Lavender

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Lavender

The genus *Lavandula*

Edited by
Maria Lis-Balchin

London and New York

First published 2002
by Taylor & Francis
11 New Fetter Lane, London EC4P 4EE

Simultaneously published in the USA and Canada
by Taylor & Francis Inc,
29 West 35th Street, New York, NY 10001

Taylor & Francis is an imprint of the Taylor & Francis Group

This edition published in the Taylor & Francis e-Library, 2004.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalogue record has been requested

ISBN 0-203-21652-0 Master e-book ISBN

ISBN 0-203-27270-6 (Adobe eReader Format)
ISBN 0-415-28486-4 (Print Edition)

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Preface to the series

There is increasing interest in industry, academia and the health sciences in medicinal and aromatic plants. In passing from plant production to the eventual product used by the public, many sciences are involved. This series brings together information which is currently scattered through an ever increasing number of journals. Each volume gives an in-depth look at one plant genus, about which an area specialist has assembled information ranging from the production of the plant to market trends and quality control.

Many industries are involved such as forestry, agriculture, chemical, food, flavour, beverage, pharmaceutical, cosmetic and fragrance. The plant raw materials are roots, rhizomes, bulbs, leaves, stems, barks, wood, flowers, fruits and seeds. These yield gums, resins, essential (volatile) oils, fixed oils, waxes, juices, extracts and spices for medicinal and aromatic purposes. All these commodities are traded worldwide. A dealer's market report for an item may say 'Drought in the country of origin has forced up prices'.

Natural products do not mean safe products and account of this has to be taken by the above industries, which are subject to regulation. For example, a number of plants which are approved for use in medicine must not be used in cosmetic products.

The assessment of safe to use starts with the harvested plant material which has to comply with an official monograph. This may require absence of, or prescribed limits of, radioactive material, heavy metals, aflatoxin, pesticide residue, as well as the required level of active principle. This analytical control is costly and tends to exclude small batches of plant material. Large-scale contracted mechanised cultivation with designated seed or plantlets is now preferable.

Today, plant selection is not only for the yield of active principle, but for the plant's ability to overcome disease, climatic stress and the hazards caused by mankind. Such methods as *in vitro* fertilization, meristem cultures and somatic embryogenesis are used. The transfer of sections of DNA is giving rise to controversy in the case of some end-uses of the plant material.

Some suppliers of plant raw material are now able to certify that they are supplying organically-farmed medicinal plants, herbs and spices. The Economic Union directive (CVO/EU No 2029/91) details the specifications for the *obligatory* quality controls to be carried out at all stages of production and processing of organic products.

Fascinating plant folklore and ethnopharmacology leads to medicinal potential. Examples are the muscle relaxants based on the arrow poison, curare, from species of *Chondrodendron*, and the anti-malarials derived from species of *Cinchona* and *Artemisia*. The methods of detection of pharmacological activity have become increasingly reliable and specific, frequently involving enzymes in bioassays and avoiding the use of laboratory animals. By using bioassay linked fractionation of crude plant juices or extracts, compounds can be specifically targeted which, for example, inhibit blood platelet aggregation, or have anti-tumour, or anti-viral, or any other

required activity. With the assistance of robotic devices, all the members of a genus may be readily screened. However, the plant material must be *fully* authenticated by a specialist.

The medicinal traditions of ancient civilisations such as those of China and India have a large armamentaria of plants in their pharmacopoeias which are used throughout South-East Asia. A similar situation exists in Africa and South America. Thus, a very high percentage of the world's population relies on medicinal and aromatic plants for their medicine. Western medicine is also responding. Already in Germany all medical practitioners have to pass an examination in phytotherapy before being allowed to practise. It is noticeable that throughout Europe and the USA, medical, pharmacy and health related schools are increasingly offering training in phytotherapy.

Multinational pharmaceutical companies have become less enamoured of the single compound magic bullet cure. The high costs of such ventures and the endless competition from 'me too' compounds from rival companies often discourage the attempt. Independent phytomedicine companies have been very strong in Germany. However, by the end of 1995, eleven (almost all) had been acquired by the multinational pharmaceutical firms, acknowledging the lay public's growing demand for phytomedicines in the Western World.

The business of dietary supplements in the Western World has expanded from the health store to the pharmacy. Alternative medicine includes plant-based products. Appropriate measures to ensure the quality, safety and efficacy of these either already exist or are being answered by greater legislative control by such bodies as the Food and Drug Administration of the USA and the recently created European Agency for the Evaluation of Medicinal Products, based in London.

In the USA, the Dietary Supplement and Health Education Act of 1994 recognised the class of phytotherapeutic agents derived from medicinal and aromatic plants. Furthermore, under public pressure, the US Congress set up an Office of Alternative Medicine and this office in 1994 assisted the filing of several Investigational New Drug (IND) applications, required for clinical trials of some Chinese herbal preparations. The significance of these applications was that each Chinese preparation involved several plants and yet was handled as a *single* IND. A demonstration of the contribution of efficacy, of *each* ingredient of *each* plant, was not required. This was a major step forward towards more sensible regulations in regard to phytomedicines.

My thanks are due to the staffs of Harwood Academic Publishers and Taylor & Francis who have made this series possible and especially to the volume editors and their chapter contributors for the authoritative information.

Roland Hardman

1 General introduction to the genus *Lavandula*

Maria Lis-Balchin

Lavandula species (Labiatiae, syn. Lamiaceae) are mainly grown for their essential oils, which are used in perfumery, cosmetics, food processing and nowadays also in 'aromatherapy' products. The dried flowers have also been used from time immemorial in pillows, sachets etc. for promoting sleep and relaxation. Numerous lavender plants are also sold as ornamental plants for the garden; these include *L. latifolia, L. pinnata, L. lanata, L. dentata* and *L. stoechas* and their numerous cultivars.

Lavender oil, distilled from *L. angustifolia* was used extensively in Victorian times as a perfume and applied in numerous cosmetic products, but now it is used mainly in combination with other essential oils and aromachemicals. This species and numerous hybrids/cultivars, for example, *Lavandin* 'grosso' were originally grown in the South of France, but are now grown virtually round the world. True lavender oil, consisting mainly of linalool and linalyl acetate, has a very variable composition due to the genetic instability of the oil-producing plants and variations due to temperature, water quantity, altitude, fertilizers, time of year, geographic distribution etc. The chemical composition also varies in the numerous hybrids, which produce larger plants with a higher essential oil yield and which are therefore grown more often.

The essential oil of lavender is often adulterated with other oils or some fractions derived from plants containing linalool and linalyl acetate, or with the synthetic components, or the original oil can be acetylated. There is a problem with recognition of such adulterations, although enantiomeric columns have been a useful tool in modern detection.

Aromatherapists consider the oil from *L. angustifolia* as the most beneficial, together with wild-grown cultivars at high altitude; as yet scientific evidence is lacking for this and all the numerous medicinal claims made, other than for a possible general relaxing effect after inhalation, produced via the Limbic system. Pharmacological studies have shown a relaxation of smooth muscles *in vitro* using animal tissues, with an initial small contraction exhibited by *L. angustifolia*; the spasmolytic action was apparently mediated through the secondary messenger cyclic AMP. Studies with animals *in vivo* have shown a decline in movement after inhalation; in man, there was a slowing down of mental and physical activities. The main components were found in the blood after inhalation and these were also active in their own right when inhaled or massaged into the skin.

Lavandula species have a variable antimicrobial effect; Spike lavender, containing camphor, is the most potent; some species have a moderate antifungal action while the antioxidant activity is very variable. Some species have an acaricidal effect and have low general insecticidal properties. *Lavandula* has a low toxicity: even the strong undiluted essential oil can be used for some burns, with, anecdotally, beneficial effects on healing, however, cases of allergic airborne contact dermatitis have been reported.

New research on *Lavandula* species has indicated a wide diversity of applications, for example, the usefulness of *L. angustifolia* essential oil in the treatment of alopecia.

2 The taxonomy of the genus *Lavandula* L.

Tim Upson

Introduction

In the introduction to the *Natural History of the Lavenders* published in 1826 the author, Baron Gingins de la Sarraz, wrote '*continuing progress in the understanding of natural history would seem to require also a constant revision of families and genera most familiar to us*'. While much progress has been made in our understanding of the genus *Lavandula* his sentiments are still true today. The genus is currently subject to ongoing research into its taxonomy and systematics being undertaken by the author and colleagues at the University of Cambridge, University of Reading and the Royal Botanic Gardens, Kew. This treatment thus represents a provisional rather than a definitive account on the taxonomy of the genus. While some aspects of the research is nearing completion there are still some problematic areas where existing treatments may not be adequate and our understanding of the taxonomy is incomplete and these are indicated and discussed where appropriate.

This treatment recognises thirty-two species of *Lavandula* which have been described in the literature plus a number of infraspecific taxa and hybrids, although the number of species is likely to be higher once all the revisionary work has been completed. The genus has a distribution stretching from the Canary Islands, Cape Verde Islands and Madeira, across the Mediterranean Basin, North Africa, South West Asia, the Arabian Peninsula and tropical NE Africa with a disjunction to India.

Some species have been widely cultivated since ancient times and are familiar garden plants and hence there are many legends and folklore associated with these plants. The essential oils, principally harvested from *L. x intermedia* and *L. angustifolia*, are of economic importance in the perfumery and fragrance industry, some are widely used in aromatherapy and are known to have antiseptic and antifungal qualities. A number of species and their hybrids are horticulturally desirable and are cultivated in both northern and southern hemispheres. The Latin name *Lavandula* comes from the ancient use of this plant to perfume water for bathing, being derived from the Latin word *lavare,* meaning to be washed.

Historical perspective: a brief history of the taxonomy of the genus

It is clear that *Lavandula* was known to the earliest botanical writers and the first written accounts of lavenders can be found in the writings of the early Greek scholars such as Theophrastus (*c.* 370–285 BC). The genus is frequently mentioned in many herbals and other botanical books although the first monograph of the genus, *De Lavandula*, was not published until 1780 (Lundmark, 1780). This work recognised five species and eight varieties.

The second monograph of the genus *Histoire Naturelle des Lavandes* (Gingins, 1826), was of great significance and is still a valuable work today. His monograph enumerated twelve species along with descriptions, geographical distributions, properties and uses. His most important contribution was the recognition of groupings of species within the genus and the erection of an infrageneric classification of three sections.

By the time of the third and most recent monograph, A *Taxonomic Study of the Genus Lavandula* (Chaytor, 1937), a substantial number of new species and varieties had been described and her revision bought much of this information together for the first time. This account recognises twenty-eight species plus many infraspecific taxa arranged in five sections. A new species, *L. somaliensis*, was described, many new combinations were made and a new section *Subnuda* was erected.

Since Chaytor's account there has been no full generic treatment although a number of useful accounts of various groups have been published. Collectively these works have contributed much to our knowledge of the genus and have been incorporated into this account. Some of the most notable works include, a revision of section *Stoechas* (Rozeira, 1949), the genus *Lavandula* in Arabia and tropical NE Africa (Miller, 1985) describing five new species from the area and on the taxa native to the Iberian Peninsula (Suarez-Cervera and Seoane-Camba, 1986, 1989).

Generic status and relationships

Lavandula is a member of the Lamiaceae (Labiatae) family and belongs to the subfamily Nepetoideae. Within the Nepetoideae a number of tribes are recognised and *Lavandula* is currently treated as a distinct and isolated group of its own, that is, the tribe Lavanduleae (Endl.) Boiss containing just the single genus *Lavandula* (Cantino *et al*., 1992).

What makes a lavender a lavender

The genus in terms of its general morphology is a rather mixed and divergent group. It is defined by the nectary lobes being opposite the ovary's rather than alternate (which is the case in all other Lamiaceae). The combination of a compact terminal spikes of flowers usually borne on a long peduncle (flower stalk); the declinate stamens (stamens curved downwards) borne within the corolla tube and persistent bracts are characteristic.

Many species are highly aromatic due to the presence of essential oils that are borne in glands covering much of the plant. In habit they vary from woody shrubs up to a metre in height, to perennial woody-based shrubs or annual herbs. The leaves can be entirely or deeply dissected, and are often absent in some of the Arabian species. The flowers (spike) consists of cymes, a branching determinate inflorescence with a flower at the end of each branch, either an opposite decussate arrangement (each pair of flower whorls at right angles to the pair above or below) or an alternate spiral arrangement. The cymes are subtended by bracts, which vary in their size, shape and nervation, which can be diagnostic for many species. The cymes can be single flowered usually without bracteoles or many flowered (3–9 flowers per cyme) with bracteoles. The bracteoles are small, often minute, bracts borne at the points of branching within each flower whorl. In some species, such as *L. stoechas* and *L. dentata*, the bracts at the apex are enlarged, coloured and sterile and known as a coma. The calyx is (two-lipped) bilabiate and varies in the number of nerves, lobe shape, presence of an appendage, colour and provides many important characters used to diagnose both sections and species. The corolla is usually bilabiate, tubular and with five lobes varying in size, colour, shape and markings.

Taxonomic treatment

The species and infraspecific taxa are arranged according to sections. Those whose sectional position is uncertain are dealt with at the end. Hybrids have been dealt with under each section except for intersectional hybrids which are placed after the sections. Keys to the species are given under each section. Only the most important synonyms are given as appropriate for each species and placed in brackets **as appropriate**. Author abbreviations follow Brummitt & Powell (1992).

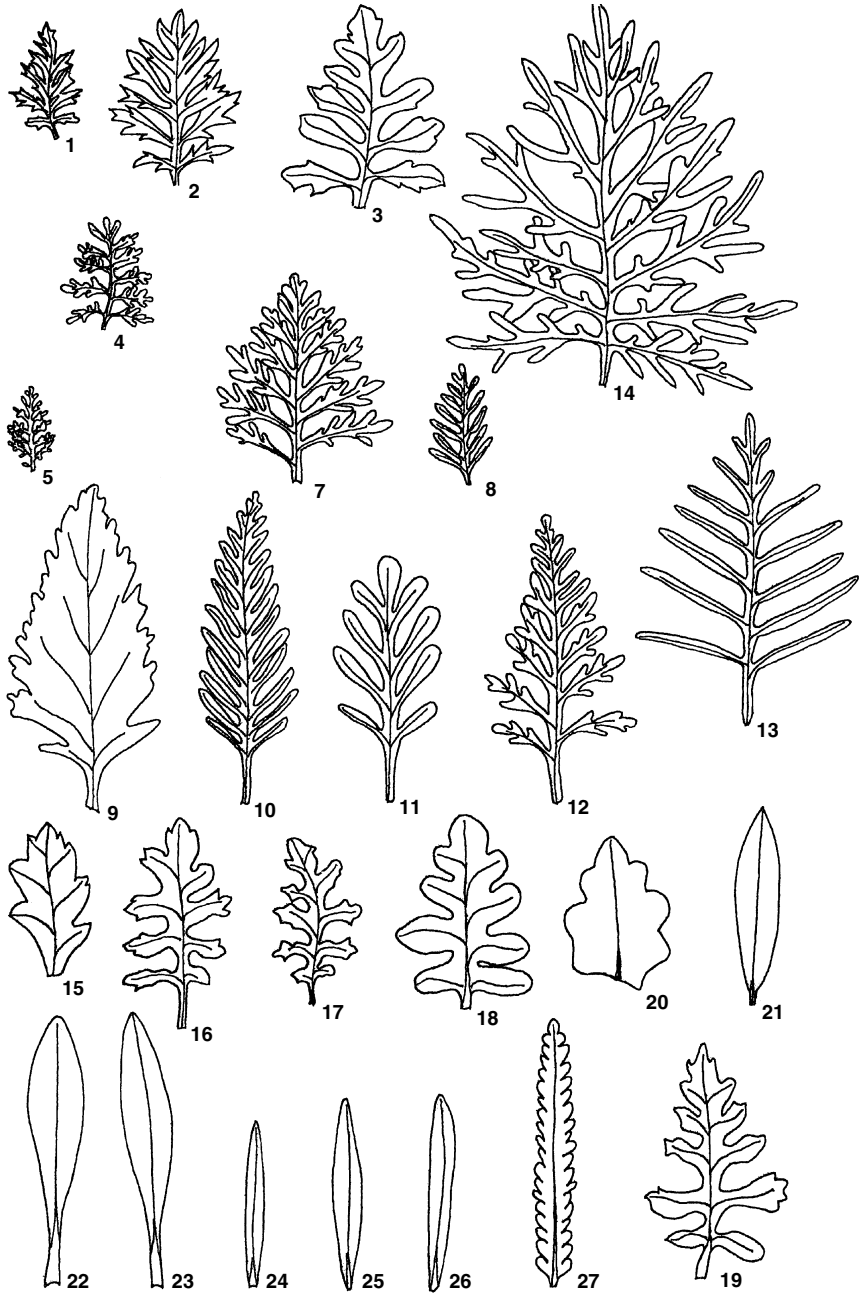
Sectional classification

Although the species exhibit a wide variation of morphological characters, it is evident that natural groupings of related taxa can be recognised. These groups have been classified as sections, of which there are six presently recognised. It seems likely that further groupings need to be recognised and current work is presently aiming to confirm this. The sections can be distinguished by differences in habit, leaf shape, the arrangement of the flowers in the verticils, bract, calyx and corolla characters (Figures 2.1–2.5).

Nomenclatural notes and clarification on sectional classification

The naming of all plants is governed by the International Code of Botanical Nomenclature which sets out a series of rules on the naming of plants. The code provides an internationally agreed set of rules and standards to which all names must comply to be accepted. While the code may require what appears to be some frustrating name changes it replaced a situation in which there was no agreed code and individuals constantly changed names to the greater confusion of everyone. Names will be stable when using this international standard once these changes and corrections have been made. In accordance with this code a number of changes have been made over recent years to the section names and hence it seems appropriate to explain and clarify these changes as follows:

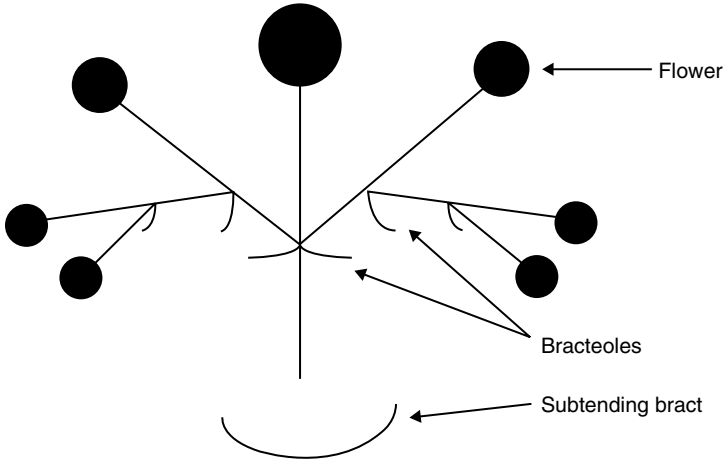
1 Section *Spica* Ging. to section *Lavandula* – Article 22 of the code requires that the name of a subdivision of a genus that includes the type of the genus must repeat the name of the genus unaltered. The type concept is a central element of botanical nomenclature. Any name must have a type specimen (this is usually a herbarium specimen) which essentially acts as a permanent reference point that determines the application of that name. This rule allows the subdivision containing the type of the genus to be instantly identified. In the case of *Lavandula* the type of the genus is a specimen of *L. spica* L. (although the correct name in general usage is *L. angustifolia*). This type species was placed by Gingins (1826) in section *Spica* and hence the name of this section was changed to *Lavandula* so as to repeat generic name as required by Article 22.
2 The names of plants must also follow certain grammatic rules of botanical Latin, again defined in the code. In the case of section *Subnuda* and *Dentata* the names as originally published are incorrect according to Article 21.2 as this requires the epithet to be a plural adjective agreeing in gender with the generic name. In practice this requires the correction of the endings to *Subnudae* and *Dentatae*, respectively.



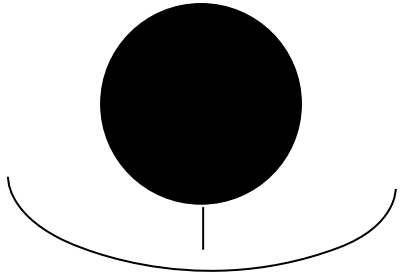
All leaves are shown life size with the exception of numbers 20 and 21 shown at 2 × life size.

1. *L. mairei* var. *mairei*
2. *L. pubescens*
3. *L. citriodora*
4. *L. maroccana*
5. *L. antineae*
7. *L. multifida*
8. *L. coronopifolia*
9. *L. rotundifolia*
10. *L. minutolii* var. *minutolii*
11. *L. pinnata*
12. *L. canariensis*
13. *L. buchii* var. *gracile*
14. *L. bipinnata*
15. *L. subnuda*
16. *L. dhofarensis*
17. *L. nimmoi*
18. *L. somaliensis*
19. *L. galgalloensis*
20. *L. hasikensis*
21. *L. atriplicifolia*
22. *L. lanata*
23. *L. latifolia*
24. *L. angustifolia*
25. *L. stoechas* subsp. *stoechas*
26. *L. viridis*
27. *L. dentata* var. *dentata*

Figure 2.1 The diversity of leaf shapes and forms found within the genus *Lavandula*.



A bicincinnus cyme illustrating the branching pattern and position of bracteoles and bracts



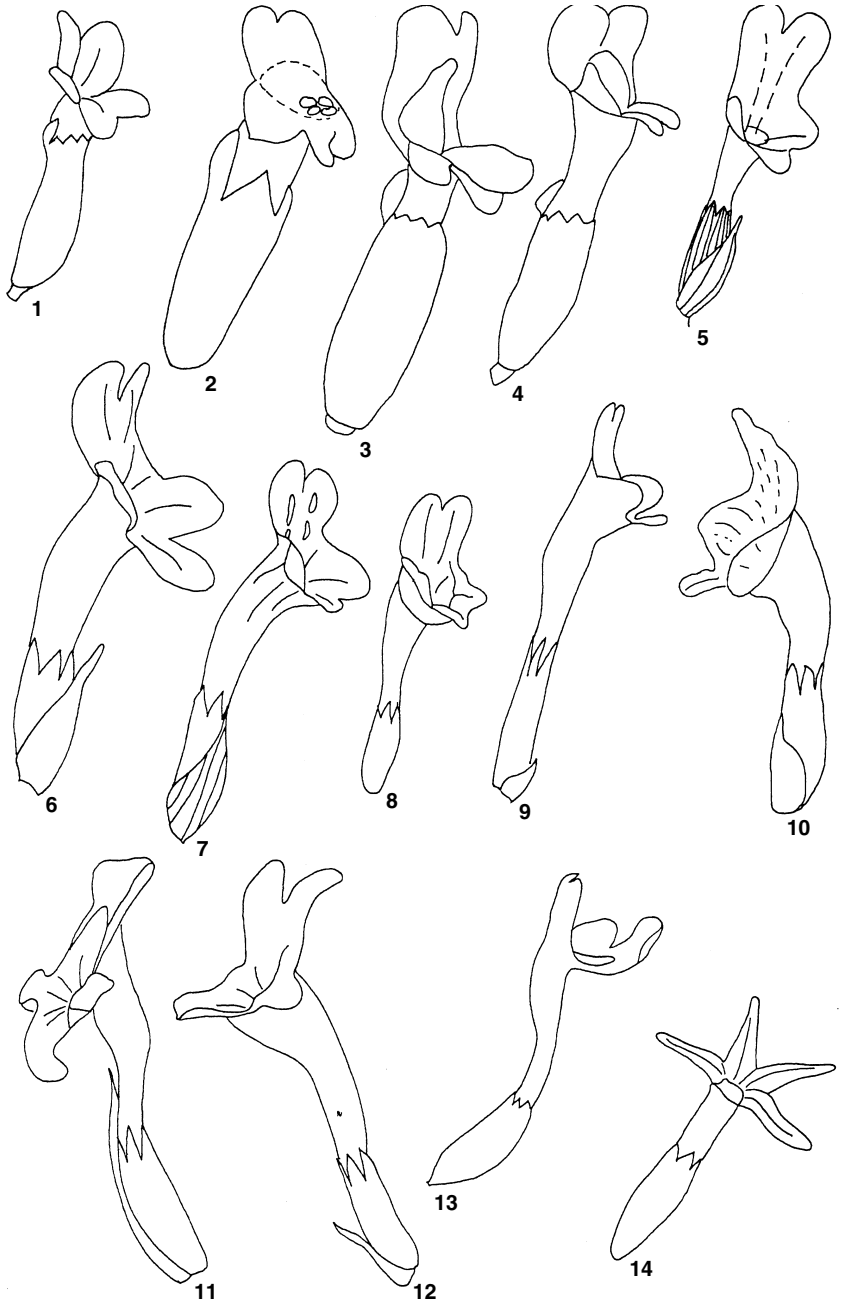
A single flowered cyme, with subtending bract

Figure 2.2 Diagrammatic representations of the structure of the many-flowered (bicicinnus) and single-flowered cymes in *Lavandula*.

Generic description

Lavandula L. (Synonyms – *Stoechas* Mill., *Fabricia* Adans., *Chaetostachys* Benth., *Sabaudia* Buscal. and Muschl., *Isinia* Rech. f.)

Shrubs, woody-based perennials or short-lived herbs; often aromatic, glabrous or with a variable indumentum. Leaves variable in shape, entire or dissected, sessile or petiolate. Inflorescence a congested terminal spike, occasionally with a coma, usually with distinct peduncle, simple or branched, verticils either a many-flowered (3–9) cyme with minute bracteoles or a reduced single-flowered cyme usually without bracteoles, subtended by persistent bracts variable in form, which maybe opposite or spirally arranged on the inflorescence axis. Calyx persistent, regular or two-lipped, upper with three-lobed, the lower two-lobed, ± equal in size or with the posterior lip larger or modified into an appendage, eight-, thirteen- or fifteen-nerved, the nerves in the lower sepals all borne to the apex. Corolla tube either just exceeding or up to 3 × longer



1. *L. dentata* var. *dentata*×160
2. *L. viridis*×160
3. *L. latifolia*×160
4. *L. lanata*×100
5. *L. multifida*×100
6. *L. canariensis*×100
7. *L. pubescens*×100
8. *L. tenuisecta*×100
9. *L. coronopifolia*×100
10. *L. maroccana*×100
11. *L. aristibracteata*×100
12. *L. subnuda*×160
13. *L. bipinnata*×100
14. *L. atriplicifolia*×100

Figure 2.3 Variation in corolla morphology within the genus *Lavandula*.

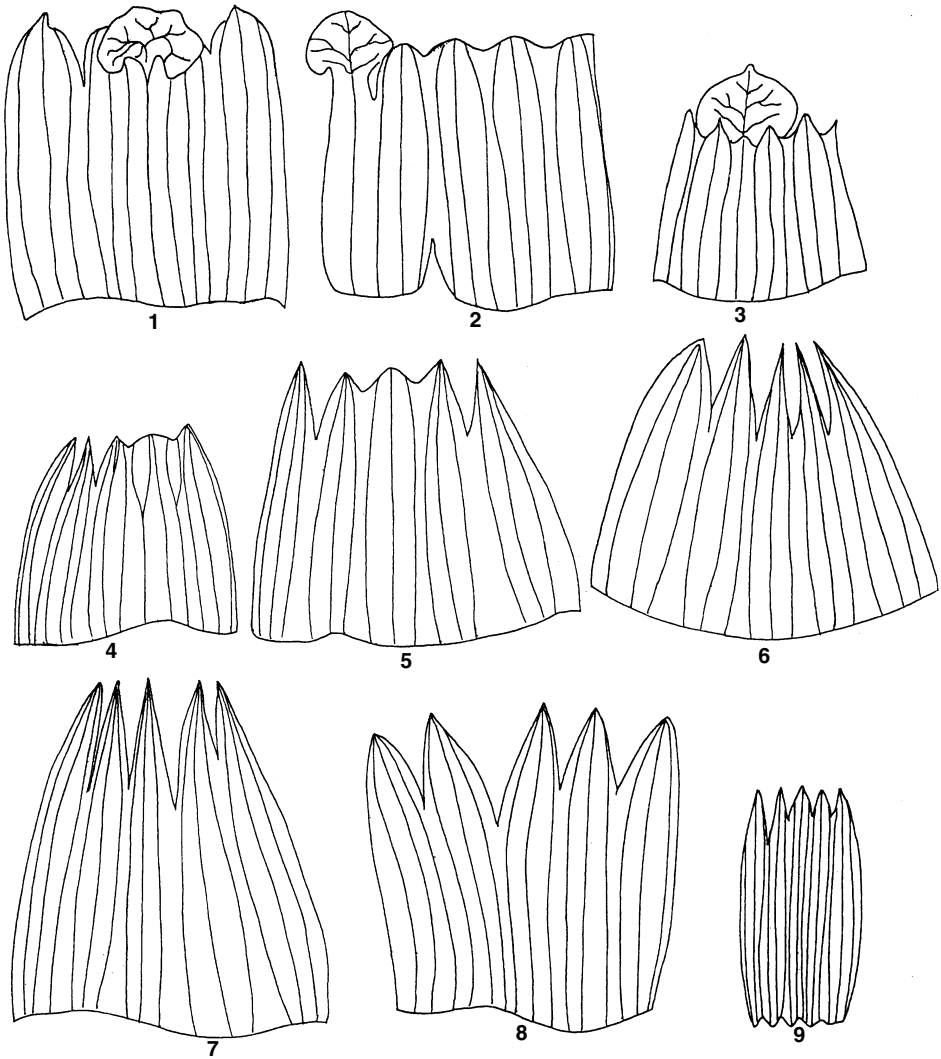
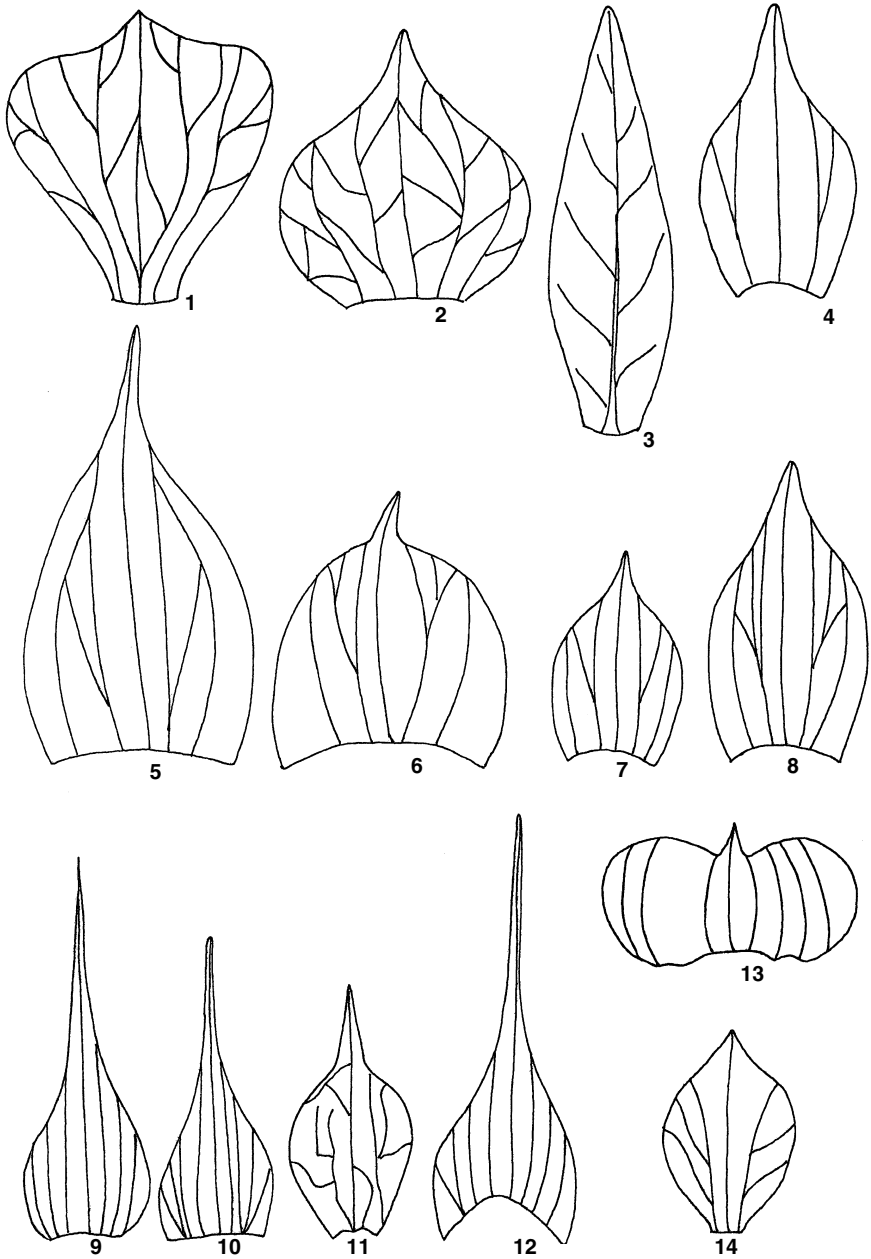


Figure 2.4 Examples of variation in the calyces within the genus *Lavandula*, illustrating differences in the calyx lobes.

than calyx, weakly or strongly two-lipped, upper lip with two lobes, the lower three-lobed, the lobes variable in size. Four stamens declinate (curving downwards), usually didynamous (two pairs of stamens unequal in length), the anterior pair longer, included within tube. Stigma single, bilobed or capitate. Nectary lobes borne opposite the ovaries. Nutlets variable in shape, colour and size, with either a small basal scar or lateral scar $0.25-0.75 \times$ length of nutlet, mostly mucilaginous.



1. *L. dentata* var. *dentata*×100
2. *L. viridis*×60 (upper bract)
3. *L. latifolia*×160
4. *L. multifida*×160
5. *L. canariensis*×250
6. *L. maroccana*×250
7. *L. coronopifolia*×250
8. *L. mairei* var. *mairei*×100
9. *L. aristibracteata*×160
10. *L. subnuda*×160
11. *L. somaliensis*×160
12. *L. bipinnata*×160
13. *L. hasikensis*×100
14. *L. atriplicifolia*×100

Figure 2.5 Examples illustrating the diversity of bract shapes in the genus *Lavandula*.

Synopsis of sectional classification and taxa recognised in this treatment

1. Section *Lavandula* (= section *Spica* Ging.)

1. *L. angustifolia* Mill. subsp. *angustifolia*
   subsp. *pyrenaica* (DC) Guinea
2. *L. lanata* Boiss.
3. *L. latifolia* Medik.

Hybrids

L. x intermedia Emeric. ex. Loisel.
L. lanata Boiss. × *L. angustifolia* Mill.

2. Section *Dentatae* Suarez-Cerv. & Seoane-Camba

4. *L. dentata* L. var. *dentata*
   forma *rosea* Maire
   forma *albiflora* Maire
   L. dentata L. var. *candicans* Batt.

3. Section *Stoechas* Ging.

5. *L. stoechas* L. subsp. *stoechas*
   forma *leucantha* Ging.
   forma *rosea* Maire
   subsp. *pedunculata* (Mill.) Samp. ex Rozeira
   subsp. *sampaiana* Rozeira
   subsp. *lusitanica* (Chaytor) Rozeira
   subsp. *luisieri* (Rozeira) Rozeira
   subsp. *atlantica* Braun-Blanq.
   subsp. *maderensis* (Benth.) Rozeira
   subsp. *cariensis* (Boiss.) Rozeira
6. *L. viridis* L'Hér.

Hybrids

L. stoechas L. × *L. viridis* L'Hér.

4. Section *Pterostoechas* Ging.

7. *L. multifida* L.
8. *L. canariensis* Mill.
9. *L. pinnata* L. f.
10. *L. buchii* Webb & Berthel. var. *buchii*
    var. *gracile* M.C. León
    var. *tolpidifolia* (Svent.) M.C. León
11. *L. minutolii* Bolle var. *minutolii*
    var. *tenuipinna* Svent.

Section *Pterostoechas* (continued)

12. *L. maroccana* Murb.
13. *L. tenuisecta* Coss. ex. Ball
14. *L. maroccana* Murb.
15. *L. mairei* Humbert var. *mairei*
    var. *antiatlantica* Maire
16. *L. antineae* Maire
17. *L. coronopifolia* Poir.
18. *L. pubescens* Decne.
19. *L. citriodora* A.G. Miller

Hybrids

L. x christiana Gattef. & Maire
L. x murbeckiana Emb. & Maire
L. canariensis Mill. × *L. buchii* Webb & Berthol. var. *buchii*

5. Section *Subnudae* Chaytor

20. *L. subnuda* Benth.
21. *L. macra* Baker
22. *L. dhofarensis* A.G. Miller
    subsp. *dhofarensis*
    subsp. *ayunensis* A.G. Miller
23. *L. setifera* T. Anderson
24. *L. nimmoi* Benth.
25. *L. galgalloensis* A.G. Miller
26. *L. aristibracteata* A.G. Miller
27. *L. somaliensis* Chaytor

6. Section *Chaetostachys* Benth.

28. *L. gibsonii* Grah.
29. *L. bipinnata* (Roth) Kuntze

Unclassified taxa

30. *L. hasikensis* A.G. Miller
31. *L. atriplicifolia* Benth.
32. *L. erythreae* (Chiov.) Cufud.

Intersectional Hybrids

L. x allardii Hy
L. x heterophylla Poir.
L. dentata L. × *L. lanata* Boiss.

Key to sections

1 Cymes 3–9 flowered; nutlets with a basal scar only 2
Cymes single-flowered; nutlets with a lateral scar 4
2 Leaves and calyx sessile, stigma capitate . . . . . Section *Stoechas*
Leaves and calyx with short stalk, stigma bilobed 3
3 Leaves with regular shallow dissections, corolla lobes subequal in size, corolla tube just exerted from calyx, calyx appendage *c.* 1.5 × width of the calyx . . . . . Section *Dentatae*
Leaves simple and entire, corolla lobes differing in size, corolla tube *c.* 2 × length of the calyx, calyx appendage the same width as the calyx . . . . . Section *Lavandula*
4 Leaves ovate lanceolate in outline, dissected or lobed; calyx zygomorphic (bilaterally symmetrical); corolla violet blue or white, strongly zygomorphic 5
Leaves linear and simple, calyx regular and lobes all equal; corolla yellow . . . . *L. atriplicifolia*/ brown in colour, with equal lobes, star shaped . . . . . *L. erythrae*
5 Cymes and bracts arranged in an opposite and decussate fashion, spike 4-seriate (quadrate) to biseriate in shape . . . . . Section *Pterostoechas*
Cymes and bracts arranged in an alternate, spiral fashion. Spike cylindrical or head like (capitate) in shape 6
6 Spikes elongated, leaves pinnatifid or bipinnatisect, bracts ovate spinescent 7
Spike capitate, leaves lobed, bracts with orbicular wings . . . . . *L. hasikensis*
7 Leaves predominantly pinnatifid to bipinnatisect, suffruticose shrubs, lateral scar on nutlets *c.* 0.25 × the length of nutlet. Lower corolla lip about the same size as lateral corolla lobes . . . . . Section *Subnudae*
Leaves very distinctly bipinnatisect, plant herbaceous, lateral scar on nutlets *c.* 0.75 × length of nutlet. Lower corolla lip larger than lateral lobes . . . . . Section *Chaetostachys*

Section 1: *Lavandula* (=*Spica* Ging.)

Woody shrubs with simple leaves generally linear in shape. Cymes borne in an opposite and decussate arrangement. Each cyme many-flowered (3–)5–7(–9) with bracteoles present, the subtending bracts variable in shape with reticulate veining. Calyx tubular with a very short stalk (pedicellate), with thirteen or eight nerves, the upper middle lobe modified into a circular appendage. The corolla tube exerted from the calyx, the upper corolla lobes larger than the lateral lobes. Stigma bilobed. Nutlets bear a small to minute basal scar and produce no mucilage on wetting.

Contains three species from central and south west Europe. Commercially this is the most important section containing, *L. angustifolia* (English lavender) and the hybrid *L. x intermedia* (lavandin), which are the principal taxa cultivated for the production of essential oils and widely grown for their horticultural value. Numerous cultivars of *L. angustifolia* and *L. x intermedia* have been and continue to be selected both for oil production and ornamental value. There is no complete listing of cultivars but the following references provide useful information: Tucker and Hensen (1985); Andrews (1994); McNaughton (2000).

One of the greatest confusions in the naming of lavenders has occurred over the application of the name *L. spica* (see Green, 1932). The Swedish botanist Carl Linnaeus first used the name

L. spica, to included both lavender (*L. angustifolia*) as his *L. spica* var. α and spike lavender (*L. latifolia*) as his *L. spica* var. β. Unfortunately, subsequent authors who recognised these taxa as distinct species where not consistent in the use of the name and *L. Spica* has variously been applied to both *L. angustifolia* and *L. latifolia*. With no consistency in the use of this name the situation became completely confused and hence the use of the name *L. spica* was abandoned, the next available name being *L. angustifolia* Miller.

Key to species and major hybrids

1 Bracts subtending flowers ovate rhombic (diamond shape) 2
Bracts subtending flowers linear to linear-lanceolate in shape 4
2 Bracts at least twice as broad as long, bracteoles minute (not clearly visible) . . . . . *L. angustifolia*
Bracts *c.* 3 × longer than broad, bracteoles large 1–4 mm 3
3 Flower stalks usually unbranched, flowers deep purple/mauve in colour, *L.* leaves with woolly grey to silver indumentum . . . . . *L. angustifolia* × *L. lanata*
Flower stalks branched, shades of purple lilac, blues or white, leaves with non-woolly grey to silver grey indumentum . . . . . *L. x intermedia*
4 Calyx with eight nerves and eight-toothed. Leaves with uniform dense white woolly indumentum . . . . . *L. lanata*
Calyx with thirteen nerves and five-toothed. Leaves with silvery–grey indumentum . . . . . *L. latifolia*

1. **L. angustifolia** Miller subsp. **angustifolia** (**L. spica** L. var. α, **L. officinalis** Chaix, **L. fragrans** Jord., **L. vera** DC)

Shrub to 50 cm with linear-lanceolate leaves grey tomentose when young, becoming greener with age. Inflorescence stalk usually unbranched 10–25 cm long with a compact spike 4–5(–8) cm, sometimes with a lower flower cluster distant from the main spike. Bracts broadly ovate-rhombic to obovate, bracteoles present but minute. Calyx thirteen-nerved, with small circular appendage. Corolla strongly bilaterally symmetrical, nearly twice the length of calyx with prominent lobes, shades of blue/mauve, white, rarely violet pink in colour. Flowers from mid-June to July. Native to SW and South Central Europe (Italy, France and Spain) in mountainous areas usually over 1500 m, but widely cultivated and sometimes naturalised elsewhere. The natural variation in this species across its range is not fully understood and there are many names in the literature. While only two subspecies are listed here this reflects that these are the only two whose delimitations and identification are clearly understood. Further work may identify other infraspecific taxa. This species produces the best quality oils and is a fine ornamental plant. Its mountain origins make this the hardiest species in cultivation. Of the many cultivars the following are some of the best known, for example, 'Hidcote' 30 cm very deep violet blue flowers (Figure 2.6), 'Loddon Blue' 60 cm dark violet blue, 'Munstead' 45 cm blue lilac flowers, 'Rosea' 45 cm pink flowers, 'Nana Alba' 20 cm dwarf white variant.

L. angustifolia Miller subsp. *pyrenaica* (DC) Guinea – a variant from the East Pyrenees and NE Spain which has larger floral bracts which usually exceed calyx in length, a shorter and more condensed spike, deep blue/purple flowers and is of smaller stature (25–35 cm).

2. **L. latifolia** Medik (**L. spica** L. var. β; **L. latifolia** Villers)

Shrub 50–70 (100) cm. Leaves grey, linear-lanceolate to spathulate in outline. Inflorescence stalk distinctly branched usually forming a trident shaped flower spike, up to 25 cm high. Spike often

Figure 2.6 *L. angustifolia* 'Hidcote' – cultivated at Cambridge University Botanic Garden. (See Color Plate I.)

interrupted, 5–8 cm long. Bracts subtending cymes linear-lanceolate in shape, Bracteoles distinct to 4 mm long. Calyx thirteen-nerved, with rotund appendage. Corolla strongly bilaterally symmetrical, blue to mauve in colour. Flowers from mid-July. Native to SW and South Central Europe to *c.* 1000 m (−1200 m) (Figure 2.7).

Only occasionally cultivated both for its oil, which is of low quality and as an ornamental.

3. **L. lanata** *Boiss.*

Shrub 50–80 cm, both stems and leaves covered with dense short white woolly indumentum of branching hairs. Leaves linear to oblanceolate (tapering towards the base). Inflorescence stalk often branched to 25 cm, spike often interrupted to 8 cm long. Fertile bracts linear-lanceolate bracteoles up to 6 mm in length, calyx eight-nerved with eight lobes (four large distinct lobes alternating with four smaller lobes) with elliptic to rotund appendage. Corolla rather small exceeding calyx by only 2–3 mm, the upper lobes only slightly larger than the lower lobes, dark purple. Flowers mid-to late July. Native to mountainous areas in South Spain over 2000 m.

Sectional hybrids

L. x intermedia Emeric ex Loisel. (**L. angustifolia** × **L. latifolia**)
(**L. hybrida** Reverchon; **L. x hortensis** Hy)

A vigorous shrub from 60–150 cm, highly variable making delimitation difficult at times. Leaves linear-lanceolate to spathulate, often grey tomentose. Inflorescence stalk branched, spike usually lax and occasionally interrupted. Fertile bracts ovate-rhombic in outline but variable in

Figure 2.7 *L. latifolia* – France, Col de Ferrier nr. Grasse. View of flower spike showing linear bracts and bracteoles. (See Color Plate II.)

exact shape and size, bracteoles 1–4 mm long. Calyx thirteen-nerved, with rotund to elliptic appendage. Corolla bilaterally symmetrical, variable in colour usually shades of lilac-purple to white. Flowers from late June to July.

A natural sterile hybrid occurring in Spain, France and Italy where the two parents meet. Commonly known as lavandin with numerous cultivars selected for oil production and horticultural purposes, for example, 'Alba' to 100 cm white flowered, Dutch Group 80 cm pale blue-violet flowers and grey leaves, 'Grappenhall' 90 cm lilac-purple flowers, green foliage, 'Grosso' 75 cm with a profusion of dark violet-blue flowers (the most popular lavender for oil production) (Figure 2.8), 'Hidcote Giant' 90 cm with stout spikes of violet-blue flowers, 'Lullingstone Castle' 100 cm dark blue-violet, grey leaves, ' Old English' 100 cm violet flowers, grey-green foliage, 'Seal' vigorous to over 100 cm, violet-blue flowers.

L. lanata Boiss. × **L. angustifolia** Mill

Similar to *L. lanata* in general habit 60–70 cm tall with grey to silver-grey leaves. Flower spike with purple flowers, bracts subtending the whorls narrowly rhombic (diamond) in shape, about 3 × longer than broad. Flowers violet purple. Flowers mid-June to July.

Several hybrids of this parentage are in cultivation and make fine ornamental garden plants that tend to be more robust in cultivation than *L. lanata*. Cultivars include: 'Richard Gray' – to 60 cm with rounded flower spikes and 'Sawyers' – taller form to 70 cm with large conical flower spikes, both of UK origin; 'Silver Frost' – to 50 cm with conical spikes raised in the United States; 'Joan Head' – 60–70 cm with cylindrical spikes raised in New Zealand.