I have naturally made use of a very wide range of literature. I have attempted to avoid the repetition of errors thereby encountered by checking most of the measurements and other characters on actual specimens. I have examined material of virtually all the species covered in this work, most of it in the fresh state. I have grown (or allowed to grow, or failed to prevent from growing) about a quarter of the species in my own garden; these, and others in other gardens (including the University of Leicester Botanic Garden) and locally in the wild, I have been able to observe closely over the changing seasons.

Many measurements given, especially those describing plant heights or lengths, should be prefixed 'normally', 'usually' or 'mostly'. It is often misleading to give ranges including the extremes that have been encountered (e.g. a grass species 2-153cm high); usually the normal range is much more useful. More exceptional measurements are often given in brackets, e.g. 3-6(9)cm, but even these do not always represent the extremes. In the case of trees, however, the maximum heights known in the British Isles are given, taken from Mitchell (1982), although this is now rather out of date. Measurements given without qualification are lengths; those separated by a multiplication sign (e.g. 3-6 x 1-2cm) are lengths and widths respectively.

Certain conventions in terminology will become apparent after usage, especially if the *Glossary* is consulted. For example, 'above' and 'below' are used only to imply the upper and lower parts of a plant; upper and lower surfaces of an organ are referred to as 'upperside' and 'lowerside', or sometimes more specifically as adaxial and abaxial sides. The term 'leaf', unless otherwise stated, refers to the leaf-blade, excluding the petiole; this fact is especially important in the case of leaf length/breadth ratios.

Sporophytic chromosome numbers (written as $2n=$) have been included for most species. The primary source for these has been the inventory of chromosome numbers of mainly native plants available from the website of the *Botanical Society of the British Isles*. This is based on material of known wild origin in the British Isles. I have supplemented those data where no counts from the British Isles are available by including counts of foreign or cultivated material (clearly distinguished - see *Signs and Abbreviations*) compiled from the standard published chromosome indices, most now available on the website of the *Missouri Botanical Garden*. I have usually not added any of the many counts from abroad differing from those from our islands. Sometimes the data available have been simplified by omitting reference to rare variations or to the existence of B-chromosomes.

Despite some criticism, I have not included flowering seasons in the descriptions,

as I consider them to be as often misleading as helpful. For example, *Silene dioica*, which is given as flowering in May and June in Clapham et al. (1952, 1962, 1987), can be found in flower every day of the year in Leicestershire, and in the Scottish mountains it does not commence flowering until July.

IDENTIFICATION KEYS

The primary means of identification is the keys to families, genera, species and subspecies. The great majority of these are dichotomous keys. In order to save space no line-gap is left between couplets, but alternate couplets are slightly indented to effect visual separation. Despite this appearance all the dichotomous keys are of the bracketed version, which I consider to be generally superior to (i.e. easier to use than) the indented type followed by some Floras.

In constructing the keys I have attempted to avoid as many as possible of the pitfalls that I have personally encountered over the years. Keys are a vital part of a Flora, yet are one of the most difficult aspects to master and they provide a frequent barrier for the beginner. Long keys are particularly daunting, so I have subdivided keys wherever necessary by providing a general key to a series (A, B, etc) of supplementary keys. Hence few keys contain more than 20 couplets and very few more than 30.

In a small number of genera multi-access keys are used instead of or as well as dichotomous keys (e.g. *Epilobium*, *Sorbus*, *Cotoneaster*). These are usually cases where some diagnostic characters are difficult to observe or are likely to be misinterpreted, so that it is hazardous to rely upon them in isolation (as often encountered in a couplet), or where aspects of the plant observable at different times of the season are important. In other cases 'difficult' characters are allowed for by providing two or more routes in a key. For example the (superior) ovaries of *Rosa* are liable to be wrongly scored as inferior, the (five) leaflets of *Lotus* are often mistaken for three plus two stipules, and the (white) petals of *Berteroa* often fade to yellow when dried. In these and in many other cases both alternatives are allowed for. A consequence of this is that the 'information' given in a number of keys to families and genera is sometimes strictly inaccurate. These keys are provided solely for the purposes of identification, and should not be used to compile descriptions of taxa. The keys to species and subspecies, however, should be free of any such misleading data, and can be considered as part of the description of the species and subspecies. Some notoriously difficult characters (e.g. aerial stems present/absent in *Viola*; inflorescences axillary/terminal in *Trifolium*; structure of the throat of the corolla-tube in Boraginaceae) have been deliberately largely ignored in the keys.

No species key is provided if the genus includes only two species, and no subspecies key if a species contains only two subspecies; in both cases the two taxa are immediately adjacent and no key is needed. The keys to families include all the families not fully treated (e.g. 101A. Clethraceae) and take full account of all the genera mentioned in certain families under 'Other genera'; likewise, the keys to genera take account of all the species mentioned in certain genera under 'Other spp.'.

I have assumed that the reader is familiar with the use of dichotomous and multi-access keys, but I provide here some hints that I have found very valuable in the past. The keys are intended for use both indoors and in the field, and with both fresh and dried material. However, certain characters are not suited to field observation and, where special dissection or high magnification is absolutely necessary, no pretence is made that less satisfactory characters will suffice. The use of insufficient magnification is a frequent cause of misidentification. *Before* starting on the keys it is important to examine in detail the structure of the flowers, making sure that the number, shape and arrangement of the various parts are fully ascertained. If the flowers are not all bisexual then the distribution of the sexes

must be understood. The structure of the gynoecium usually presents the greatest problems; sectioning with a razor-blade vertically and transversely is often required. If fresh material is being collected, observations on underground parts, woodiness of stems and range of leaf-shape should be recorded. If possible, flowers (and fruits) of varying ages should be gathered. Mistakes are often made in distinguishing between a compound leaf (no buds in axils of leaflets) and a group of simple leaves (with buds, often very rudimentary, in axils).

In general, flowers are needed for identification by means of the keys, but there are some exceptions such as near the start of the General Key and in Keys A and B of the *Key to Families of Angiosperms*, and in some of the keys to the genera of Poaceae. The recent book by Poland & Clement (2009) attempts to remedy this. Apart from non-flowering material, it is usually not possible to key out a range of abnormalities such as extreme horticultural variants (e.g. *flore pleno* or otherwise with more floral parts than usual, extremely dissected leaves or petals, unusual colour variants), abnormally tall or dwarfed plants, monstrosities such as many-headed *Plantago* and leafy-stemmed *Taraxacum*, plants with petaloid or leafy bracts, gall-induced variations, and various odd mutants (e.g. *Fraxinus* leaves with one leaflet). In the wild such plants usually occur with normal ones.

Finally, four tips. Firstly, before using a key to genera read carefully the family description and any notes that follow it, and before using a key to species read carefully the genus description and any subsequent notes. These descriptions and notes always contain useful data and sometimes vital ones, since special terms and conventions (e.g. 'spikelet length' in *Festuca* is not actually the total spikelet length) are often defined. Secondly, read the *whole* of *both* alternatives of each couplet before attempting to choose between them. Thirdly, if there is genuine doubt about which alternative to choose, follow both, as usually one will soon show itself to be unsuitable. Fourthly, if a nonsensical answer is obtained, check back to ensure that the frequent error of choosing the correct alternative but following the wrong subsequent route has not been committed.

ILLUSTRATIONS

Some sort of illustration is provided for about half of the numbered taxa. The page on which each occurs is indicated in bold in the right-hand margin of the text. The purpose is not to picture a representative sample of the taxa, but (1) to provide drawings of (mostly alien) species for which ready sources are not available in the literature; and (2) to illustrate diagnostic parts (e.g. seeds, leaves, flowers) of more critical groups of taxa on a comparative basis.

The illustrations are either line drawings or photographs. The former have mostly been executed by Hilli Thompson, to whom I am greatly indebted for the tremendous trouble she has taken to capture accurately the minute detail of the specimens. However, the choice of subject-matter, the supply of material, and the checking of accuracy, was carried out by me, and if there are faults in those respects they are my responsibility. The few drawings not made by Hilli Thompson are all attributed and acknowledged in the appropriate caption. Rosemary Wise contributed the additional drawings required for this third edition. Other artists who made drawings especially for this Flora and to whom I offer my sincere thanks are Dick Roberts (40, 873), Jerzy Zygmunt (364), Kery Dalby (494), Olga Stewart (647, 648, 649, 652, 653), Fred Rumsey (661), and Sue Ogden (1085-1088).

The photographs, most of them taken via the light microscope or scanning electron microscope, have been prepared by me or on my behalf by various colleagues in the School of Biological Sciences, University of Leicester, except in the few cases specifically acknowledged. I am extremely grateful for the help in this respect given me by Abdul-Karim Al-Bermani, John Bailey, Jenny Haywood, George McTurk, Ian Riddell and Andrew Scott. Additional SEMs required for this

third edition were kindly provided by David Twell and Stefan Hyman of the Electron Microscope Laboratory at the University of Leicester.

CONSERVATION AND RARITY

By far the greatest threat to our wild flora is the destruction of habitats, still continuing at a most alarming rate in the name of everything from 'agricultural policy' and 'economic development' to 'leisure activity'. When populations of plants (or animals) are decimated they become highly vulnerable to secondary pressures, of which collecting is one. There can be little objection to the accumulation of a reference collection of plants, providing uncommon species are excluded and populations of even common ones are not significantly reduced. Indeed, a collection of accurately determined plants is the best way of learning them and of enabling identification of extra species encountered later. Often, however, only a small part of the plant (e.g. a basal leaf or a single flower) is needed for diagnostic purposes. Rarely are underground parts essential, and, even where they are, these can usually be adequately substituted by notes made in the field. It should be noted that in Great Britain it is actually illegal under the *Wildlife and Countryside Act 1981* to uproot any wild plant, even common weeds, without the land-owner's permission, and the *Act* specifies more detailed regulations governing Nature Reserves and rare species contained in the *Schedule of Protected Plants* (updated by quinquennial reviews). Under the *Act* it is an offence to pick, remove or destroy any part (including seeds) of the species in the *Schedule*, to attempt to do so, or to trade in these species. For practical purposes the species marked **RRR** should be those so treated. Other Acts cover Eire and Northern Ireland.

Since it is only botanists who have a good knowledge of our wild flora, it is vital that they consider themselves under a special obligation to protect it by example and by persuasion.

Rare taxa are referred to in this Flora under three categories, marked by **R**, **RR** and **RRR** in the right-hand margin; no plants in any of these categories should be collected, damaged or disturbed (e.g. by trampling, or by 'arranging' the immediate surroundings during photography). Even taxa not so marked are frequently rare in some areas (e.g. montane species in the south); where they are rare they should be respected as much as species that are rare throughout the British Isles. The '**R**' signs of rarity are given for only native taxa and archaeophytes; hybrids not treated fully and aliens are not designated. Many taxa that are rare as natives are much commoner as aliens; only the native (or archaeophyte) distribution is considered for present purposes. The precise meanings of these signs are as follows:

R - Uncommon, found in not more than 250 different 10 × 10km grid-squares in the British Isles (there are 3859 of these grid squares in total) since 1987.

RR - Scarce, found in not more than 100 different 10 × 10km grid-squares in the British Isles since 1987.

RRR - Rare, found in not more than 15 different 10 × 10km grid-squares in the British Isles since 1987.

These three lists have been compiled from the raw data obtained during the surveys carried out for *New Atlas of the British and Irish Flora* (Preston et al. 2002), kindly made available by the Biological Records Centre, an up-to-date source providing a far more accurate summary than was possible in the earlier editions of this Flora. Useful discussions of nearly all the taxa in the **RR** and **RRR** categories above are to be found in Stewart et al. (1994) and Wiggington (1999).

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SYNOPSIS OF FAMILIES

With notes on changes from Editions 1 & 2

LYCOPHYTES

1. Lycopodiaceae
2. Selaginellaceae
3. Isoetaceae

CLUBMOSES & QUILLWORTS

EUSPORANGIATE FERNS

4. Ophioglossaceae

ADDER'S-TONGUES & MOONWORTS

CALAMOPHYTES

5. Equisetaceae

HORSETAILS

LEPTOSPORANGIATE FERNS

6. Osmundaceae
7. Hymenophyllaceae
8. Marsileaceae
9. Salviniaceae
- 9A. Cyatheaceae
10. Dicksoniaceae
11. Dennstaedtiaceae
12. Pteridaceae
13. Aspleniaceae
14. Thelypteridaceae
15. Woodsiaceae
16. Blechnaceae
17. Onocleaceae
18. Dryopteridaceae
- 18A. Davalliaceae
19. Polypodiaceae

TRUE FERNS

Incl. Azollaceae

Incl. Adiantaceae

17. Onocleaceae split off

Segregate of 15. Woodsiaceae

GYMNOSPERMS

20. Pinaceae
21. Araucariaceae
22. Taxaceae
23. Cupressaceae

CONIFERS

Incl. Taxodiaceae

PRE-DICOTS

Nymphaeales

24. Cabombaceae
25. Nymphaeaceae

Piperales

26. Saururaceae
27. Aristolochiaceae

Laurales

28. Lauraceae

PRIMITIVE ANGIOSPERMS

SYNOPSIS OF FAMILIES

xxix

EU-DICOTS**Ceratophyllales**

29. Ceratophyllaceae

Ranunculales

30. Papaveraceae

31. Berberidaceae

32. Ranunculaceae

Proteales

33. Platanaceae

Buxales

34. Buxaceae

Gunnerales

35. Gunneraceae

Saxifragales

36. Paeoniaceae

37. Grossulariaceae

38. Saxifragaceae

39. Crassulaceae

40. Haloragaceae

Vitales

41. Vitaceae

Fabales

42. Fabaceae

43. Polygalaceae

Rosales

44. Rosaceae

45. Elaeagnaceae

46. Rhamnaceae

47. Ulmaceae

48. Cannabaceae

49. Moraceae

50. Urticaceae

Fagales

51. Nothofagaceae

52. Fagaceae

53. Myricaceae

54. Juglandaceae

55. Betulaceae

Cucurbitales

56. Cucurbitaceae

Celastrales

57. Celastraceae

58. Parnassiaceae

Oxalidales

59. Oxalidaceae

Malpighiales

60. Euphorbiaceae

61. Elatinaceae

62. Salicaceae

63. Violaceae

64. Linaceae

65. Hypericaceae

TRUE DICOTYLEDONS

Incl. Fumariaceae

129. Escalloniaceae split off

58. Parnassiaceae split off

Incl. Caesalpiniaceae & Mimosaceae

Segregate of 52. Fagaceae

51. Nothofagaceae split off

Segregate of 38. Saxifragaceae

Segregate of Clusiaceae

Geraniales

66. Geraniaceae

Myrtales

67. Lythraceae

68. Onagraceae

69. Myrtaceae

Crossosomatales

70. Staphyleaceae

Sapindales

71. Anacardiaceae

72. Sapindaceae

Incl. Aceraceae & Hippocastanaceae

73. Rutaceae

74. Simaroubaceae

Malvales

75. Malvaceae

Incl. Tiliaceae

76. Thymelaeaceae

77. Cistaceae

Brassicales

78. Tropaeolaceae

79. Limnanthaceae

80. Resedaceae

80A. Cleomaceae

Segregate of Capparaceae

81. Brassicaceae

Santalales

82. Santalaceae

Incl. Viscaceae

Caryophyllales

83. Frankeniaceae

84. Tamaricaceae

85. Plumbaginaceae

86. Polygonaceae

87. Droseraceae

88. Caryophyllaceae

89. Amaranthaceae

Incl. Chenopodiaceae

90. Aizoaceae

91. Phytolaccaceae

92. Nyctaginaceae

93. Montiaceae

Segregate of 94. Portulacaceae

93A. Basellaceae

94. Portulacaceae

93. Montiaceae split off

Cornales

95. Cornaceae

103. Garryaceae & 134. Griselinaceae split off

96. Hydrangeaceae

Ericales

97. Balsaminaceae

98. Polemoniaceae

99. Primulaceae

Incl. Myrsinaceae (& Samolaceae)

100. Diapensiaceae

101. Sarraceniaceae

101A. Clethraceae

102. Ericaceae

Incl. Empetraceae, Monotropaceae, Pyrolaceae

Garryales

103. Garryaceae

Segregate of 95. Cornaceae, incl. Aucubaceae

SYNOPSIS OF FAMILIES

xxxi

Gentianales

104. Rubiaceae

105. Gentianaceae

106. Apocynaceae

(Order uncertain)

107. Boraginaceae

Incl. Hydrophyllaceae

Solanales

108. Convolvulaceae

Incl. Cuscutaceae

109. Solanaceae

Lamiales

110. Oleaceae

111. Calceolariaceae

Segregate of 117. Scrophulariaceae

112. Gesneriaceae

113. Veronicaceae

Segregate of 117. Scrophulariaceae

114. Plantaginaceae

Paraphyletic due to exclusion of 113, 115 & 116

115. Hippuridaceae

116. Callitrichaceae

117. Scrophulariaceae

111, 113, 119 & 120 & semi-parasitic genera split off; incl. Buddlejaceae

118. Lamiaceae

119. Phrymaceae

Segregate of 117. Scrophulariaceae

120. Paulowniaceae

Segregate of 117. Scrophulariaceae

121. Orobanchaceae

Semi-parasitic Scrophulariaceae added

122. Lentibulariaceae

123. Acanthaceae

123A. Bignoniaceae

124. Verbenaceae

Aquifoliales

125. Aquifoliaceae

Asterales

126. Campanulaceae

127. Menyanthaceae

128. Asteraceae

Escalloniales

129. Escalloniaceae

Segregate of 37. Grossulariaceae

Dipsacales

130. Adoxaceae

131. Caprifoliaceae

Paraphyletic due to exclusion of 130, 132 & 133

132. Valerianaceae

133. Dipsacaceae

Apiales

134. Griseliniaceae

Segregate of 95. Cornaceae

135. Pittosporaceae

136. Araliaceae

137. Hydrocotylaceae

Segregate of 138. Apiaceae

138. Apiaceae

137. Hydrocotylaceae split off

MONOCOTS**Alismatales**

139. Acoraceae

140. Araceae

141. Lemnaceae

142. Tofieldiaceae

143. Alismataceae

144. Butomaceae

145. Hydrocharitaceae

146. Scheuchzeriaceae

147. Aponogetonaceae

148. Juncaginaceae

149. Zosteraceae

150. Potamogetonaceae

151. Ruppiaceae

Dioscoreales

152. Nartheciaceae

153. Dioscoreaceae

Liliales

154. Melanthiaceae

155. Alstroemeriaceae

156. Colchicaceae

157. Liliaceae

Asparagales

158. Orchidaceae

159. Iridaceae

160. Xanthorrhoeaceae

161. Alliaceae

162. Asparagaceae

Arecales

162A. Arecaceae

Commelinales

163. Commelinaceae

164. Pontederiaceae

Poales

165. Typhaceae

166. Bromeliaceae

167. Eriocaulaceae

168. Juncaceae

169. Cyperaceae

170. Poaceae

MONOCOTYLEDONS

Segregate of 140. Araceae

139. Acoraceae split off; paraphyletic due to exclusion of 141. Lemnaceae

Segregate of 157. Liliaceae

Incl. Najadaceae

Incl. Zannichelliaceae

Segregate of 157. Liliaceae

Segregate of 157. Liliaceae

Segregate of 157. Liliaceae

Segregate of 157. Liliaceae

141, 151, 153, 154, 155, 159, 160 & 161 split off

Segregate of 157. Liliaceae

Segregate of 157. Liliaceae

Segregate of 157. Liliaceae; incl. Agavaceae

Incl. Sparganiaceae

HOW TO USE THIS BOOK

Before consulting the information in this *Flora*, it is strongly recommended that the *Contents*, the *Introduction* and this page (including the reverse of it) be read carefully.

The *Index* at the end of the book should be used in order to look up a family, genus, species, subspecies or hybrid; both Latin and English names are indexed.

In order to identify a vascular plant it is necessary first to decide whether it is a pteridophyte, gymnosperm or angiosperm. Many Floras purport to do this by means of keys, but in reality the questions posed (e.g. plant reproducing by spores; ovules enclosed in a carpel) amount to the same as the decision called for here. In practice it is best to become familiar with the range of form and structure found in the relatively few pteridophytes and gymnosperms, all other vascular plants being angiosperms. In the case of pteridophytes, the few that do not have divided fern-like leaves can easily be learnt and, in the case of gymnosperms, all have simple narrow leaves (except *Araucaria*) and woody female cones (except *Taxus* and *Juniperus*). It is especially crucial to distinguish between superficially similar but unrelated plants that provide pitfalls for the unwary. Well-known examples are mosses and Lycophytes; *Equisetum* and *Hippuris*; *Lemna* and *Azolla*; *Isoetes* and *Littorella*; *Pilularia* and *Juncus*; and *Alnus* and conifers. If flowers, spore-bearing sporangia or woody cones are evident, then the task is an easy one. If not, familiarity and experience will soon prevent one from falling into traps such as the above. According to the decision, follow the generic or family keys starting on pages 1, 41 and 56, the positions of which are marked by black-edged pages. These will lead to a family or genus, which will provide further keys as necessary, enabling one to arrive at the genus, species and subspecies. Where relevant, keys to genera are given under each family, to species under each genus, and to subspecies under each species. Before using the keys the appropriate part of the introductory chapter (pp. xxii-xxiii) should be studied.

The arrangement of the information given in each species account is as follows:

1. Accepted Latin Name Author(s) (*Synonyms* Authors) - *English Name*. Brief description to give habit and comparative diagnostic features, not always repeating those in species key; chromosome number. Status; most characteristic habitats; distribution in BI; area of most likely origin if not native.

Illustrations are numbered according to the page on which they appear, not in a sequence from 1 onwards. References to illustrations are given in the right-hand margin adjacent to the relevant taxon by sole means of a bold number.

Rarity and extinction status are similarly referred to in the margin by means of **R**, **RR**, **RRR** and **E**. For the precise meaning of these symbols, see pp. xix and xxiv.

A glossary is placed after the systematic accounts (marked by a black-edged page).

Signs and abbreviations are listed on the next page.

Maps and a ruler are provided on the front and end covers.

SIGNS AND ABBREVIATIONS

BI	- British Isles
CI	- Channel Islands
Br	- Great Britain
En	- England
Ir	- Ireland
Sc	- Scotland
Wa	- Wales
N, E, S, W, NE, etc.	- points of compass
C, M, MW, etc.	- central, Mid-, Mid-West, etc.
Leics, W Kent, etc.	- (vice-counties) see end papers
Jan, Feb, Mar, etc.	- months of year
agg.	- aggregate
auct.	- of various authors but not the original one
c.	- about, approximately
cv.	- cultivar
E (in margin)	- extinct as native (see p. xix)
<i>et al.</i>	- <i>et alii</i> (and others)
excl.	- excluding
f.	- form (forma)
FIG, Fig	- Figure (number following is the page number)
hort.	- invalid horticultural name
incl.	- including
intrd	- introduced
microsp., microspp.	- microspecies (singular and plural)
natd	- naturalised
nom. illeg.	- illegitimate (but valid) name
nom. nud.	- name invalid since without description
nom. inval.	- name invalid for some other reason
nothosp., nothospp.	- nothosubspecies (singular and plural)
nothovar.	- nothovariety
R.	- River
R, RR, RRR (in margin)	- see p. xxiv (degrees of rarity)
sp., spp.	- species (singular and plural)
ssp., sspp.	- subspecies (singular and plural)
surv	- survivor
var., vars	- variety, varieties
±	- more or less
>, <	- more than, less than
≥	- over and including; at least; not less than
≤	- up to and including; at most; not more than
0	- absent
x	- times (2x, etc. = twice, etc.); or indicating a hybrid
2n=	- sporophytic chromosome number based on wild material from BI
(2n=)	- sporophytic chromosome number of other material
µm	- micron, see <i>Glossary</i>