

THE EUROPEAN GARDEN FLORA

The European Garden Flora is the definitive manual for the accurate identification of cultivated ornamental flowering plants. Designed to meet the highest scientific standards, the vocabulary has nevertheless been kept as uncomplicated as possible so that the work is fully accessible to the informed gardener as well as to the professional botanist. This new edition has been thoroughly reorganised and revised, bringing it into line with modern taxonomic knowledge. Although European in name, the Flora covers plants cultivated in most areas of the United States and Canada as well as in non-tropical parts of Asia and Australasia.

Volume IV contains accounts of 82 families, mostly rather small, but including the Primulaceae (with *Primula* as its largest genus) and Ericaceae (with *Rhododendron*, the largest genus in the Flora).

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THE EUROPEAN GARDEN FLORA FLOWERING PLANTS

*A manual for the identification of plants cultivated
in Europe, both out-of-doors and under glass*

VOLUME IV

Angiospermae – Dicotyledons

Second edition

edited by

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assisted by

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PREFACE TO THE SECOND EDITION

Work on the first edition of this Flora was begun in 1976, and publication of 6 volumes followed reasonably regularly thereafter (vol. II, 1984; vol. I, 1986; vol. III, 1989; vol. IV, 1995; vol. V, 1997 and vol. VI, 2000). During the whole period of production, the work of 175 authors and contributors was supervised by an editorial committee, chaired from 1977 to 1989 by the late Dr S.M. Walters and by myself from 1989 to 2000. The membership of the committee varied, but included (at different times) Dr J.C.M. Alexander, the late Mr A. Brady, Mr C.D. Brickell, Dr J.R. Edmondson, the late Mr P.S. Green, Professor V.H. Heywood, Professor P.-M. Jørgensen, Dr S.L. Jury, Ms S.G. Knees, Dr A. Leslie, the late Mr J. Lewis, Ms V.A. Matthews, Ms H.S. Maxwell, Mrs D.M. Miller, Dr E.C. Nelson, Dr N.K.B. Robson, the late Professor D.A. Webb, the late Professor D.O. Wijnands and the late Dr P.F. Yeo. Over the whole period the project was sponsored by the Royal Horticultural Society of London, the Royal Botanic Garden Edinburgh (where the secretariat was based) and the Stanley Smith Horticultural Trust. Financial and other support was provided by the Cory Foundation of Cambridge University Botanic Garden, the Coke Trust, the Cruden Foundation, the Edinburgh Botanic Garden (Sibbald) Trust, the Humphrey Whitbread Trust, the John S. Cohen Foundation, the Lok Wan Tho Memorial Fund, the Royal Botanic Garden Edinburgh (especially staff time and office space, logistic and IT support), the Royal Horticultural Society, the Stanley Smith Horticultural Trust (the major provider of funds over the whole period), the Will Charitable Trust, the William Adlington Cadbury Charitable Trust and the Wolfson Industrial Fellowship. More detail on the history of the project can be found in an article in *The Plantsman* (7: pp. 164–7, 2000).

Following completion of the work on volume VI in 1999, Ms S.G. Knees was appointed to the Stanley Smith Horticultural Fellowship at the Royal Botanic Garden Edinburgh, and for 3 years worked on the correction, updating and improvement of the text (in both paper and computerised form); this work now provides the foundation for the new second edition, which has been edited by myself, Ms S.G. Knees and Ms H.S. Cubey (née Maxwell), assisted by Mr J.M.H. Shaw (Nottingham), Ms L. Banfield (RBG Edinburgh), Mr P. Harrold (RBG Edinburgh), Ms A. Laporte-Bisquit (RBG Edinburgh), Mr M.F. Gardner (RBG Edinburgh), Ms S. Neale (RBG Edinburgh), Mr G.D. Rowley (Reading), Miss N. Zantout (RBG Edinburgh and Bremen) and Mr C.D. Brickell (Pulborough).

We are particularly grateful to the Royal Botanic Garden Edinburgh for allowing Ms Knees and Ms Cubey time from their official duties at the garden to complete the necessary changes to, and organisation of, the text. We are also grateful to all those contributors who have revised the accounts written for the first edition.

The current edition contains many corrections, updates and improvements to the original text. The major change is the omission of the ferns and their allies (Pteridophyta) and the Gymnosperms. These groups, considered as cultivated plants, do not fit well with a Flora-type treatment, being mainly cultivars of relatively few genera and species; there are many, more appropriate, guides to them available. Because of this omission, it has been thought sensible to combine the original volumes I & II into a single large volume (I) containing all the Monocotyledons; volumes II–V (equivalent to III, IV, V & VI of edition 1) contain the Dicotyledons. Contributions that have been only lightly revised are presented here under the name of the original author. Those that have been more heavily altered are under the name of the original author plus that of the editor.

Because the original was first conceived during the 1970s, long before the current and continuing storm of changes to family and generic placements caused by the introduction of cladistic and molecular taxonomic methods, the text was organised and families and genera were recognised according to the system presented in H. Melchior's edition (edn 12) of *Syllabus der Pflanzenfamilien* (1964). Use of this system is no longer tenable, but the editors were loath to accept any of the current labile and uncertainly documented systems (e.g. those developed by the Angiosperm Phylogeny Group) as these are more likely to confuse users of this book rather than help them. Instead, for the recognition of genera and families, we have chosen to follow R.K. Brummitt's *Vascular Plants, Families and Genera* (1992), which provides a published and easily available listing of all the families and genera recognised at Kew in the 1990s. Because Brummitt's list is in alphabetical order, the order of families and genera used here is rather arbitrary, but retains essentially that of the genera found in edition 1, thus maintaining some degree of continuity with the original publication.

Many other changes in detail have been made to the text, most of which do not require mention here. However, it is important to note that, though we have tried to list (under the heading 'Literature') taxonomically useful, up-to-date literature for all genera and families, it does not necessarily follow that the text of

the Flora will contain any or all of the changes proposed in this literature. Further relevant literature continues to appear on a regular basis and interested readers are referred to *Kew Record*, or the extremely valuable *ePIC* plant information database available on the website of the Royal Botanic Gardens Kew (www.kew.org.uk).

Each volume contains its own index, and a consolidated index to accepted Families and Genera will be found in volume V.

James Cullen
Director, Stanley Smith (UK) Horticultural Trust
Cambridge, April, 2009.

PREFACE TO THE FIRST EDITION

The ideas that led to the production of *The European Garden Flora* derived from two independent sources, and were developed during the late 1960s and early 1970s. One of us (SMW), then Director of the University of Cambridge Botanic Garden and heavily involved in the completion of *Flora Europaea*, had been thinking of how botanic gardens might make some contribution to the problems of horticultural taxonomy and classification. He had indeed discussed these matters with the British amateur botanist David McClintock, who was himself very anxious to further research towards the production of a Flora for gardens. The other (JC), then Assistant Regius Keeper at the Royal Botanic Garden Edinburgh, formerly Assistant Director at Liverpool University Botanic Gardens, Ness, had independently developed similar ideas and had produced some samples to show how such a Flora might be prepared.

These two sources came together at the 1976 Scientific Review Group (of which SMW was a member) of the work of the Royal Botanic Garden Edinburgh. Discussion between us soon revealed our common concerns. The need for such a Flora and the recommendation that the RBG Edinburgh should be actively involved in its production were written into the Review Group report, to become part of the official policy of the Garden.

A meeting of the British botanists and horticulturists who might wish to be involved in such a production was called by us in Autumn 1976 and held at the offices of the Royal Horticultural Society in London. It was agreed that such a Flora should be produced, that its content should be mainly those species, subspecies and (botanical) varieties that were grown in Europe (both outdoors and under glass), that it should be organised from RBG Edinburgh, that it should use a minimum of taxonomic jargon, and that it should seek contributors from all parts of the world. The group at this first meeting constituted itself into the Editorial Committee (which was later strengthened by the inclusion of members from other countries in Europe) to oversee the project, and to organise and administer the grants necessary to see the production through. A twenty-year timescale was envisaged.

For the first two years, the preparation of lists of species that could or should be included in the projected Flora was the main concern. For this purpose, a vacation student (Ms Margaret McDonald, the first of many) was employed by RBG Edinburgh to make an index from all the available nurserymen's catalogues. This early predecessor of *The Plant Finder* became the basis for the content of the Flora. The employment and training of vacation

students has been a constant feature of the development of the project.

In 1979 the Editorial Committee approached the Stanley Smith Horticultural Trust for a grant to employ a Research Associate to work full-time at Edinburgh. The application was successful, and in October 1979, Dr Crinan Alexander began work in this capacity. He continued, supported by grants from other donors, until he was succeeded by Sabina G. Knees in 1987. Since 1994 various other workers have been employed on an ad hoc basis; they are individually acknowledged in volumes IV, V and VI.

The first volume of the Flora (volume II) was published in 1984; subsequent volumes followed in 1986, 1989, 1995 and 1997; this, the final volume, will be published in 2000. If we take the originally envisaged twenty-year span as beginning with the first appointment of the Research Associate, then the production has slipped by only a single year.

Full acknowledgement of the contributions of the various authors (now over 200), editors and collaborating institutions has been given in the individual volumes. Here we would like to add some more general acknowledgements. Firstly, to the Royal Botanic Garden Edinburgh, which has fully honoured its commitment to the 1976 Review Group by providing staff-time, secretariat and logistical support (telephones, stationery, computers, etc.) over the whole 24-year period. Similarly, though on a smaller scale, the University of Cambridge Botanic Garden has provided background support. The Royal Horticultural Society has provided funds and facilities over a long period, especially since 1987. Several grant-giving bodies have been associated with the project; again, these are acknowledged in the various volumes, but a special acknowledgment is due to the Stanley Smith Horticultural Trust (now the Stanley Smith (UK) Horticultural Trust) and its first Director, Sir George Taylor FRS, for its continued support, but especially for its faith in the project at the beginning. Finally, all the volumes have been published by Cambridge University Press; we are grateful to them for persisting with the project over such a long period and especially to the two editors who have seen the process through – Martin G. Walters and Dr Maria Murphy.

James Cullen
S. Max Walters
Cambridge, September 1999

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Special thanks are due to Sophie Durlacher, who undertook the arduous task of project managing this second edition.

We are grateful to J.C.M Alexander, Diane Allison, Peter Barnes, Anke Berg, Elaine Campbell, Eleanor Catherine, Mark Coode, Urs Eggli, M. Flanagan, Christine Grey-Wilson, Geoffrey Herklotts, Frances Hibberd, Michael Hickey, Christopher Hogg, Julia Howe, Sarah Johnstone, Christabel King, Rosemary King, Debbie Maizells, Victoria A. Matthews, Suzanne Maxwell, Gillian Meadows, Mary Mendum, Diane Nicol-Brown, Susan Oldfield, Christina Oliver, Donald Pigott, Rodella Purves, Sally Rae, Gordon Rowley, Alison Rutherford, Julian Shaw, Niki Simpson, Rosemary M. Smith, Mark Tebbitt, Margaret Tebbs, Vicky Thomas, Femke de Vries, Maureen Warwick and Rosemary Wise for the preparation of illustrations and also to Edinburgh University Press for allowing us to re-use illustrations from volumes 6 (1978) and 7 (1982) of P.H. Davies (ed.) *Flora of Turkey*.

INTRODUCTION

Amenity horticulture (gardening, landscaping, etc.) touches human life at many points. It is a major leisure activity for very large numbers of people, and is a very important means of improving the environment. The industry that has grown up to support this activity (the nursery trade, landscape architecture and management, public parks, etc.) is a large one, employing a considerable number of people. It is clearly important that the basic material of all this activity, i.e. plants, should be readily identifiable, so that both suppliers and users can have confidence that the material they buy and sell is what it purports to be.

The problems of identifying plants in cultivation are many and various, and derive from several sources, which may be summarised as follows:

(a) Plants in cultivation have originated in all parts of the world, many of them from areas whose wild flora is not well known or documented. Many have been introduced, lost and reintroduced under different names.

(b) Plants in gardens are growing under conditions to which they are not necessarily well adapted, and may therefore show morphological and physiological differences from the original wild stocks.

(c) All plants that become established in cultivation have gone through a process of selection, some of it conscious (selection of the 'best' variants, etc.), some of it unconscious (by methods of cultivation and particularly propagation), so that, again, the populations of a species in cultivation may differ significantly from the wild populations.

(d) Many garden plants have been 'improved' by hybridisation (deliberate or accidental), and so, again, differ from the original stocks.

(e) Finally, and perhaps most importantly, the scientific study of plant classification (taxonomy) has concentrated mainly on wild plants, largely ignoring material in gardens.

Nevertheless, the classification of garden plants has a long and distinguished history. Many of the herbals of pre-Linnaean times (i.e. before 1753) consist partly or largely of descriptions of plants in gardens, and this tradition continued, and perhaps reached its peak, in the late eighteenth and early nineteenth centuries – the period following the publication of Linnaeus' major works, when exploration of the world was at its height. This is the period that saw the founding of *Curtis' Botanical Magazine* (1787) and the publication of J.C. Loudon's *Encyclopaedia of plants* (1829, and many subsequent editions).

The further development of plant taxonomy, from about the middle of the nineteenth century to the present, has seen an

increasing divergence between garden and scientific taxonomy, leading on the one hand to such works as the *The Royal Horticultural Society's dictionary of gardening* (1951 and reprints), based on G. Nicholson's *Illustrated dictionary of gardening* (1884–1888), *The new Royal Horticultural Society's dictionary of gardening* (1992), and the very numerous popular, usually illustrated, works on garden plants available today, and, on the other hand, to the Floras, Revisions and Monographs of scientific taxonomy.

Despite this divergence, a number of plant taxonomists realised the importance of the classification and identification of cultivated plants, and produced works of considerable scientific value. Foremost among these stands L.H. Bailey, editor of *The standard cyclopaedia of horticulture* (1900, with several subsequent reprints and editions), author of *Manual of cultivated plants* (1924, edn 2, 1949) and founder of the journals *Gentes Herbarium* and *Baileya*. Other important workers in this field are T. Rumpler (*Vilmorin's Blumengärtnerei*, 1879), L. Dippel (*Handbuch der Laubholzkunde*, 1889–93), A. Voss & A. Siebert (*Vilmorin's Blumengärtnerei*, edn 3, 1894–6), C.K. Schneider (*Illustriertes Handbuch der Laubholzkunde*, 1904–12), A. Rehder (*Manual of cultivated trees and shrubs*, 1927, edn 2, 1947), J.W.C. Kirk (*A British garden flora*, 1927), F. Enke (*Parey's Blumengärtnerei*, edn 2, 1958), B.K. Boom (*Flora Cultuurgewassen*, 1959 and proceeding), V.A. Avrorin & M.V. Baranova (*Decorativn'ie Travyanist'ie Rasteniya Dlya Otkritogo Grunta SSSR*, 1977) and R. Mansfeld (*Verzeichnis landwirtschaftlicher and gärtnerischer Kulturpflanzen*, edn 2, 1986).

The present Flora, which, of necessity, is based on original taxonomic studies by many workers, attempts to provide a scientifically accurate and up-to-date means for the identification of plants cultivated for amenity in Europe (i.e. it does not include crops, whether horticultural or agricultural, or garden weeds), and to provide what are currently thought to be their correct names, together with sufficient synonymy to make sense of catalogues and other horticultural works. The needs of informed amateur gardeners have been borne in mind at all stages of the work, and it is hoped that the Flora will meet their needs just as much as it meets the needs of professional taxonomists. The details of the format and use of the Flora are explained in section 2 below (p. xvi).

In writing the work, the Editorial Committee has been fully aware of the difficulties involved. Some of these have been outlined above; others derive from the fact that herbarium material of cultivated plants is scanty and usually poorly annotated, so that material of many species is not available for checking the use of names, or for comparative purposes. Because of these facts, attention has been drawn to numerous problems which cannot be solved

but can only be adverted to. The solution of such problems requires much more taxonomic work.

The form in which contributions appear is the responsibility of the Editorial Committee. The vocabulary and the technicalities of

plant description are therefore not necessarily those used by the contributors.

1. SELECTION OF SPECIES

The problem of determining which species are in cultivation is complex and difficult, and has no complete and final answer. Many species, for instance, are grown in botanic gardens but not elsewhere; others, particularly orchids, succulents and some alpine, are to be found in the collections of specialists but are not available generally. Yet others have been in cultivation in the past but are now lost, or perhaps linger in a few collections, unrecorded and unpropagated. Further problems arise from the fact that the identification of plants in collections is not always as good as it might be, and some less well-known species probably appear in published lists under the names of other, well-known species (and vice versa).

The Flora attempts to cover all those species that are likely to be found in general collections (i.e. excluding botanic gardens and specialist collections) in Europe, whether they are grown outdoors or under glass. In order to produce a working list of such species, a compilation of all European nursery catalogues available to us was made in 1978 by Margaret McDonald, a vacation student working at the Royal Botanic Garden, Edinburgh. Since then, numerous additions have been made. This list (known as the 'Commercial List'), which includes well over 12,000 specific names, forms the basis of the species included here. Since 1987 the annual production by the Hardy Plant Society (later, the Royal Horticultural Society) of the *Plant Finder* has made the process of ascertaining which plants are on sale very much simpler. Similar publications on the continent of Europe – Erhardt, A. & W., *Pflanzen-Einkaufsführer* (1990), Pereire, A. & Bonduel, P., *Où trouver vos Plantes* (1992) and van der Laar, H.J., *Naamlijst van Houtige Gewassen* (1985–89) – have made the process of scanning catalogues no longer necessary. Another work of great benefit to cultivated plant taxonomy is *Index Hortensis* by Piers Trehane; volume I covering herbaceous perennials was published in 1989; other groups will be covered in subsequent volumes. This work gives the nomenclaturally correct names and synonyms for plants in cultivation and also has extensive lists of cultivars. In addition to the 'Commercial List', *The Plant Finder* and *Index Hortensis*, several works on the flora of gardens

have been consulted, and the species covered by them have been carefully considered for inclusion. These works are: *The Royal Horticultural Society's dictionary of gardening*, edn 2 (1956, supplement revised 1969); *The new RHS dictionary of gardening* (1992); Encke, F. (ed.), *Parey's Blumengärtnerei* (1956); Boom, B.K., *Flora der Cultuurgewassen van Nederland* (1959 and proceeding); Bean, W. J., *Trees and shrubs hardy in the British Isles* (edn 8, 1970–81); Krüssmann, G., *Handbuch der Laubgehölze* (edn 2, 1976–78); *Manual of cultivated broad-leaved trees and shrubs* (English edition, translated by M.E. Epp, G.S. Daniels, editor, 1986); Encke, F., Buchheim, G. & Seybold, S. (eds), *Zander's Handwörterbuch der Pflanzennamen* (edn 14, 1993), and, since 1986, Mansfeld, R., *Verzeichnis landwirtschaftlicher und gärtnerischer Kulturpflanzen* (edn 2, 1986) and Jelitto L. & Schacht, W., *Die Freiland Schmuckstauden* (1963); Jelitto, L., Schacht, W., & Fessler, A. (eds), (edn 3, 1985), *Hardy herbaceous perennials revised*, English edition (1989); and Brickell, C.D. (ed.), *The Royal Horticultural Society A–Z encyclopedia of garden plants* (2003). Most of the names included in these works are covered by the present Flora, though some have been rejected as referring to plants no longer in general cultivation.

As well as the works cited above, several relating to plants in cultivation in North America have also been consulted: Rehder, A., *Manual of cultivated trees and shrubs* (edn 2, 1947) and *Bibliography of cultivated trees and shrubs* (1949); Bailey, L.H., *Manual of cultivated plants* (edn 2, 1949); *Hortus Third* (edited by the staff of the L.H. Bailey Hortorium, Cornell University, 1976).

The contributors have also drawn on their own experience, as well as that of the family editors, European advisers and other experts, in deciding which species should be included.

Most species have a full entry, being keyed, numbered and described as set out under section 2c below (p. xvii). A few, less commonly cultivated, species (additional species) are not keyed or numbered individually, but are described briefly under the species to which they are most likely to key out in the formal key.

2. USE OF THE FLORA

a. *The taxonomic system followed in the Flora.* Plants are described in this work in a taxonomic order, so that similar genera and species occur close to each other, rendering comparison of descriptions

easier than in a work where the entries are alphabetical. The families (and higher groups) follows R. K. Brummitt's *Vascular Plants: Families and Genera* (1992).

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The order of the species within each genus has been a matter for the individual author's discretion. In general, however, some established revision of the genus has been followed, or, if no such revision exists, the author's own views on similarity and relationships have governed the order used.

b. *Nomenclature*. The arguments for using Latin names for plants in popular as well as scientific works are often stated and widely accepted, particularly for Floras such as this, which cover an area in which several languages are spoken. Latin names have therefore been used at every taxonomic level. A concise outline of the taxonomic hierarchy and how it is used can be found in C. Jeffrey's *An introduction to plant taxonomy* (1968, edn 2, 1982). Because of the difficulties of providing vernacular names in all the necessary languages (not to say dialects), they have not been included. S. Priszter's *Trees and shrubs of Europe, a dictionary in eight languages* (1983) is a useful source for the vernacular names of woody plants.

Many horticultural reference works omit the authority that should follow every Latin plant name. Knowledge of this authority prevents confusion between specific names that may have been used more than once within the same genus, and makes it possible to find the original description of the species (using *Index Kewensis*, which lists the original references for all Latin names for higher plants published since 1753). In this Flora authorities are therefore given for all names at or below genus level. These are unabbreviated to avoid the obscure contractions that mystify the lay reader, and on occasion, the professional botanist. In most cases we have not thought it necessary to include the initials or qualifying words and letters that often accompany author names, e.g. A. Richard, Reichenbach filius, fil. or f. (the exceptions involve a few, very common surnames).

In scientific taxonomic literature, the authority for a plant name sometimes consists of two names joined together by *ex* or *in*. Such formulae have not been used here: the authority has been shortened in accordance with *The international code of botanical nomenclature*: e.g. *Capparis lasiantha* R. Brown *ex* de Candolle becomes *Capparis lasiantha* de Candolle; *Viburnum ternatum* Rehder in Sargent becomes *Viburnum ternatum* Rehder. The abbreviations *hort.* and *auct.*, which sometimes stand in place of the authority after Latin names, have not been used in this work as they are often obscure or misleading. The situations described by them can be clearly and unambiguously covered by the terms *invalid*, *misapplied* or *Anon.* *Invalid* implies that the name in question has not been validly published in accordance with the Code of Nomenclature, and therefore cannot be accepted. *Misapplied* refers to names which have been applied to the wrong species in gardens or in literature. *Anon.* is used with validly published names for which there is no apparent author.

Gardeners and horticulturists complain bitterly when long-used and well-loved names are replaced by unfamiliar ones. These changes are unavoidable if *The international code of botanical nomenclature* is adhered to. Taxonomic research will doubtless continue to unearth earlier names and will also continue to realign or split up existing groups, as relationships are further investigated. However, the previously accepted names are not lost; in this work they appear as synonyms, given in brackets after the currently accepted name;

they are also included in the index. Dates of publication are not given either for accepted names or for synonyms.

c. *Descriptions and terminology*. Families, genera and species included in the Flora are mostly provided with full-length descriptions. Shorter, diagnostic descriptions are, however, used for genera or species that differ in only a few characters from others already fully described, e.g.:

3. *P. vulgaris* Linnaeus. Like *P. officinalis* but leaves lanceolate and corolla red ...

This implies that the description of *P. vulgaris* is generally similar to that of *P. officinalis* except in the characters mentioned; it should not be assumed that plants of the two species will necessarily look very like each other. Additional species (see p. xvi), subspecies, varieties, formae and cultivars (see p. xviii) are described very briefly and diagnostically.

Unqualified measurements always refer to length (though 'long' is sometimes added in cases where confusion might arise); similarly, two measurements separated by a multiplication sign indicate length and breadth respectively.

The terminology has been simplified as far as is consistent with accuracy. The technical terms that, inevitably, have had to be used are explained in the glossary (p. 565). Technical terms restricted to particular families or genera are defined in the observations following the family or genus description, and are also referred to in the glossary.

d. *Informal keys*. For larger genera and families an informal key is often given; this will not necessarily enable the user to identify precisely every species included, but will provide a guide to the occurrence of the more easily recognised characters. A selection of these characters is given, each of which is followed by the entry-numbers of those species which show that character. In some cases, where only a few species of a genus show a particular character, the alternative states are not specified, e.g.:

Leaves. Leathery: **18, 19**.

This means that only species **18** and **19** in the particular genus have leathery leaves; the other species may have leaves of various textures, but they are not leathery.

e. *Formal keys*. For every family containing more than one genus, and for every genus containing more than one full-entry species, a dichotomous key is provided. This form of key, in which a series of decisions must be made between pairs of contrasting characteristics, should lead the user step by step to an entry number followed by the name of a species. The reader should then check this identification with the description of that species; in some cases, other less commonly cultivated species may be mentioned under the description of the full-entry species, when the brief descriptions of these should also be scanned, so that a final identification can be made. A key to all the families of the Dicotyledons to be included in the Flora is provided (p. 1).

f. *Horticultural information*. Notes on the cultural requirements and methods of propagation are generally included in the observations on

each genus; more rarely, such information is given in the observations under the family description. These notes are generally brief and very generalised, and merely provide guidance. Reference to general works on gardening is necessary for more detailed information.

g. *Citation of literature.* References to taxonomic books, articles and registration lists are cited for each family and genus, as appropriate. No abbreviations are used in these citations (though very long titles have been shortened). The citation of a particular book or article does not necessarily imply that it has been used in the preparation of the account of the particular genus or family in this work.

h. *Citation of illustrations.* Where possible, references to good illustrations are given for each species, subspecies or variety; the names under which they were originally published (which may be different from those used here) are not normally given. The illustrations may be coloured or black and white, and may be drawings, paintings or photographs. Up to five illustrations per species have been given, and an attempt has been made to choose from widely available, modern works. Where no illustrations are cited, they either do not exist, as far as we know, or those that do are considered to be of doubtful accuracy or of very restricted availability.

There are considerable difficulties with the citation of references to illustrations, particularly with regard to their dates of publication. These difficulties arise from two main sources. 1. Many illustrated plant books of the 19th and early 20th centuries were published in fascicles, as illustrations became available, out of proper order. This means, however, that the dates of publication of individual illustrations are often more or less unknown, and, anyway, these dates do not correspond to the date of the final binding. 2. Many popular illustrated books published since the 1950s have gone through many reprints, each of which bears its own date, so that the same book may well be cited with different dates in different places in this work. We have tried to cite meaningful dates wherever this was possible, but the user should understand that the date given here for a particular volume may not correspond with the date printed in the copy available to him.

In searching for illustrations, use has been made of *Index Londinensis* (1929–31, supplement 1941), R.T. Isaacs's *Flowering plant index of illustration and information* (1979) and an extensive index compiled over the last 30 years at the Royal Botanic Garden, Edinburgh.

Several pages of figures of diagnostic plant parts are included with various groups in the Flora, and should be particularly helpful when plants are being identified by means of the keys. Some of these are original, others have either been redrawn from various sources or are silhouettes of photocopies of leaves.

i. *Geographical distribution.* The wild distribution, as far as it can be ascertained, is given in italics at the end of the description of each species, subspecies or variety. The choice and spelling of place names in general follows *The Times Atlas*, Comprehensive edition (1994 reprint), except:

(1) Well-established English forms of names have been used in preference to less familiar vernacular names, e.g. Crete instead of Kriti, Naples instead of Napoli, Borneo instead of Kalimantan;

(2) New names or spellings will be adopted as soon as they appear in readily available works of reference.

(3) Because of a lack of precise information, certain areas, now politically divided, are referred to under their older names (e.g. 'former Yugoslavia', 'former USSR', etc.).

j. *Hardiness* (see map, p. xix). For every species a hardiness code is given. This gives a tentative indication of the lowest temperatures that the species can withstand:

G2 – needs a heated glasshouse even in south Europe.

G1 – needs a cool glasshouse even in south Europe.

H5 – hardy in favourable areas: withstands 0 to -5°C minimum.

H4 – hardy in mild areas: withstands -5 to -10°C minimum.

H3 – hardy in cool areas: withstands -10 to -15°C minimum.

H2 – hardy almost everywhere: withstands -15 to -20°C minimum.

H1 – hardy everywhere: withstands -20°C and below.

The map of mean January minima (p. xix) shows the isotherms corresponding to these codes.

k. *Flowering time.* The terms spring, summer, autumn and winter have been used as a guide to flowering times in cultivation in Europe. It is not possible to be more specific when dealing with an area extending from northern Scandinavia to the Mediterranean. In cases where plants do not flower in cultivation, or flower rarely, or whose time of flowering is not recorded, no flowering time is given.

l. *Subspecies, varieties and cultivars.* Subspecies and varieties are included, where appropriate. This is done in various ways, depending on the number of such groups; all are self-explanatory.

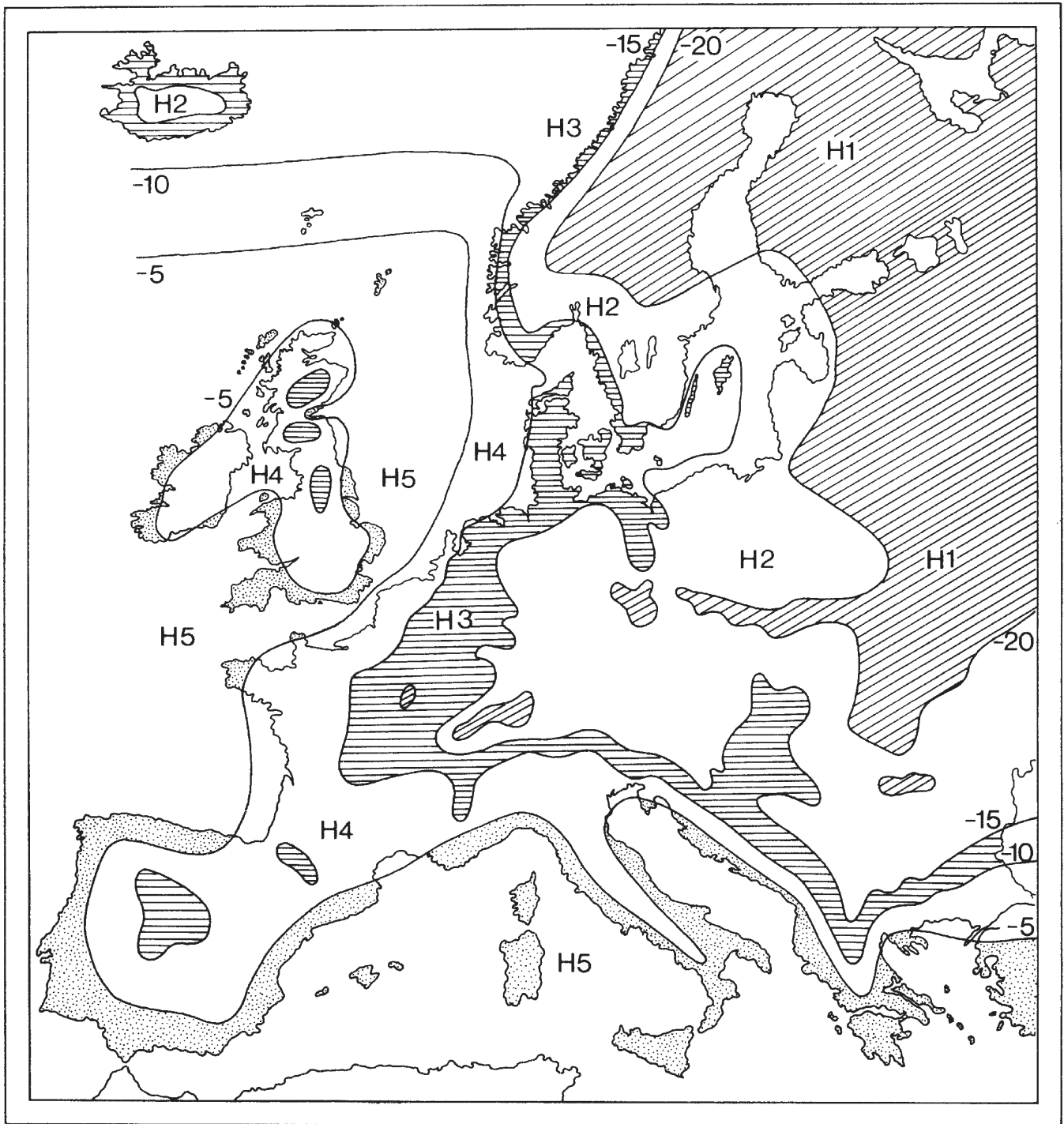
No attempt has been made to describe the range of cultivars of any species, either partially or comprehensively. The former is scarcely worth doing, the latter virtually impossible. Reference to individual, commonly grown cultivars is, however, made in various ways:

(1) If a registration list of cultivars exists, it is cited in the 'Literature' paragraph (see section 2g) following the description of the genus.

(2) If a particular cultivar is very widely grown, it may be referred to, either in the description of the species to which it belongs (or most resembles), or in the observations to that species.

(3) If, in a particular species, cultivars are numerous and fall into reasonably distinct groups based on variation in some obvious character, then these groups may be referred to, together with an example of each, in the observations to the species.

m. *Hybrids.* Many hybrids between species (interspecific hybrids) and some between genera (intergeneric hybrids) are in cultivation, and some of them are widely grown. Commonly cultivated interspecific hybrids are, where possible, included as though they were species. Their names, however, include a multiplication sign indicating their hybrid origin; the names of the parents (when known or presumed) are also given. Other hybrids that are less frequently grown are mentioned in the observations to the parent species they most resemble. In some genera, where the number of hybrids is very large, only a small selection of those most commonly grown is mentioned.



Map 1. Mean minimum January isotherms for Europe (hardiness codes).
 (After Krüssmann, *Handbuch der Laubgehölze*, 1960 and *Mitteilungen der Deutsche Dendrokigische Gesellschaft* 75: 1983.)