Winter Botany in the British Isles

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Contents

Preface

I am a strong believer in a top down approach when it comes to identification. In the context here, this means trying to compartmentalise hundreds of species into natural groups such as orders, families or genera. Not only does it allow you to not have to worry about species (for the moment), but it allows you to see evolutionary groups of plants more easily. When confronted with new species in other parts of the world, with luck they will be placed within your working knowlegde.

This guide is not intended as a replacement to the guides that already exist but it can be viewed to supplement them. By its nature of only dealing with genera the keys are necessarily shorter and less complex, which is the idea of this guide. Where possible the terminology is minimised and only the major characters of use are mentioned. This key will have very little in it that is actually new, at least in its current form; it will be a synthesis of what in the literature already exists. So for this I cannot take credit. I have relied heavily on the literature, in no particular order: Winter Botany by William Trelease (date?), The Vegetative Key to the British Flora by John Poland and Eric Clement (date?), Flora of the British Isles by Clive Stace (2012), Trees of Britain and Northern Europe by Alan Mitchell (1976), more recently Identification of trees and shrubs in winter using buds and twigs by Bernd Schulz (2018) and the Conifers Plant Crib at the BSBI (1998) by Peter Sell, http://bsbi.org/wp-content/uploads/dlm_uploads/Conifers_Crib_3.pdf. As always, where I could, terminology was simplified, though a glossary will be provided at the end.

The key to broad sections is outlined first as this is a winter botanical key, not all species will be in leaf. First thing to note is that I have separated out the conifers first, because I believe them to have such a distinct structure compared to flowering plants that it would be confusing to integrate them with the other keys. This is not the case for deciduous coniferous species however, which have been included in the main keys. When there are no leaves on a coniferous plant, it is difficult to tell that a deciduous conifer is not a flowering plant. Luckily, there are only four genera that fit into this category *Larix*, *Gingko*, *Metasequoia* and *Taxodium*.

The key should cater for any woody plant you find in the winter in the UK, save a few rare hortal escapes (though many of these are also covered), whether you are at the top of a mountain or by the sea.

My interest was sparked in the winter of 2016, mostly because I was frustrated I knew nothing about twigs! I have been compiling this on and off since then.

Introduction

Many woody plants in (especially northern) temperate climates with seasonal weather shed their leaves in the colder months of the year. On the most recent years growth, leaves fall to reveal the twig beneath. It is these structures left behind after the leaves fall that are valuable in identification. The twig itself can vary in thickness, colour, growth pattern (straight or zig-zagged) and cross sectional shape of the twig (round, oval, square).

Where the leaf falls a scar is left behind. The distribution of leaf scars on a twig (phyllotaxy) is of major importance. The presence of at least one leaf scar indicates where the node is on a twig. Leaf scars can be present in groups of three or more, in which case they are considered whorled. Secondly leaf scars can be paired, usually on opposite sides of the twig. Thirdly and most commonly, leaf scars are present singularly at a node.Leaf scars are characteristic in size, shape and the number and distribution of vascular bundles present within them.

Above the leaf scar, a bud will be present which contains meristems that will continue next years growth. They are often surrounded by scales, the size, shape and number of which are often diagnostic. Buds can be multiple at one node either next to each other (collateral), or above one another (superposed). The presence or absence of an *end* or *terminal* bud is determined either by the absence of an obvious leaf scar or by its morphological difference to lateral buds. Terminal buds are usually larger, if present. Sometimes buds can appear to be different even on the lateral buds and this is usually associated with a difference between buds that will go on to produce flowers, and those that will continue vegetative growth.

Twigs can have many and varied outgrowths on them. These vary from small, thin flexible outgrowths (hairs), which can be shaped simply, forked, tree-like, woolly, star-shaped and glandular to name a few. Hardened outgrowths of the stem are called *prickles*. In contrast, *spines* are modified leaves and therefore have a bud at the base of them (be careful, bud may be obscured!) and *thorns* are modified stems.

Where there is only one species in the genus, or the key specifically arrives at a species, the species is indicated in parentheses.

General Key

1. Leaves evergreen, needle like, scale like or both, usually hard, mostly resinous or odorous. Reproducing through cones -> Key 1 (Conifers)
2. Leaves evergreen, deciduous or absent, not needle or scale like, resinous or not. Reproducing (almost exclusively) through flowers and fruits -> 3 (Flowering plants)
    3. Leaves evergreen and parallel veined -> Key 2
    4. If leaves evergreen, then not parallel veined -> 5
3. Leaves or leaf scars >2 per node (whorled, pseudowhorled or in bundles) -> Key 3
4. Leaves or leaf scars <3 per node -> 7
    7. Leaves or leaf scars 2 per node (opposite or subopposite) -> Key 4
    8. Leaves or leaf scars 1 per node (alternate) -> Key 5

Key 1: Conifers

Conifers are seed plants without flowers, instead reproducing through cones. Only a few species are deciduous and the rest are evergreen. Most coniferous genera are highly distinct, with discrete and interesting characters.

General Key

1. Leaves whorled. Either whorled on short shoots and needle like, 3(4)-whorled around a twig or in large distant whorls -> Key 1.1
2. Leaves not whorled -> 3
    3. Leaves needle like, in bundles of 2's, 3's or 5's -> *Pinus*
    4. If leaves needle like, not bundled -> 5
3. Leaves strictly opposite, adnate, scale like -> Key 1.2
4. Leaves alternate or spiral. Adnate, scale like or not -> 7
    7. Young twigs brown or grey (by year 2). If shoot ribbed, not green -> Key 1.3
    8. Young twigs green (until year 3). Shoot ribbed by green leaf bases -> Key 1.4

Key 1.1: Leaves whorled

1. Leaves deciduous, cones persistent… *Larix*
2. Leaves evergreen -> 3
    3. Leaves in rosettes of 20-80 leaves on short shoots … *Cedrus*
    4. Leaves never on short shoots -> 5
3. Leaves many, >7, 70-120mm long in large, distant whorls … *Sciadopitys*
4. Leaves in 3's, rarely 4's -> 7
    7. Leaves blunt tipped … *Fitzroya* (*cupressoides*)
    8. Leaves sharply pointed … *Juniperus*

Key 1.2: Leaves strictly opposite, scale like (Cupressaceae)

1. Leaves broader, with large white patches below… *Thujopsis* (*dolabrata*)

2. Leaves smaller, not broad -> 3
    3. Shoots with at least some leaves in whorls of 3 (check young foliage)… *Juniperus*
    4. Leaves never 3-whorled -> 5
3. Branchlets spreading in 3 dimensions. Twigs rounded or 4-sided. Scale leaves all similar. Female cone thickly woody… *Cupressus*
4. Branchlets arranged in 1 plane, or rarely 3 dimensions. Twigs flat, or slightly flat and 4 sided. -> 7
    7. Young shoots slightly flat and nearly 4 sided. One common cultivar with branchlets in 3 dimensions… *x Cupressocyparis* (*leylandii*)
    8. Young shoots very flat, lateral scale leaves keeled -> 9
5. Scale leaves same colour on both sides, scentless foliage when crushed… *Platycladus* (*orientalis*)
6. Scale leaves lighter or whitish at margins below -> 11
    11. Female cones globular and woody, terminal shoots whip-like… *Chamaecyparis*
    12. Female cones flask shaped with scales overlapping, terminal shoots erect… *Thuja* (*plicata*)

Key 1.3: Young twigs brown or grey

1. Leaves with sucker like base, attached directly to twig… *Abies*
2. Leaves without sucker like base, attached to a projection on twig -> 3
    3. Leaves with indistinct petiole, twig very rough when leaves fallen… *Picea*
    4. Leaves with obvious petiole, bare shoots slightly rough -> 5
3. Leaves minutely serrate, buds hidden by leaves… *Tsuga*
4. Leaves entire, buds prominent… *Pseudotsuga* (*menziesii*)

Key 1.4: Young twigs green

1. Leaves with a petiole… *Taxus* (*baccata*)
2. Leaves sessile -> 3
    3. Leaves of two kinds, scale like, and linear/flat… *Sequoia* (*sempervirens*)
    4. Leaves all similar -> 5
3. Leaves >25mm long, >10mm wide, sharply spine tipped… *Araucaria* (*araucana*)
4. Leaves <25mm long -> 7
    7. Leaves spirally arranged, with free part 3-7mm… *Sequoiadendron* (*giganteum*)
    8. Leaves in 5 ranks, incurved, with free part 5-20mm… *Cryptomeria* (*japonica*)

Chapter 1

Key 2: Leaves evergreen, parallel veined (Asparagaceae)

1. Leaves >20cm long in rosettes at apex of stem, palm-like -> 3
2. Leaves <20cm long spirally arranged on stems … *Ruscus*
3. Leaves with translucent veins … *Cordyline* (*australis*)
4. Leaves with indistinct opaque veins … *Yucca*

Chapter 2

Key 3: Leaves or leaf scars whorled

1. Leaves evergreen -> 3
2. Leaves deciduous, leaf scars apparent -> 15
    3. Leaves pseudowhorled -> 5
    4. Leaves in true whorls -> 7
3. Matted evergreen shrub < 0.4m … *Empetrum*
4. Tall shrub to small tree >2m … *Rhododendron*
    7. Leaves 3 whorled -> 9
    8. Leaves >4 whorled -> 11
5. Young twigs glandular hairy … *Erica*
6. Young twigs not glandular hairy -> 11
    11. Leaves > 10mm wide … *Kalmia*
    12. Leaves < 1mm wide … *Erica*
7. Leaves tough >6mm wide, strongly retrorsely scabrid … *Rubia*
8. Lvs ± 1mm wide … *Erica*
    15. Leaf scars minute, many, alternate, raised on spurs on second year shoots, reproductive organs cones … *Larix*
    16. Leaf scars larger, 3 per node, not raised -> 17
9. Twigs stout, leaf scars large with ~ 12 bundle traces in an ellipse. Buds usually arranged in two large and one small … *Catalpa* (*bignonioides*)
10. Twigs slender, leaf scars smaller with 3 or fewer bundle traces -> 19
    19. Bundle trace 1, twigs mostly dead… *Fuschia*
    20. Bundle traces 3 -> 21
11. Twigs with stellate scales … *Deutzia* (better characters?)
12. Twigs hairless or with simple hairs … *Hydrangea*

Add Philadelphus?

Chapter 3

Key 4: Leaves or leaf scars opposite

1. Plants scrambling, climbing or parasitic on trees -> Key 4.1
2. Plants not as above -> 3
    3. Plants evergreen -> Key 4.2
    4. Plants deciduous -> Key 4.3

Key 4.1: Climbing, or epiphytic plants parasitic on trees

1. Plant parasitic on tree branches with twigs repeatedly forked at the nodes -> 3
2. Plant rooted in soil -> 5
    3. Twigs sickly green … *Viscum* (*album*)
    4. Twigs brown … *Loranthus* (rare hortal)
3. Evergreen (or semi-evergreen) -> 7
4. Deciduous -> 9
    7. Leaves simple … *Lonicera*
    8. Leaves compound, climbing using coiling petioles … *Clematis*
5. Climbing by coiling petioles, persisting in winter … *Clematis*
6. Climbing by aerial roots or scrambling -> 11
    11. Anvil shaped hairs on stems, stems twining clockwise, fruits persistent with many overlapping papery bracts … *Humulus* (*lupulus*)
    12. Not as above -> 13
7. Bundle traces 1, scrambling, weakly climbing … *Jasminum* (*nudiflorum*)
8. Bundle traces >1 -> 15
    15. Bundle traces 3 … *Lonicera*
    16. Bundle traces 5 … *Schizophragma* (*hydrangoides*)

Key 4.2: Evergreen plants

1. Leaves simple and entire -> 3
2. Leaves compound or toothed -> 5
    3. Trailing, thin, wiry shrubs <20cm tall at maturity -> Key 4.2.1
    4. Tree or upright shrub -> Key 4.2.2
3. Leaves ternate… *Choisya* (*ternata*)
4. Leaves toothed -> Key 4.2.3

Key 4.2.1: Wiring, creeping, trailing shrubs

1. Leaves with stellate hairs … *Helianthemum*
2. Leaves with simple hairs or hairless -> 3
    3. Leaves translucent dotted with sunken glands, aromatic … *Thymus*
    4. Leaves not translucent dotted or aromatic -> 5
3. Leaves with revolute margins -> 7
4. Leaves with flat margins -> 11
    7. Leaves < 2mm long, petiole absent … *Calluna*
    8. Leaves >2mm long, petiole present -> 9
5. Leaves linear, rounded in cross section, 2-5mm long … *Frankenia*
6. Leaves oblong, 5-8mm long -> *Loiseleuria*
    11. Stipules absent -> 13
    12. Stipules present … *Herniaria*
7. *Veronica* bifurcate Linnaea here
8. *Veronica* bifurcate Linnaea here

Linnaea here?

Key 4.2.2: Shrubs, trees. Leaves simple.

1. Leaves with clear 2 pinnate translucent veins on leaves -> 3
2. Leaves with 2 pinnate veins indistinct or absent -> 19
    3. Leaves sessile -> 3
    4. Leaves petiolate -> 9
3. Leaves <1.5cm wide and with revolute margins at maturity -> 5
4. Leaves >2cm wide, with either transulcent dotted leaves or with minute glands attached to veinlets. Leaf scars triangular, bundle trace 1, pith spongey and excavated (hollow) -> *Hypericum*
5. Leaves <4mm wide, rosemary scented. Bundle traces 3 … *Rosmarinus*
6. Leaves >4mm wide (on average), odourless. Bundle traces in a transverse line … *Kalmia*
    9. Leaves >2cm long -> 11
    10. Leaves <2cm long … *Lonicera*
7. Leaves with dendritic hairs … *Phlomis*

8. Leaves with hairs simple or absent -> 13
    13. Leaves with dense silver silky hairs below … *Olearia* (GARRYA? LEAVES GREY WOOLLY BELOW AND UNDULATE LEAF MARGINS?)
    14. Leaves hairless both sides, except for vein axils below -> 15
9. Vein axils below with tufts of hairs … *Viburnum*
10. Leaves glabrous -> 17
    17. Sipules present, fused between petiole bases, young twigs ± square … *Coprosma*
    18. Stipules absent, young twigs rounded, at most angled slightly below the nodes … *Ligustrum*
11. Leaves white hairy at least below, strongly aromatic -> 21
12. Leaves never white hairy, aromatic or not -> 23
    21. Leaves hairy with long stellate hairs both sides, lavendar scented … *Lavandula*
    22. Leaves glabrous above, rosemary scented … *Rosmarinus*
13. Twigs square, leaves odorous -> 25
14. Twigs round, leaves odourless -> 29
    25. Leaves gland pitted one or either side -> 25
    26. Leaves not gland pitted -> *Buxus* (*sempervirens*)
15. Young twigs green, minutely ciliate, menthol scented … *Hyssopus*
16. Young twigs whitish, leaves long ciliate at base, sage scented … *Satureja*
    29. Leaves strongly revolute, <2mm long, sessile … *Calluna*
    30. Leaves not revolute -> 31
17. Leaves fleshy, mealy grey <6cm, not valvate when developing … *Atriplex*
18. Leaves not fleshy, valvate when developing … *Veronica* (sect Hebe)

Key 4.2.3: Shrubs, trees. Leaves toothed.

1. Twigs with dendritic hairs … *Phlomis*
2. Twigs never with dendritic hairs -> 3
    3. Twigs with stellate hairs -> 5
    4. Twigs without stellate hairs -> 7
3. Stipules present, leaves white felted below … *Buddleja*
4. Stipules absent, leaves stellate hairy below … *Viburnum*
    7. Leaves < 2cm long, stems creeping and prostrate … *Linnaea*
    8. Leaves >2cm long, stems never creeping -> 9
5. Petiole with 1 vascular bundle -> 11
6. Petiole with 3 vascular bundles -> 13
    11. Twigs square … *Phygelius*
    12. Twigs round -> 15
7. Not net veined, weak 2 pinnate veins. Leaves with yellow blotches above, petiole green … *Aucuba* (*japonica*)
8. Net veined and strongly 3-pli-veined. No yellow blotches, petiole reddish … *Viburnum*

15. Young twigs brown, each leaf tooth with a fragile claw like gland … *Euonymus*
16. Young twigs green, leaf teeth without glands -> 17

9. Leaves cuneate at base, buds with scales … *Rhamnus*
10. Leaves rounded at base, buds naked … *Phillyrea*

Key 4.3: Deciduous plants

1. Bundle trace 1 -> Key 4.3.1
2. Bundle traces >1 -> 5
    3. Bundle traces 3 -> Key 4.3.2
    4. Bundle traces >3 -> Key 4.3.3

Key 4.3.1: Bundle trace 1

1. Twigs green … *Euonymus*
2. Twigs not green when mature -> 3
    3. Trees -> 5
    4. Shrubs -> 9
3. Terminal buds always present, buds felted brown, grey or black … *Fraxinus*
4. Terminal buds absent -> 11
    7. Pith chambered, twigs densly hairy … *Paulownia* (*tomentosa*)
    8. Pith solid, twigs red brown… *Metasequoia* (*glyptostryboides*)
5. Buds sometimes whorled in 3's… *Fuschia*
6. Buds strictly opposite -> 11
    11. Pith present, solid, whitish -> 13
    12. Twigs hollow or chambered, brownish -> 15
7. Buds mostly in pairs at twig apices, glandular ciliate with 6-7 scales … *Syringa*
8. Buds singular at twig apices, ciliate with ± 4 pairs of opposite scales … *Ligustrum*
    15. Buds >11 pairs of scales, twigs chambered to hollow between nodes … *Forsythia*
    16. Buds <4 pairs of scales, or absent, twigs hollow but never chambered -> 17
9. Leaf scars mostly torn, partly connected by transverse ridges, buds with keeled scales. Fruits white or red berries … *Symphoricarpos*
10. Leaf scars never torn, triangularly lens shaped, not partly connected by ridges, buds without scales … *Hypericum*

Key 4.3.2: Bundle traces 3

1. Transverse ridge not present between buds or leaf scars -> 3
2. Transverse ridge present between buds or leaf scars, or leaf scars abut -> 5

    3. Shoots thorny, buds with 8-10 dark brown scales, terminal buds present… *Rhamnus* (*cathartica*)
    4. Shoots not thorny, buds red with one scale visible, terminal buds absent… *Cercidiphyllum* (*japonicum*)
3. Buds hidden behind leaf scar (which is like a thin membrane)… *Philadelphus*
4. Buds exposed and obvious -> 7
    7. Buds naked -> 9
    8. Buds with scales -> 13
5. Only terminal bud naked, twigs stout… *Hydrangea*
6. All buds naked -> 11
    11. Twigs but especially buds with stellate hairs… *Viburnum*
    12. Twigs and buds without stellate hairs but with medifixed hairs… *Cornus*
7. Stipule scars large and obvious… *Staphylea*
8. Stipule scars absent or not obvious -> 15
    15. Buds with a pair of scales fused, enveloping bud, buds globose, red. Or flowering in winter, fragrant… *Viburnum*
    16. Bud scales >2, not fused, not flowering in winter -> 17
9. Pith hollow between nodes -> 19
10. Pith solid, or spongey -> 23
    19. Buds solitary, twigs green … *Leycesteria*
    20. Buds often superposed or collateral, twigs never green -> 21
11. Buds >3mm long, with buds often superposed… *Lonicera*
12. Buds <3mm long, buds often collateral… *Symphoricarpos*
    23. Twigs with 2-4 ridges decurrent from nodes. 2-valved capsules persistent … *Weigela*
    24. Twigs without ridges decurrent from nodes, fruits rarely persistent -> 25
13. Bundle traces forming a line, fruits persistent, bristly with 5 lobed calyx…*Kolkwitzia*
14. Bundle traces distinct, fruits not persistent, or if they are, not as above -> 27
    27. Pith spongey, twigs stout… *Sambucus*
    28. Pith solid, twigs more slender… *Acer*

Key 4.3.3: Bundle traces >3

1. Leaf bases obscuring leaf scars -> 3
2. Leaf scars clearly present -> 5
    3. Twigs green, hollow… *Leycesteria* (*formosana*)
    4. Twigs red or purplish, solid… *Acer* (section Palmata)
3. At least some nodes in whorls of 3 -> 7
4. Nodes strictly opposite -> 11
    7. Bundle traces >8 in an ellipse or horseshoe shape, terminal bud absent -> 9
    8. Bundle traces < 7 (usually 3-5), terminal bud present… *Hydrangea*
5. Each node with one small leaf scar, and two large… *Catalpa* (*bignonioides*)
6. Leaf scars all the same size… *Clerodendron* (*trichotomum*)
    11. Large stipule scars between leaf scars… *Staphylea* (*pinnata*)

12. If stipule scars present, inconspicuous -> 13
7. Trees -> 15
8. Shrubs -> 21
    15. Terminal bud present, pith solid -> 17
    16. Terminal bud absent, pith chambered… *Paulownia* (*tomentosa*)
9. Bundle traces many in a closed circle, buds furry… *Fraxinus*
10. Bundle traces <9, distinct, buds not furry but may be hairy -> 19
    19. Terminal buds >15mm, leaf scars large, shield shaped… *Aesculus*
    20. Terminal buds < 15mm, leaf scars smaller, mostly crescent shaped… *Acer*
11. Terminal bud very large (15-20mm), naked… *Hydrangea*
12. Terminal bud smaller <15mm, often absent from shoots -> 23
    23. Pith wide, spongey, twigs stout … *Sambucus*
    24. Pith narrower, hard, more slender … *Acer*

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Prickles are acute outgrowth of the stem, spines are modified leaves and thorns are modified stems.

The key should cater for any woody plant you find in the winter in the UK, save a few rare

hortal escapes (though many of these are also covered), whether you are at the top of a mountain or by the sea.

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Chapter 4

Keys

General Key

1. Leaves evergreen, needle like, scale like or both, usually hard, mostly resinous or odorous. Reproducing through cones -> Key 1 (Conifers)
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    4. If leaves evergreen, then not parallel veined -> 5
3. Leaves or leaf scars >2 per node (whorled, pseudowhorled or in bundles) -> Key 3
4. Leaves or leaf scars <3 per node -> 7
    7. Leaves or leaf scars 2 per node (opposite or subopposite) -> Key 4
    8. Leaves or leaf scars 1 per node (alternate) -> Key 5

Key 1: Coniferous plants reproducing by cones

Conifers are seed plants without flowers, instead reproducing through cones. Only a few species are deciduous and the rest are evergreen. Most coniferous genera are highly distinct, with discrete and interesting characters.

1. Leaves whorled. Either whorled on short shoots and needle like, 3(4)-whorled around a twig or in large distant whorls -> Key 1.1
2. Leaves not whorled -> 3
    3. Leaves needle like, in bundles of 2's, 3's or 5's -> *Pinus*
    4. If leaves needle like, not bundled -> 5
3. Leaves strictly opposite, adnate, scale like -> Key 1.2

4. Leaves alternate or spiral. Adnate, scale like or not -> 7
    7. Young twigs brown or grey (by year 2). If shoot ribbed, not green -> Key 1.3
    8. Young twigs green (until year 3). Shoot ribbed by green leaf bases -> Key 1.4

Key 1.1: Leaves whorled

1. Leaves deciduous, cones persistent… *Larix*
2. Leaves evergreen -> 3
    3. Leaves in rosettes of 20-80 leaves on short shoots … *Cedrus*
    4. Leaves never on short shoots -> 5
3. Leaves many, >7, 70-120mm long in large, distant whorls … *Sciadopitys*
4. Leaves in 3's, rarely 4's -> 7
    7. Leaves blunt tipped … *Fitzroya* (cupressoides)
    8. Leaves sharply pointed … *Juniperus*

Key 1.2: Leaves strictly opposite, scale like (Cupressaceae)

Cupressus - foliage in spray like plumes, branchlets at varying angles. Twigs rounded or 4-sided, the scale-leaves even on all sides

x Cupressocyparis - foliage in flattened pinnate sprays, cone globular and woody. Young shoots only slightly flat, nearly 4-sided

Chamaecyparis - foliage in flattened pinnate sprays, cone globular and woody. Twigs flat, the facial scale-leaves usually flat, rarely keeled, the lateral scale-leaves keeled. Young shoots distinctly flat. Terminal shoot usually 'whip-like', drooping; cones globose, the peltate scales touching only at the margins

Thuja - foliage in flattened pinnate sprays, cone flask shaped, leathery. Twigs flat, the facial scale-leaves usually flat, rarely keeled, the lateral scale-leaves keeled. Young shoots distinctly flat. Terminal shoot erect; cones ovate to oblong, their scales overlapping. Foliage spreading in flat sprays, aromatic when crushed; scale-leaves a different colour on lower sides from upper

Platycladus -foliage in flattened pinnate sprays, cone flask shaped, leathery. Foliage scentless. Twigs flat, the facial scale-leaves usually flat, rarely keeled, the lateral scale-leaves keeled. Young shoots distinctly flat. Foliage in vertical sprays, without scent when crushed; scale-leaves the same colour on both sides

1. Leaves broader, with large white patches below… *Thujopsis* (dolabrata)
2. Leaves smaller, not broad -> 3
    3. Shoots with at least some leaves in whorls of 3 (check young foliage)… *Juniperus*
    4. Leaves never 3-whorled -> 5
3. Branchlets spreading in 3 dimensions. Twigs rounded or 4-sided. Scale leaves all similar. Female cone thickly woody… *Cupressus*

4. Branchlets arranged in 1 plane, or rarely 3 dimensions. Twigs flat, or slightly flat and 4 sided. -> 7
    7. Young shoots slightly flat and nearly 4 sided. One common cultivar with branchlets in 3 dimensions… *x Cupressocyparis* (leylandii)
    8. Young shoots very flat, lateral scale leaves keeled -> 9
5. Scale leaves same colour on both sides, scentless foliage when crushed… *Platycladus* (orientalis)
6. Scale leaves lighter or whitish at margins below -> 11
    11. Female cones globular and woody, terminal shoots whip-like… *Chamaecyparis*
    12. Female cones flask shaped with scales overlapping, terminal shoots erect… *Thuja* (plicata)

Olfactory table:

Thujopsis Juniperus - smells like gin? Cupressus x Cupressocyparis Platycladus - no smell Chamaecyparis Thuja - sweet pineapple

Key 1.3: Young twigs brown or grey

1. Leaves with sucker like base, attached directly to twig… *Abies*
2. Leaves without sucker like base, attached to a projection on twig -> 3
    3. Leaves with indistinct petiole, twig very rough when leaves fallen… *Picea*
    4. Leaves with obvious petiole, bare shoots slightly rough -> 5
3. Leaves minutely serrate, buds hidden by leaves… *Tsuga*
4. Leaves entire, buds prominent… *Pseudotsuga* (menziesii)

Key 1.4: Young twigs green

1. Leaves with a petiole… *Taxus* (baccata)
2. Leaves sessile -> 3
    3. Leaves of two kinds, scale like, and linear/flat… *Sequoia* (sempervirens)
    4. Leaves all similar -> 5
3. Leaves >25mm long, >10mm wide, sharply spine tipped… *Araucaria* (araucana)
4. Leaves <25mm long -> 7
    7. Leaves spirally arranged, with free part 3-7mm… *Sequoiadendron* (giganteum)
    8. Leaves in 5 ranks, incurved, with free part 5-20mm… *Cryptomeria* (japonica)

Key 2: Leaves evergreen, parallel veined (Asparagaceae)

1. Leaves >20cm long in rosettes at apex of stem, palm-like -> 3
2. Leaves <20cm long spirally arranged on stems … *Ruscus*

3. Leaves with translucent veins … *Cordyline* (australis)
4. Leaves with indistinct opaque veins … *Yucca*

Key 3: Leaves or leaf scars whorled

1. Leaves evergreen -> 3
2. Leaves deciduous, leaf scars apparent -> 15
    3. Leaves pseudowhorled -> 5
    4. Leaves in true whorls -> 7
3. Matted evergreen shrub < 0.4m … *Empetrum*
4. Tall shrub to small tree >2m … *Rhododendron*
    7. Leaves 3 whorled -> 9
    8. Leaves >4 whorled -> 11
5. Young twigs glandular hairy … *Erica*
6. Young twigs not glandular hairy -> 11
    11. Leaves > 10mm wide … *Kalmia*
    12. Leaves < 1mm wide … *Erica*
7. Leaves tough >6mm wide, strongly retrorsely scabrid … *Rubia*
8. Lvs ± 1mm wide … *Erica*
    15. Leaf scars minute, many, alternate, raised on spurs on second year shoots, reproductive organs cones … *Larix*
    16. Leaf scars larger, 3 per node, not raised -> 17
9. Twigs stout, leaf scars large with ~ 12 bundle traces in an ellipse. Buds usually arranged in two large and one small … *Catalpa* (bignonioides)
10. Twigs slender, leaf scars smaller with 3 or fewer bundle traces -> 19
    19. Bundle trace 1, twigs mostly dead… *Fuschia*
    20. Bundle traces 3 -> 21
11. Twigs with stellate scales … *Deutzia* (better characters?)
12. Twigs hairless or with simple hairs … *Hydrangea*

Add Philadelphus?

Key 4: Leaves or leaf scars opposite

1. Plants scrambling, climbing or parasitic on trees -> Key 4.1
2. Plants not as above -> 3
    3. Plants evergreen -> Key 4.2
    4. Plants deciduous -> Key 4.3

Key 4.1: Climbing, or epiphytic plants parasitic on trees

1. Plant parasitic on tree branches with twigs repeatedly forked at the nodes -> 3

2. Plant rooted in soil -> 5
    3. Twigs sickly green … *Viscum* (album)
    4. Twigs brown … *Loranthus* (rare hortal)
3. Evergreen (or semi-evergreen) -> 7
4. Deciduous -> 9
    7. Leaves simple … *Lonicera*
    8. Leaves compound, climbing using coiling petioles … *Clematis*
5. Climbing by coiling petioles, persisting in winter … *Clematis*
6. Climbing by aerial roots or scrambling -> 11
    11. Anvil shaped hairs on stems, stems twining clockwise, fruits persistent with many overlapping papery bracts … *Humulus* (lupulus)
    12. Not as above -> 13
7. Bundle traces 1, scrambling, weakly climbing … *Jasminum* (nudiflorum)
8. Bundle traces >1 -> 15
    15. Bundle traces 3 … *Lonicera*
    16. Bundle traces 5 … *Schizophragma* (hydrangoides)

Key 4.2: Evergreen plants

1. Leaves simple and entire -> 3
2. Leaves compound or toothed -> 5
    3. Trailing, thin, wiry shrubs <20cm tall at maturity -> Key 4.2.1
    4. Tree or upright shrub -> Key 4.2.2
3. Leaves ternate… *Choisya* (ternata)
4. Leaves toothed -> Key 4.2.3

Key 4.2.1: Wiring, creeping, trailing shrubs

1. Leaves with stellate hairs … *Helianthemum*
2. Leaves with simple hairs or hairless -> 3
    3. Leaves translucent dotted with sunken glands, aromatic … *Thymus*
    4. Leaves not translucent dotted or aromatic -> 5
3. Leaves with revolute margins -> 7
4. Leaves with flat margins -> 11
    7. Leaves < 2mm long, petiole absent … *Calluna*
    8. Leaves >2mm long, petiole present -> 9
5. Leaves linear, rounded in cross section, 2-5mm long … *Frankenia*
6. Leaves oblong, 5-8mm long -> *Loiseleuria*
    11. Stipules absent -> 13
    12. Stipules present … *Herniaria*
7. *Veronica* bifurcate Linnaea here
8. *Veronica* bifurcate Linnaea here

Linnaea here?

Key 4.2.2: Shrubs, trees. Leaves simple.

1. Leaves with clear 2 pinnate translucent veins on leaves -> 3
2. Leaves with 2 pinnate veins indistinct or absent -> 19
    3. Leaves sessile -> 3
    4. Leaves petiolate -> 9
3. Leaves <1.5cm wide and with revolute margins at maturity -> 5
4. Leaves >2cm wide, with either transulcent dotted leaves or with minute glands attached to veinlets. Leaf scars triangular, bundle trace 1, pith spongey and excavated (hollow) -> *Hypericum*
5. Leaves <4mm wide, rosemary scented. Bundle traces 3 … *Rosmarinus*
6. Leaves >4mm wide (on average), odourless. Bundle traces in a transverse line … *Kalmia*
    9. Leaves >2cm long -> 11
    10. Leaves <2cm long … *Lonicera* (leaves <2cm long? Really?)
7. Leaves with dendritic hairs … *Phlomis*
8. Leaves with hairs simple or absent -> 13
    13. Leaves with dense silver silky hairs below … *Olearia* (GARRYA? LEAVES GREY WOOLLY BELOW AND UNDULATE LEAF MARGINS?)
    14. Leaves hairless both sides, except for vein axils below -> 15
9. Vein axils below with tufts of hairs … *Viburnum*
10. Leaves glabrous -> 17
    17. Sipules present, fused between petiole bases, young twigs ± square … *Coprosma*
    18. Stipules absent, young twigs rounded, at most angled slightly below the nodes … *Ligustrum*
11. Leaves white hairy at least below, strongly aromatic -> 21
12. Leaves never white hairy, aromatic or not -> 23
    21. Leaves hairy with long stellate hairs both sides, lavendar scented … *Lavandula*
    22. Leaves glabrous above, rosemary scented … *Rosmarinus*
13. Twigs square, leaves odorous -> 25
14. Twigs round, leaves odourless -> 29
    25. Leaves gland pitted one or either side -> 25
    26. Leaves not gland pitted -> *Buxus*
15. Young twigs green, minutely ciliate, menthol scented … *Hyssopus*
16. Young twigs whitish, leaves long ciliate at base, sage scented … *Satureja*
    29. Leaves strongly revolute, <2mm long, sessile … *Calluna*
    30. Leaves not revolute -> 31
17. Leaves fleshy, mealy grey <6cm, not valvate when developing … *Atriplex*
18. Leaves not fleshy, valvate when developing … *Veronica* (sect Hebe)

Key 4.2.3: Shrubs, trees. Leaves toothed.

1. Twigs with dendritic hairs … *Phlomis*

2. Twigs never with dendritic hairs -> 3
    3. Twigs with stellate hairs -> 5
    4. Twigs without stellate hairs -> 7
3. Stipules present, leaves white felted below … *Buddleja*
4. Stipules absent, leaves stellate hairy below … *Viburnum*
    7. Leaves < 2cm long, stems creeping and prostrate … *Linnaea*
    8. Leaves >2cm long, stems never creeping -> 9
5. Petiole with 1 vascular bundle -> 11
6. Petiole with 3 vascular bundles -> 13
    11. Twigs square … *Phygelius*
    12. Twigs round -> 15
7. Not net veined, weak 2 pinnate veins. Leaves with yellow blotches above, petiole green … *Aucuba*
8. Net veined and strongly 3-pli-veined. No yellow blotches, petiole reddish … *Viburnum*
    15. Young twigs brown, each leaf tooth with a fragile claw like gland … *Euonymus*
    16. Young twigs green, leaf teeth without glands -> 17
9. Leaves cuneate at base, buds with scales … *Rhamnus*
10. Leaves rounded at base, buds naked … *Phillyrea*

Evergreen:

TOOTHED LVS Aucuba - bt's 3, pith chambered with granular septa, scars slightly raised, large and crescent shaped

Buddleja - stems 4 ridged, pith large, white and continuous, scars half round or triangular, small, bt 1. Stipule scars transversely connected Viburnum - bt's 3 or in groups of 3 with the middle bundles 2, pith continuous, leaf scars crescent shaped or angular v shaped Linnaea - leaf scars raised and shrivelled, single bt obscured Euonymus - scars small, elevated, bt 1 towards the top of the scar Phygelius - twigs square Rhamnus - pith rounded continuous and white, bt's 3 or in a transverse series, buds with scales Phillyrea - bt 1, scars crescent shaped

LVS TERNATE Choisya - ! ENTIRE LVS Phlomis - Coprosma - Buxus - bt 1, leaf scars minute and crescent shaped, pith minute and cont. Twigs flat grooved between each pair of leaves Olearia Kalmia - bt's in a transverse line, scars half round or shield shaped, pith small and cont Calluna - scars opposite, minute, crescent shaped, bt 1, pith round cont Hebe - Viburnum - bt's 3 or in groups of 3 with the middle bundles 2, pith continuous, leaf scars crescent shaped or angular v shaped Ligustrum - pith moderate, white and homogenous, scars crescent shaped with bt 1 Lavandula - Rosmarinus - twigs 4 sided, leaf scars deeply u shaped, bt's 3 Hypericum - leaf scars triangular, 1 bt, pith spongey and finally excavated ?? Garrya - bt's 3, pith continuous, scars angularly u-shaped

?? Hyssopus Satureja ?? Atriplex

?? Helianthemum Thymus Loiseleuria Frankenia Herniaria Fuschia Weigela Kolkwitzia Phygelius Phillyrea ?? Akebia

Key 4.3: Deciduous plants

1. Bundle trace 1 -> Key 4.3.1
2. Bundle traces >1 -> 5
    3. Bundle traces 3 -> Key 4.3.2
    4. Bundle traces >3 -> Key 4.3.3

Key 4.3.1: Bundle trace 1

1. Twigs green … *Euonymus*
2. Twigs not green when mature -> 3
    3. Trees -> 5
    4. Shrubs -> 9
3. Terminal buds always present, buds felted brown, grey or black … *Fraxinus*
4. Terminal buds absent -> 11
    7. Pith chambered, twigs densly hairy … *Paulownia* (tomentosa)
    8. Pith solid, twigs red brown… *Metasequoia* (glyptostryboides)
5. Buds sometimes whorled in 3's… *Fuschia*
6. Buds strictly opposite -> 11
    11. Pith present, solid, whitish -> 13
    12. Twigs hollow or chambered, brownish -> 15
7. Buds mostly in pairs at twig apices, glandular ciliate with 6-7 scales … *Syringa*
8. Buds singular at twig apices, ciliate with ± 4 pairs of opposite scales … *Ligustrum*
    15. Buds >11 pairs of scales, twigs chambered to hollow between nodes … *Forsythia*
    16. Buds <4 pairs of scales, or absent, twigs hollow but never chambered -> 17
9. Leaf scars mostly torn, partly connected by transverse ridges, buds with keeled scales. Fruits white or red berries … *Symphoricarpos*
10. Leaf scars never torn, triangularly lens shaped, not partly connected by ridges, buds without scales … *Hypericum*

Key 4.3.2: Bundle traces 3

1. Transverse ridge not present between buds or leaf scars -> 3
2. Transverse ridge present between buds or leaf scars, or leaf scars abut -> 7
    3. Shoots thorny, buds with 8-10 dark brown scales, terminal buds present… *Rhamnus* (cathartica)
    4. Shoots not thorny, buds red with one scale visible, terminal buds absent… *Cercidiphyllum* (japonicum)
3. Buds hidden behind leaf scar (which is like a thin membrane)… *Philadelphus*
4. Buds exposed and obvious -> 7
    7. Buds naked -> 9
    8. Buds with scales -> 13
5. Only terminal bud naked, twigs stout… *Hydrangea*

6. All buds naked -> 11
    11. Twigs but especially buds with stellate hairs… *Viburnum*
    12. Twigs and buds without stellate hairs but with medifixed hairs… *Cornus*
7. Stipule scars large and obvious… *Staphylea*
8. Stipule scars absent or not obvious -> 15
    15. Buds with a pair of scales fused, enveloping bud, buds globose, red. Or flowering in winter, fragrant… *Viburnum*
    16. Bud scales >2, not fused, not flowering in winter -> 17
9. Pith hollow between nodes -> 19
10. Pith solid, or spongey -> 23
    19. Buds solitary, twigs green … *Leycesteria*
    20. Buds often superposed or collateral, twigs never green -> 21
11. Buds >3mm long, with buds often superposed… *Lonicera*
12. Buds <3mm long, buds often collateral… *Symphoricarpos*
    23. Twigs with 2-4 ridges decurrent from nodes. 2-valved capsules persistent … *Weigela*
    24. Twigs without ridges decurrent from nodes, fruits rarely persistent -> 25
13. Bundle traces forming a line, fruits persistent, bristly with 5 lobed calyx…*Kolkwitzia*
14. Bundle traces distinct, fruits not persistent, or if they are, not as above -> 27
    27. Pith spongey, twigs stout… *Sambucus*
    28. Pith solid, twigs more slender… *Acer*

Key 4.3.3: Bundle traces >3

1. Leaf bases obscuring leaf scars -> 3
2. Leaf scars clearly present -> 5
    3. Twigs green, hollow… *Leycesteria* (formosana)
    4. Twigs red or purplish, solid… *Acer* (section Palmata)
3. At least some nodes in whorls of 3 -> 7
4. Nodes strictly opposite -> 11
    7. Bundle traces >8 in an ellipse or horseshoe shape, terminal bud absent -> 9
    8. Bundle traces < 7 (usually 3-5), terminal bud present… *Hydrangea*
5. Each node with one small leaf scar, and two large… *Catalpa* (bignonioides)
6. Leaf scars all the same size… *Clerodendron* (trichotomum)
    11. Large stipule scars between leaf scars… *Staphylea* (pinnata)
    12. If stipule scars present, inconspicuous -> 13
7. Trees -> 15
8. Shrubs -> 21
    15. Terminal bud present, pith solid -> 17
    16. Terminal bud absent, pith chambered… *Paulownia* (tomentosa)
9. Bundle traces many in a closed circle, buds furry… *Fraxinus*
10. Bundle traces <9, distinct, buds not furry but may be hairy -> 19
    19. Terminal buds >15mm, leaf scars large, shield shaped… *Aesculus*
    20. Terminal buds < 15mm, leaf scars smaller, mostly crescent shaped… *Acer*

11. Terminal bud very large (15-20mm), naked… *Hydrangea*
12. Terminal bud smaller <15mm, often absent from shoots -> 23
    23. Pith wide, spongey, twigs stout … *Sambucus*
    24. Pith narrower, hard, more slender … *Acer*

Deciduous:

Fuschia Weigela Kolkwitzia

`Clerodendron - twigs obscurely 4 sided, pith large round white and continuous, buds su`

– Clerodendron trichotomum

`Paulownia - twigs stout, compressed at nodes. Pith large and chambered or hollowed betw`

QA - Paulownia tomentosa

`Rhamnus - pith rounded, continuous and white, scars small or more or less raised, bt's`

OB - Rhamnus alaternus

`Aesculus - pith large, 6 sided, pale. Upper most buds very large, half dozen exposed s`

RG - Aesculus hippocastanum RG - Aesculus carnea RG - Aesculus indica

`Sambucus - twigs (6)8-10 sided, pith large, soft and continuous, buds with 3-5 pa`

SJ - ebulus SC - nigra SC - racemosa

`Fraxinus - twigs stout, stiff, squarish and compressed at nodes. Buds sessile, superpos`

SC - excelsior SC - angustifolium SC - ornus

`Viburnum (lantana, opulus) - twigs more or less 6 sided, pith round to 6 sided, continu`

QA - opulus (interpetiolar ridge) OA - lantana (interpetiolar ridge)

Leycesteria - soft wooded shrubs, twigs slender and round and pith excavated. Buds with 1-2 pairs of exposed scales, the outer attenuate. Leaf scars raised and minute so as to equal bud. Opposite scars connect in a cross line. Bt's 3. With interpetiolar ridge

OA/LA - formosana

`Cornus - twigs often bright coloured, round to 6 sided, pith white, continuous or soft`

LA - koenigii LA - mas LA - sanguinea LA - sericea

`Deutzia - twigs stellate pubescent, pith round, pale and spongey or brown and excavate`

OA - scabra

Philadelphus - twigs lined to hexagonal, buds with 2 valvate and hairy scales. Leaf scars half round with a thin membrane that covers the bud or crescent shaped when this is burst, connected transversely. Bt's 3. With interpetiolar ridge

OA - coronarius OA - microphyllus

Acer - twigs terete to six sided, pith round continuous and pale, buds with 2 to several pairs of scales, leaf scars U shaped bundle traces 3, 5, 7, 9

QA - campestre QA - cappadocicum RG/SC - negundo QA - platanoides QA - pseudoplatanus QA - saccharum

Lonicera - twigs rounded, slender, bt's 3. With interpetiolar ridge

LA - xylosteum LA - maackii LA - formosa LA - x purpusii LA - tatarica

Hydrangea - pith large, continuous and pale, buds with 4-6 exposed scales, leaf scars crescent shaped, with connecting crossline. Bt's 3. With interpetiolar ridge

OA - macrophylla

*Euonymus - twigs characteristically green, pith round to 4 angled, greenish and spongey. Buds with 3-5 pairs of at first serrulate scales, scars small, half elliptical, somewhat elevated. Bt 1, transverse towards the top of the scar. No interpetiolar ridge.

OB - latifolius OB - europaeus

*Ligustrum - twigs rounded to 4 lined below the nodes, pith moderate white and homogenous, buds with 2-3 exposed scales. Leaf scars crescent shaped, raised and small. Bt 1. No interpetiolar ridge

LB - vulgare LB - ovalifolium (mostly evergreen)

*Forsythia - pith chambered to excavated, twigs moderately 4 sided. Buds with a dozen pairs of scales. Leaf scars shield shaped, small. Bt 1. No interpetiolar ridge

OB - x intermedia

*Symphoricarpos - small deciduous shrubs. Pith brownish, usually excavated, buds with about 3 pairs of keeled scales. Leaf scars small and mostly torn, raised and partly connected by transverse ridges, bt 1

LA - albus LA -orbiculatus LA - x chenaultii

Hypericum - twigs angled at least below the nodes, pith brown, spongey and finally excavated. Buds with 2 or several scarcely specialised scales. Scars triangularly lens shaped, bt 1 Syringa - twigs moderate to slender, pith homogenous, buds with around 4 pairs of scales. Scars crescent or shield shaped. Bt 1 transverse and compound. No interpetiolar ridge.

LB - vulgaris

`Staphylea - twigs moderate and rounded, glabrous. Pith large, continuous. Buds ovoid, glabr`

Key 5: Leaves or leaf scars alternate

1. Plants scrambling or climbing -> Key 5.1
2. Plants not as above -> 3

3. Plants evergreen -> Key 5.2
4. Plants deciduous -> Key 5.3

Key 5.1: Plants scrambling or climbing

1. Plant with leaf opposed tendrils -> 3
2. Plant without tendrils -> 5
    3. Tendrils simple or forked and never thickened into pads, no lenticels on twigs, buds smaller, subglobose … *Vitis*
    4. Tendrils branched 2 or more times and often thickened into pads, lenticels on twigs, buds larger, round conical … *Parthenocissus*
3. Leaves evergreen -> 7
4. Leaves deciduous -> 9
    7. Stems with adventitious aerial roots, leaves lobed… *Hedera*
    8. Without aerial adventitious roots, leaves almost always entire… *Muehlenbeckia*
5. Stipule (ochreae) scars encircling twigs, at least in older twigs… *Fallopia*
6. Stipule scars absent -> 11
    11. Buds absent… *Salpichroa* (rare)
    12. Buds present -> 13
7. Buds superposed (one above another)… *Aristolochia*
8. Buds single at nodes -> 15
    15. Bundle trace 1, buds with << 12 scales -> 17
    16. Bundle traces 6 or 3 at level of stem, buds with ~12 mucronate scales… *Akebia*
9. Twigs pale, inconspicuously 5 ridged, hard wooded scrambling shrub, sometimes spiny… *Lycium*
10. Twigs darker, rounded, soft wooded twiner, never spiny. Frequently with dried berries in panicles… *Solanum*

Key 5.2: Evergreen plants

1. Leaves simple -> 3
2. Leaves compound -> Key 5.2.1
    3. Leaves entire -> Key 5.2.2
    4. Leaves toothed or lobed -> Key 5.2.3

Key 5.2.1: Leaves compound

1. Leaflets with spiny margins… *Mahonia*
2. Leaflets without spiny margins -> 3
    3. Leaves 1-pinnate… *Coronilla*
    4. Leaves > 1 pinnate… *Acacia*

Key 5.2.2: Leaves entire

1. Tree or tall shrub >1.2m -> 3
2. Low growing shrub <1.2m, prostrate, erect or mat forming -> 35
    3. Leaves with peltate scales or stellate hairs -> 5
    4. Leaves without peltate scales or stellate hairs -> 9
3. Peltate scales present -> 7
4. Peltate scales absent, stellate hairs present. Leaves spine tipped when young -> *Quercus*
    7. Leaves strongly net veined… *Olearia*
    8. Leaves not strongly net veined…*Eleagnus*
5. Stipules modified into spines (in leaf axils), wood yellow underneath… *Berberis*
6. Spines not present -> 11
    11. Leaves white felted or woolly beneath -> 13
    12. Leaves never white felted -> 15
7. Leaves white felted, buds naked… *Brachyglottis*
8. Leaves short woolly below, bud with several scales… *Pittosporum*
    15. Petiole with sheathing base on stem, twigs yellowish green… *Griselinia*
    16. Petiole never sheathing, twigs green or brown -> 17
9. Twigs and leaves with almond odour when crushed… *Photinia*
10. Not with an almond odour -> 19
    19. Leaves bay scented… *Laurus*
    20. Leaves not bay scented -> 21
11. Leaves dotted with translucent glands… *Skimmia*
12. Leaves never with translucent glands -> 23
    23. Leaves sessile… *Bupleurum*
    24. Petiole present -> 25
13. Leaves spine tipped at apex… *Ilex*
14. Leaves never spine tipped -> 27
    27. Leaves sivery due to crystalline cells on both sides… *Atriplex*
    28. Leaves never silvery -> 29
15. Twigs hairless -> 31
16. Twigs hairy (look closely) -> 33
17. Leaves much larger > 8cm long… *Rhododendron*
18. Leaves smaller < 7cm… *Pittosporum*
19. Leaves in pseudowhorls at twig apex leading to bunched leaf scars from last years growth, twig hairs not S-shaped at base. Stipules absent… *Pittosporum*
20. Leaves never in pseudowhorls, twig hairs S-shaped at base, stipules present and soon falling… *Cotoneaster* 35 (2). Leaves revolute at least when young, often strongly revolute at maturity -> 37
    36. Leaves with flat margins, not revolute when young -> 47
21. Leaves hairless -> 39
22. Leaves hairy -> 45
    39. Leaves strongly revolute, cylindrical, glandular ciliate only when young … *Empetrum*

40. Leaves weakly revolute -> 41

23. Leaves gland dotted below… *Vaccinium*
24. Leaves not gland dotted below -> 43
    43. Stems >1mm diameter, not rooting at nodes… *Andromeda*
    44. Stems <1mm diameter, rooting at nodes… *Vaccinium*
25. Leaves orange woolly below… *Rhododendron* (subgenus Ledum)
26. Leaves white woolly below… *Daboecia*
    47. Stipules or stipule scars present… *Cotoneaster* (Herniaria keys out here if evergreen, but apparently alternate leaved due to one leaf smaller or aborted)
    48. Stipules absent -> 49
27. Leaves fleshy -> 51
28. Leaves not fleshy -> 55
    51. Leaves cylindrical, or nearly so -> 53
    52. Leaves flat, green… *Sedum*
29. Leaves glaucous… *Suaeda*
30. Leaves green… *Artemisia*
    55. Leaves ± linear… *Iberis*
    56. Leaves more obovate -> 57
31. Leaves >5cm… *Daphne*
32. Leaves <3cm -> 59
    59. Leaves strongly net veined… *Arctostaphylos*
    60. Leaves not net veined, very rare… *Diapensia*

Key 5.2.3: Leaves toothed or lobed

1. Leaves toothed -> 3
2. Leaves lobed -> 39
    3. Branches spiny or thorny -> 5
    4. Branches unarmed -> 7
3. Spines at stem nodes, leaves spine toothed… *Berberis*
4. Spines at ends of branches, leaves not spine toothed… *Pyracantha* (coccinea)
5. Low shrub < 60cm tall -> 9
6. Large shrub or tree -> 17
7. Leaves strongly net veined -> 11
8. Leaves not net veined -> 13
    11. Leaves <3cm long, white woolly below, buds without scales… *Dryas* (octopetala)
    12. Leaves >5cm long, not white woolly below, buds with scales… *Gaultheria* (shallon)
9. Leaves gland pitted below… *Vaccinium* (vitis-idaea)
10. Leaves not gland pitted below -> 15
    15. Leaves few and clustered at stem apices… *Gaultheria* (procumbens)
    16. Leaves many and distributed along stems… *Phyllodoce* (caerulea)
11. Plant with peltate scales… *Eleagnus* (macrophylla)
12. Without peltate scales -> 19

19. Plant with stellate hairs, buds clustered at leaf apices… *Quercus*
20. Plant without stellate hairs -> 21

13. Leaves white hairy below -> 23
14. Leaves not white hairy below -> 25

23. Young twigs white felted… *Brachyglottis* (x jubar)
24. Young twigs brown… *Olearia* (macrodonta)

15. Leaves at least at apex, spiny -> 27
16. Leaves not spiny -> 29

27. Twigs green, leaves >3cm, tree… *Ilex*
28. Twigs reddish, leaves <3cm, shrub… *Gaultheria*

17. (Young) twigs with glandular hairs or reddish bristly hairs -> 31
18. (Young) twigs not glandular hairy or bristly -> 35

31. Leaves aromatic with glands below… *Escallonia* (macrantha)
32. Leaves not aromatic, no glands below -> 33

19. Tall shrub to 5m, leaves cuneate at base… *Arbutus* (unedo)
20. Shrub to 1.5m, leaves rounded to cordate at base… *Gaultheria* (shallon)

35. Young twigs hairy -> 37
36. Young twigs hairless… *Prunus*

21. Leaves <5m long… *Rhamnus* (alaternus)
22. Leaves >7cm long… *Leucothoe* (fontanesia) 39 (2). Leaves with stellate hairs -> 41

40. Leaves with simple hairs, or hairless -> 43

23. Stellate hairs both sides… *Lavatera*
24. Stellate hairs below only… *Quercus*

43. Leaves >90cm, divided to base in 30-40 lobes, in terminal crown, trunk covered in petiole bases. Palm… *Trachycarpus* (fortunei)
44. Leaves <10cm, not as above -> 45

25. Leaves white woolly on one or both sides -> 47
26. Leaves not woolly or velvety, leaves to 25cm, palmately lobed… *Fatsia* (japonica)

47. Leaves white woolly all over, pinnately lobed, aromatic. Plant not rooting at nodes… *Santolina* (chamaecyparissus)
48. Leaves white woolly below only -> 49

27. Leaves to 12cm, ovate, with translucent dots… *Rubus* (tricolor)
28. Leaves <2cm, oblong, no translucent dots… *Dryas* (octopetala)

Key 5.3: Deciduous plants

1. Twigs with spines, prickles or thorns -> Key 5.3.1
2. Twigs unarmed -> 3

3. Buds with bud scales -> 5
4. Buds without bud scales, or buds hidden/obscured -> Key 5.3.2

3. Leaf scars with 3 bundle traces, or in 3 distinct groups -> 7
4. Leaf scars not with 3 bundle traces, or leaf scars and bundle traces obscured/absent -> 9

7. Terminal buds present -> Key 5.3.3

8. Terminal buds absent -> Key 5.3.4

5. Terminal buds present -> Key 5.3.5
6. Terminal buds absent -> Key 5.3.6

Key 5.3.1: Twigs with spines, prickles or thorns

1. Plant with prickles or spines -> 3
2. Plant with thorns -> 13
    3. Plants with spines, occurring beneath each bud at each node -> 5
    4. Plants without spines, but with prickles on stems -> 9
3. 1 or 3(+) spines at each node -> 7
4. 2 spines at each node, flattened lengthwise and buds concealed beneath leaf scar… *Robinia*
    7. Leaf scars many on short shoots beneath bud, wood bright yellow beneath… *Berberis*
    8. Leaf scars singular and distinct above spines… *Ribes* (uva-crispa)
5. Twigs extremely stout, leaf scars half encircling twig with ~15 bundle traces in a line… *Aralia* (elata)
6. Not as above, bundle traces 3, if visible -> 11
    11. Plant with persistant petiole base, where leaf has torn off… *Rubus*
    12. Leaf scars present, almost linear… *Rosa* 13 (2). Twigs with peltate scales -> 15
7. Twigs never with peltate scales -> 17
    15. Twigs without terminal buds, grey to bronze brown scales… *Hippophae* (rhamnoides)
    16. Twigs with terminal buds (in at least some twigs), olive brown to silver scales… *Eleagnus* (umbellatus)
8. Twigs never with terminal buds -> 19
9. Twigs with terminal buds -> 21
    19. Buds mostly lateral to thorns… *Chaenomeles*
    20. Buds, often many, on thorns themselves. (something about collateral buds?)… *Prunus* (spinosa) [[21. Thorns not very sharp… *Malus*
10. Thorns sharp -> 23
    23. Twigs densly long, patent hairy… *Mespilus* (germanica)
    24. Twigs not hairy or adpressed hairy -> 25
11. Buds purplish, acute… *Pyrus*
12. Buds rounded, reddish… *Crataegus*]] IMPROVE. FIND BUDS.

Key 5.3.2: Buds without bud scales, or buds hidden.

```
Buds without bud scales, or buds at least partly obscured
    With terminal buds
        LABURNUM
        RHAMNUS (FRANGULA)
```

```
        PARROTIA
        PTEROCARYA
        JUGLANS

    Without terminal buds
        RHUS - leaf scar small and almost encircling bud. Buds with long hairs, blunt conical
        ROBINIA - leaf scar large, buds covered initially by a membrane, twigs angled. Bundle
        BUDDLEJA (ALTERNIFOLIA) - deciduous, soft wooded shrubs, stems 4 ridged. Twigs almost
        COTONEASTER - shrubs to small trees, twigs rounded. Pith continuous. Bundle trace 1,
        SPARTIUM - twigs green, elongated, striate ridged. Pith continuous. Buds shorter than
        GENISTA? - twigs green, ribbed or grooved. Pith continuous. Buds small, solitary, ses
        CYTISUS - twigs green, terete, ribbed or grooved. Pith continuous. Buds small with ~4
```

1. Terminal buds present -> 3
2. Terminal buds absent -> 11
3. Pith chambered -> 5
4. Pith continuous -> 7
    5. Terminal bud leaves spreading, >15mm long… *Pterocarya* (fraxinifolia)
    6. Terminal bud leaves compact, <15mm long… *Juglans*
5. Twigs with at least some stellate hairs, buds dark brown… *Parrotia* (persica)
6. Twigs never with stellate hairs -> 9
    9. Stipules persistent on large leaf cushions, buds silvery hairy… *Laburnum*
    10. Stipules minute, if present, buds densely brown hairy…*Rhamnus* (frangula)

11 (2). Buds obscured, either by remains of leaf bases or by a membrane -> 13 12. Buds entirely unobscured -> 19 13. Buds obscured by a membrane, later splitting. Bundle traces 3… *Robinia* (pseudo-acacia) 14. Buds obscured by leaf bases, bundle trace 1 -> 15 15. Twigs finely striated, rush like… *Spartium* (junceum) 16. Twigs angled winged, or grooved -> 17 17. Twigs 5 angled or winged… *Cytisus* 18. Twigs furrowed with >5 angles, the slender twigs 4 angled… *Genista* (CHECK) 19. Stems 4 ridged, with some stellate hairs… *Buddleja* 20. Stems not 4 ridged -> 21 21. Leaf scar almost encircling the bud. Stipules absent. Twigs very hairy with milky sap. Bundle traces 3… *Rhus* 22. Leaf scar tiny, not encircling bud. Stipules mostly persistent. Twigs hairy or not, no sap. Bundle trace 1… *Cotoneaster*

Key 5.3.3: Leaf scars with 3 bundle traces, terminal buds present.

(buds), (leaf scars), (twigs)

```
With three bundle traces
    Buds with bud scales
        With terminal buds
        JUGLANS - lateral buds often superposed, blunt to acute with broad. Bud scales thin and s
        ALNUS - lateral buds spiral in 1/3 divergence. First bud scale turned towards the stem (a
        BETULA - only short shoots with terminal buds, with 5-8 scales on lateral short shoots ar
        STACHYURUS - buds dimorphic. inflorescence branches well developed in racemes. Terminal b
```

```
PRUNUS - usually ~6 exposed scales, buds collaterally multiple, elongated ovoi
RIBES - buds scales spiral , simple, rather loose, acute, short stalked. Bark s
ARONIA - red buds, long acute terminal bud, oblong, flattened and appressed. 5
FAGUS - buds long fusiform with scales in 4 rows (decussate), divergent and ob
POPULUS - buds dimorphic. Terminal buds surrounded by adaxial stipule scales i
AMELANCHIER - buds elongated with half a dozen scales (sometimes more), reddis
COTINUS - buds bluish-white with waxy bloom, two valvate bud scales. Leaf scar
MESPILUS - Buds acute ovoid with >6 bud scales, ciliate. Leaf scars small, dar
PYRUS - terminal buds of long shoots are more densly hairy. Basal bud scales o
MALUS - unsatisfactory at present...
LABURNUM - bud scales very silver hairy, terminal 3-4mm long. Leaf scar with s
LIQUIDAMBAR - buds ovoid, acute with 5-6 bud scales, glossy, reddish with thin
DAVIDIA - buds acute ovoid, with round base, glossy dark wine red with up to 6
SORBUS - buds variable, sub conical or oblong (globose in torminalis), with te
The Sorbus species with 3 bundle traces are:
  Sorbus torminalis - green, glossy bud scales with brown margins, terminal bu
  Sorbus aria (agg) - Woolly buds, green with brown margin (terminal buds 10mm
```

1. Pith chambered… *Juglans*
2. Pith not chambered -> 3
    3. Flower buds numerous on elongated racemes (hortal)… *Stachyurus* (praecox)
    4. Flower buds if present, different -> 5
3. Lateral buds short to long stalked -> 7
4. Lateral buds sessile -> 9
    7. Tree. Lateral buds long stalked, with 2(3) valvate scales… *Alnus*
    8. Small shrub. Lateral buds short stalked, with >5 scales… *Ribes*
5. Trunk and boughs of tree with transverse stripes. Buds often collateral… *Prunus*
6. Not as above -> 11
    11. Only short shoots with terminal buds (5-8 scaled), lateral buds 3-5 scaled… *Betula*
    12. Either long shoots or both long and short shoots with terminal buds -> 13
7. Buds clearly dimorphic. Terminal buds: spiral bud scales, lateral buds: distichous scales with lowest above leaf scar… *Populus*
8. Buds similar (terminal buds may be larger), or not as above -> 15
    15. Terminal buds elongated, slender, acute -> 17
    16. Terminal buds less elongate, more squat -> 21
9. Buds divergent, oblique over leaf scars. >10 bud scales exposed… *Fagus*
10. Bud more appressed to twig, <10 bud scales exposed -> 19
    19. 5 or fewer glandular denticulate scales on buds… *Aronia*
    20. 5 scales on buds… *Amelanchier*
11. Bud scales 2, valvate. Twigs pruinose, wood yellow… *Cotinus* (coggyria)
12. Bud scales >2, twigs not pruinose, wood not yellow -> 23
    23. Twigs hairy -> 25
    24. Twigs hairless -> 33
13. Stipules persistent on leaf scar cushion. Buds densly silver hairy… *Laburnum*
14. Stipules not persistent on leaf scar cushion -> 27

27. Buds with at least some white hairs -> 29
28. Buds with hairs not white or absent -> 35

15. Bud scales green with brown margin, buds raised on petiole base differently coloured to rest of twig… *Sorbus*
16. Not as above -> 31
    31. Lateral buds appresssed… *Malus*
    32. Lateral buds spreading -> 33
17. Leaf scars raised equal to bud width, terminal bud larger to 12mm… *Pyrus* and *Malus*
18. Leaf scars raised, > bud width, spreading hirsute to twig apex, terminal bud to 6mm… *Mespilus*
    35. Buds with golden hairs at tip, otherwise brown, acute conical… *Pyrus*
    36. Buds mostly hairless, buds either glossy or sticky ->37
19. Buds shiny dark purple, twigs with indisinct white partitions… *Davidia*

20. Buds sticky, green to brown. Pith 5 angled, not partitioned… *Liquidambar*

Key 5.3.4: Leaf scars with 3 bundle traces, terminal buds absent

```
TILIA - bud scales 2(3), mostly green or red glistening. Leaf scars 2 ranked on shoots, stipule
      BETULA - only short shoots with terminal buds, with 5-8 scales on lateral short shoots ar
      CYDONIA - buds with 1-2 exposed bud scales, appressed. Leaf scars small, shallow, u shape
      ULMUS - buds solitary, ovoid, oblique to leaf scar, bud scales ~6, 2 ranked. Leaf scars 2
      CORYLUS - buds with 4-6 scales, obliquely sessile. Leaf scars 2 ranked anf half round/ tr
      CARPINUS -
      OSTRYA -
      BACCHARIS -
      MYRICA -
      COLUTEA -
      KERRIA -
      SORBARIA -
      PRUNUS -
      RHAMNUS -
      SALIX -
```

Key 5.3.5

```
      GINGKO
      TAXODIUM
      LARIX
      DAPHNE
      RHODODENDRON
      DAPHNE
```

ELAEGNUS
FICUS
LIRIODENDRON
MAGNOLIA
ALNUS
SORBUS
FAGUS
PAEONIA
QUERCUS
POTENTILLA

Key 5.3.6

NOTHOFAGUS
TAMARIX
MORUS
PLATANUS
CASTANEA
TILIA
AILANTHUS
GENISTA
CYTISUS
TAXODIUM
SPIRAEA
HIPPOCREPIS
COTONEASTER
POTENTILLA

Lvs simple

K = Simple, entire, alt (only helpful for evergreen taxa)
N = Simple, toothed, alt (only helpful for evergreen taxa)

TWIGS, PITH, BUDS, LEAF SCARS, BT'S

Olearia -

KA - paniculata #EVERGREEN - leaves with peltate scales, entire, alternate. Net veined. Unarmed NC - macrodonta #EVERGREEN - leaves without peltate scales, toothed, alternate. Net veined. Twigs brown, angled. Upturned spine like teeth on leaves

Eleagnus

KA - umbellata #EVERGREEN NB, NC - macrophylla

Hippophae

KA - rhamnoides

Quercus

KA - ilex #EVERGREEN NC, ND, PA - suber, ilex #EVERGREEN PA - cerris PA - robus PA - petraea PA - rubra PA - coccinea

Buddleja

KA - alternifolia

Cotoneaster

KB - many species SOME #EVERGREEN

Frangula

KB - alnus

Salix

KB - many KF

Photinia

KB - davidiana #EVERGREEN

Cydonia

KB - oblonga

Fagus

KB - sylvatica

Pyrus

KB - salicifolius

Brachyglottis

KB, NC - x jubar #EVERGREEN

Rhododendron

KB - ponticum #EVERGREEN KB, NF - luteum

Pittosporum

KB - tobira #EVERGREEN KB - tenuifolium #EVERGREEN KC - crassifolium #EVERGREEN

Berberis

KB - many sp

Laurus

KB - nobilis #EVERGREEN

Bupleurum

KB - fruticosum #EVERGREEN

Vaccinium

KB, NF - corymbosum

Cotinus

KB - coggyria

Skimmia

KC - japonica #EVERGREEN

Atriplex

KC - halimus #EVERGREEN

Ilex

KC, ND - x altaclerensis #EVERGREEN ND - aquifolium #EVERGREEN

Griselinia

KC - littoralis #EVERGREEN

Tamarix

KC - gallica KC - africana

Lycium

KC - barbarum KC - chinense

Berberis

BER - many species SOME #EVERGREEN

Spartium

KC - junceum

Genista

KC - aetnensis KC - tenera KF - tinctoria KF - hispanica occidentalis KF - anglica KF - pilosa

Hedera -

KD - helix etc

Muehlenbeckia

KD - complexa

Fallopia

KD - baldschuanica

Empetrum

KE - nigrum #EVERGREEN

Ledum

KE - palustre #EVERGREEN

Daboecia

KE - cantabrica #EVERGREEN

Vaccinium

KE - vitis-idaea #EVERGREEN KE - macrocarpon #EVERGREEN KE - oxycoccos #EVERGREEN KE - microcarpon #EVERGREEN KF - uliginosum

Andromeda

KE - polifolia #EVERGREEN

Herniaria

KF - ciliolata #EVERGREEN???

Suadea

KF - vera #EVERGREEN

Artemisia

KF - campestris maritima #EVERGREEN??

Sedum

KF - praealtum #EVERGREEN

Daphne

KF - laureola #EVERGREEN KF - mezereum

Iberis

KF - sempervirens #EVERGREEN

Arctostaphylos

KF - uva-ursi #EVERGREEN

Diapensia

KF - lapponica #EVERGREEN

`Lvs toothed`

Chaenomeles

NA - japonica NA - speciosa

Berberis

NA - many sp

Ribes

NA, PB - uva-crispa PB - rubrum PB - spicatum PB - alpinus PB - odoratum PB - nigrum PB -sanguineum

Pyracantha

NA - coccinea #EVERGREEN

Rhamnus

NA - cathartica ND - alaternus

Prunus

NA - spinosa ND - laurocerasus, lusitanica #EVERGREEN NF - many sp

Crataegus

NA - mollis NA - persimilis

Malus

NA - sylvestris NF - domestica

Pyrus

NA - communis NA - pyraster NA - cordata

Dryas

NB - octopetala #EVERGREEN

Gaultheria

NB, ND - shallon #EVERGREEN NB - procumbens #EVERGREEN ND - mucronata

Salix

NB - many sp NF - many sp

Arctostaphylos

NB - alpinus

Vaccinium

NB - myrtillus NB - vitis-idaea #EVERGREEN

Phyllodoce

NB - caerulea #EVERGREEN

Tilia

NB - petiolaris, tomentosa NE - many sp NF - many sp

Populus

NC - many sp NF - many sp PA - many sp

Sorbus

NC - many sp PA - many sp PA - torminalis

SD - aucuparia, domestica, cashmiriana, pseudohupehensis

Escallonia #EVERGREEN

ND - macrantha

Arbutus #EVERGREEN

ND - unedo

Leucothoe #EVERGREEN

ND - fontanesiana

Parrotia

NE - persica

Alnus

NE - glutinosa, incana, rubra NF - cordata

Castanea

NE - sativa

Corylus

NE - avenalla, colurna PB - avenalla

Betula

NE - many sp

Ulmus

NE - many sp

Carpinus

NE - betulus

Ostrya

NE - carpinifolia

Kerria

NE - japonica

Fagus

NE - sylvatica

Nothofagus

NE - obliqua, x dodecaphleps, alpina

Amelanchier

NF - lamarckii

Myrica

NF - gale, pensylvanica

Baccharis

NF - halmifolia

Spiraea

NF - many sp PB - many sp

Morus

NF - nigra

Mespilus

NF - germanica

Aronia

NF - arbutifolia, melanocarpa

Amelanchier

NF - lamarckii

leaves lobed

Lavatera

PA - arborea PB - x clementii #EVERGREEN

Platanus

PA - x hispanica, orientalis

Trachycarpus

PA - fortunei #EVERGREEN

Ficus

PA, PB - carica

Liriodendron

PA - tulipifera

Crataegus

PB - monogyna, laevigata

Santolina

PB - chamaecyparissus #EVERGREEN

Rubus

PB - tricolor #EVERGREEN PB - odoratus PB - parviflorus

RF - all other brambles SA - cockburnianus, idaeus

Dryas

PB - octopetala #EVERGREEN

Fatsia

PB - japonica #EVERGREEN

Vitis

PC - vinifera, coignetiae

Parthenocissus

PC - tricuspidata RH - inserta, quinquefolia

Solanum

PC - dulcamara

Laburnum

RA - anagryoides, x watereri, alpinum

Ulex

see key 2

Leaves compound

Choisya

already keyed

Medicago

RG - arborea

Akebia

RH - quinata

Rosa

SA - many sp

Robinia

SB - pseudoacacia

Juglans

SB, SD - regia

Coronilla

SB - valentina #EVERGREEN

Potentilla

SB - fruticosa

Hippocrepis

SB - emerus

Cotulea

SB - arborescens

Rhus

SD - typina

Pterocarya

SD - fraxinifolia

Ailanthus

SD - altissima

Mahonia

SD - aquifolium, x media #EVERGREEN

Sorbaria

SD - sorbifolia, kirilowii, tomentosa

Aralia

TA - elata

Acacia

TA - dealbata #EVERGREEN

Lupinus

RE - arborea

Acaena?

Cut text

17. Bundle traces many (9 or more) in an elliptical, arc shaped or U-shaped series -> 19
18. Bundle traces fewer (7 or less). Buds not superposed. -> 21
    19. Pith chambered … *Paulownia* (>3)
    20. Pith not chambered … *Fraxinus* (>3)

19. Buds naked often behind a persistent petiole base … *Cornus* (3)
20. Buds with 5-6 scales (thorny?) … *Rhamnus* (3)

    23. Terminal buds very large, at least 2x as large as laterals, 20mm+. Leaf scars very large, distinct … *Aesculus* (>3)
    24. Terminal buds not much larger than laterals, or absent -> 25

21. Stipule scars large and obvious ± 1/4 to 1/2 size of leaf scars … *Staphylea* (3)
22. Stipule scars absent or not obvious -> 27

    27. Buds with a pair of scales meeting in the middle or ± so - buds globose, red … *Viburnum* (3)
    28. Buds with > 2 scales or buds naked -> 29

23. Terminal buds or all buds naked -> 31
24. All buds with scales -> 35

    31. Naked buds stellate scurfy … *Viburnum* (3)
    32. Naked buds not stellate scurfy -> 33

25. Bundle traces 3. Lateral buds >5mm, adpressed, hairy … *Cornus* (3)
26. Bundle traces >3. Lateral buds minute <2mm … *Hydrangea* (3, but check all Hydrangeas)

Vegetative key to Quercus species:

Quercus - buds with 5-ranked scales, clustered towards end of twig. Fruits nuts held in a cupule.

1. Leaves evergreen, white to grey woolly below at least when young -> 3
2. Leaves deciduous -> 5
    3. Bark corky, leaves with 5-8 spine tipped teeth … Quercus suber
    4. Bark not corky, leaves only spined on young shoots … Quercus ilex
3. Terminal bud cluster with long, narrow, persistent stipules … Quercus cerris
4. Terminal bud cluster with without long, narrow, persistent stipules -> 7
    7. Leaves lobed with aristate teeth. Hairless except for tufts of orange stellate hairs in vein axils below. Petiole >2.5cm -> 9
    8. Leaves not toothed with aristate teeth. hairs present or not, but not as above. Petiole <2.5cm -> 11
5. Leaves dull above, lobes < half way to midrib. Hair tufts inconspicuous … Quercus rubra
6. Leaves shiny above, lobes > half way to midrib. Hair tufts obvious … Quercus coccinea
    11. Petiole to 1cm. Leaves cordate with reflexed auricles at base. Dull dark green above. Hairless or simple hairs below … Quercus robur
    12. Petiole >1cm. Leaves cuneate, auricles absent. Shiny dark green above. Hairs stellate below … Quercus petraea

Glossary: Stipules - small herbaceous organs at base of buds or petiole Stellate - star shaped Aristate - with an awn or bristle Cordate - heart shaped, with base rounded Auricules - small lobed appendage Cuneate - tapered to a base