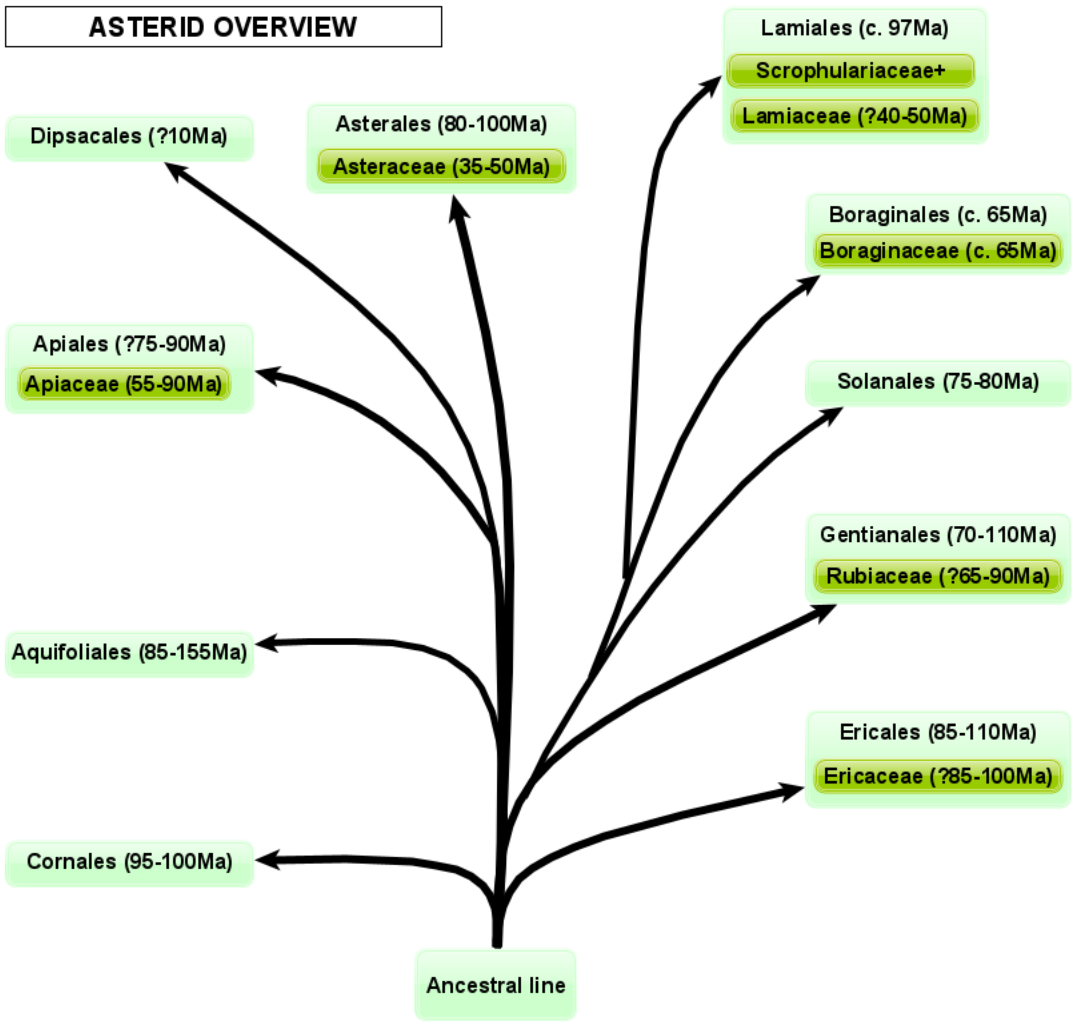
# HAMPSHIRE FLORA GROUP WORKSHOPS: DEVELOPING IDENTIFICATION SKILLS

# MODULE 5: ASTERALES AND CARYOPHYLLALES

This last module in the workshop series is something of a "sweeping up" exercise. In Module 4 we dealt with most of the Asterids but left out the important Order Asterales in order not to overload the content; and in Module 3 we considered one family from the "Other Core Eudicots" order Caryophyllales while leaving two other important families for later. Conveniently, all these groups offer plants flowering on through the summer, making it easier to organise a hands-on workshop late in the season.

# Order Asterales: its place in the Asterids




The Asterales is a relatively small order in terms of family numbers: eleven worldwide, with just three in Britain. Of these, only two (Campanulaceae and Asteraceae) have numerous genera, and the latter is by far the larger (in fact, the second largest in terms of species). It is not easy to pin down the age of Campanulaceae because of a lack of fossils, but the family has been through some quite dramatic adaptive radiation, giving rise to many endemics particularly on island chains. The oldest Asteraceae are reckoned to have diverged about 50 million years ago, which is comparatively recent for such a large family, and in evolutionary terms they have been particularly successful in regions that are at least seasonally arid.

# Asterales in Britain

The three British family members of the order are:

Campanulaceae
Menyanthaceae
**Asteraceae**
We shall look at Asteraceae in detail later.

## Major traits

| **ASTERALES** | **Constant traits** | **Common traits** | **Exceptions** |
|---|---|---|---|
| | Stipules absent | | |
| | Stamens 5 | | |
| | Petals 4-5, fused at least at base | | |
| | Style 1 | | |
| | | Leaves alternate | Some Asteraceae (see below) |
| | | Flowers bisexual | *Pratia*; some Asteraceae (see below) |
| | | Inferior ovary | Menyanthaceae |
| | | Stamens borne on corolla-tube | Campanulaceae |
| | | Stamens held in a ring, either appressed or fused, pollen discharging inwards | Menyanthaceae |
| | | Stigma branched or lobed | *Downingia* |
| | | Ovary 1-celled | Campanulaceae |
| **CAMPANULACEAE** | Herbaceous (in Britain) | | |
| | | Biennial or perennial | *Legousia. Lobelia* (some), *Downingia* |
| | | Milky latex | *Legousia, Jasione* |
| | | Flowers actinomorphic | *Lobelia, Pratia, Downingia* |

| ASTERALES | Constant traits | Common traits | Exceptions |
|---|---|---|---|
| **ASTERACEAE** | Flowers borne on capitula (receptacles) | | |
| | Sepals absent or modified into a membranous ring, teeth, bristles, awns or hairs | | |
| | Corollas 3-5-lobed | | |
| | Fruit a single-seeded achene | | |
| | | Capitula bearing multiple flowers | *Echinops, Olearia paniculata, Ambrosia* |
| | | Anthers fused in ring around style | *Xanthium* |
| | | Style branched (branches truncate in many genera) | *Arctotis, Arctotheca, Calendula* |

## The Asteraceae family

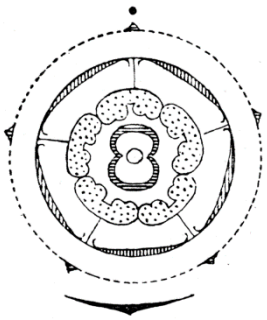
This is the largest family in the dicots, with over 1600 genera and around 25,000 species, not counting microspecies. Even in Britain we have over 100 genera to deal with, and these include many introduced species not always well covered in field guides. Our two largest genera, Hawkweeds *Hieracium* and Dandelions *Taraxacum*, have hundreds of described microspecies.

Fortunately it is a highly distinctive family, and many species belong to groupings ('Tribes') that share common features, making it a bit easier to "divide and conquer" when attempting to identify to species. There are two other workshops devoted to the family, one a general conspectus and one dealing solely with the Cichorieae tribe (Dandelion-like species), and we shall not attempt to cover all the ground that they do; but hopefully there will be enough here to give you a feel for the features of the family as a whole and an understanding of how it breaks down to the 16 tribes recognised in the British native and introduced flora.

## What distinguishes a Composite?

The most obvious feature that people will recognise is the crowding together of small florets into a single head at the end of a stem. The head is often known as a capitulum, and the stem end (usually thickened) is called the receptacle. Around the outside of the head are a series of bracts, rather like sepals in a simple flower, known as either involucral bracts or phyllaries. The fruits of the individual flowers, which are the lowest part of the corolla, sit directly on the receptacle (or embedded in it) without stalks, and are achenes (single-seeded dry fruits).

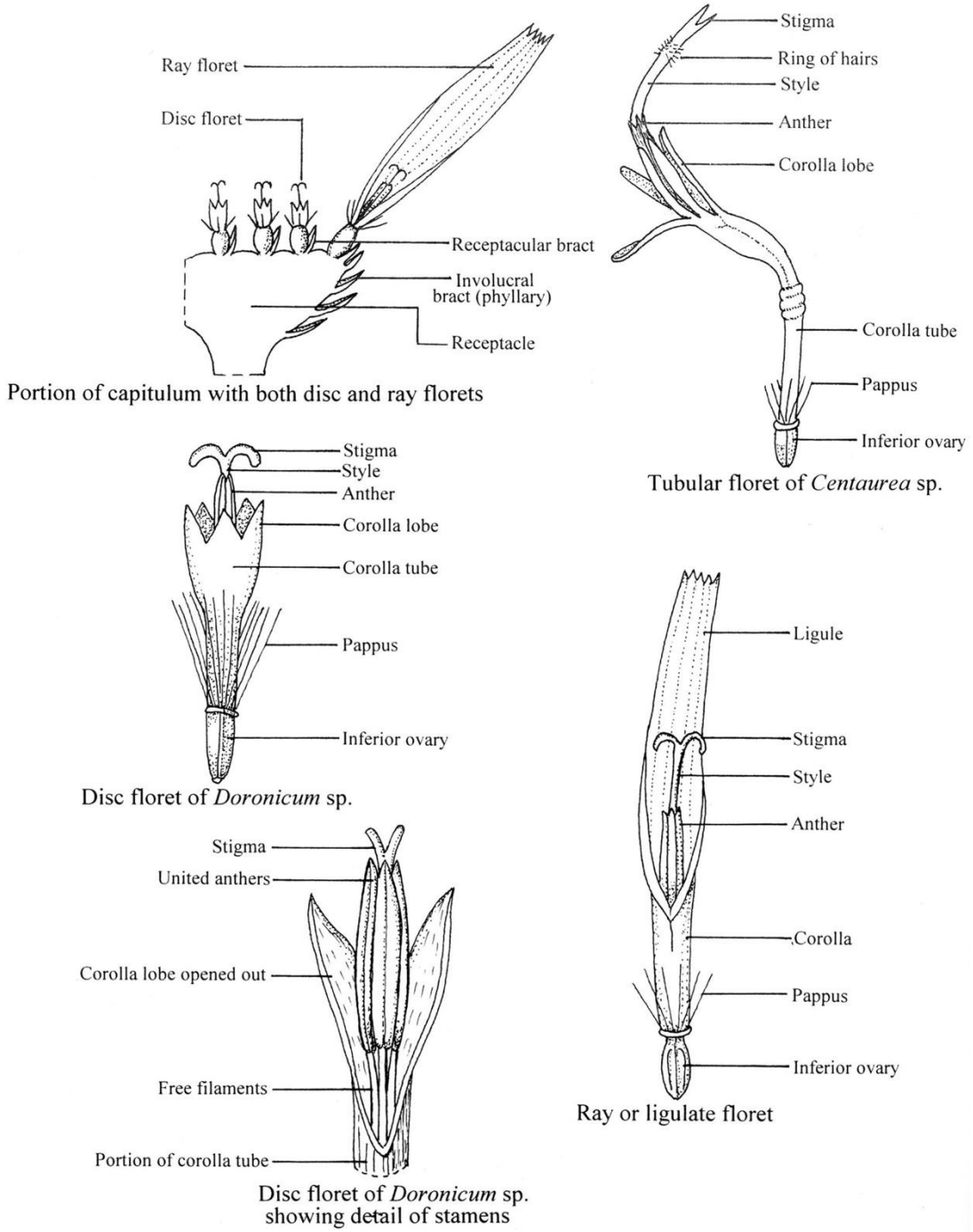
This is not the only family that has such an arrangement, other examples in the British flora being the Dipsacaceae (Teasel and Scabious family) – think of the Scabious genera *Knautia* and *Scabiosa*. Here we must look at differences in the flower structure. Asteraceae flowers have five stamens, which arise from the sides of the corolla, and the anthers come together to make a tube-like structure encircling the style. Dipsacaceae flowers have four stamens which are free to the base of the flower, and their anthers stand free. Rampions (*Phyteuma*), in the family Campanulaceae (Bellflowers), have a similar ring of 5 almost fused anthers around the style, but the stamens grow free from the base of the flower and not from the corolla. In other British families with crowded heads of flowers, florets are usually borne on at least a short stalk.



**Plan section of a thistle flower**

## Floral structures

Most Composites bear flowers that are both male and female in the same flowering head, although not all the flowers in that head are necessarily bisexual. A few genera (aliens in Britain) have separate male and female heads on the same plant (are **monoecious**). Others, such as *Petasites* (Butterburs), are **dioiceous**; they have male and female flowers on separate plants.




Composite flowers that are not all-male or sterile have an **inferior ovary**; that is, the fruiting part is borne below all the other parts of the flower. This sits directly onto or into the receptacle. In some genera, the sculpturing of the little depressions where it sits (the **receptacular pits** or **achene pits**) are an important (if sometimes tricky) identification feature.

*Receptacle pits of Erigeron karvinskianus*

The whole receptacle is surrounded by a series of leafy, membranous or spiny bracts that are at first glance rather like the sepals of a single flower. These are the phyllaries or involucral bracts. The arrangement and nature of involucral bracts may be important in identification: for instance, do they form a single row, two neat rows each of a different length, or are they of varying lengths? Do any of them spread, or are they all appressed? Do they have membranous margins? What colour are they? What sort of hairs do they bear?

*The phyllaries of Crepis albida: all similar, not in regular ranks*

*The 2-ranked phyllaries of Cosmos: an outer ring of linear-lanceolate leafy bracts, an inner of broad membranous bracts*

On the receptacle surface, sometimes arising from the base of the floret and often one per floret, there may be receptacular bracts that usually take the form of scales or bristles.

The ovary is surmounted by the actual calyx of the flower, which if present doesn't take the usual form of bract-like or petal-like appendages. Instead it forms a structure known as the **pappus**. Most people will think of the typical feathery appendage that makes up a dandelion clock or thistledown, but the pappus may be a ring of scales, a horny membranous ring, a number of bristles (possibly barbed or hooked), or absent altogether.

*Galinsoga quadriradiata achenes, showing pappus scales (on top) and one receptacular scale (at base)*

Composite flowers come in two forms, which according to species (or sometimes variety within species) may occur together in the same head, or one or the other form uniquely in the head.

One form has the corolla as a closed tube (often slender) with 5 (sometimes 4) lobes at its apex, radially symmetrical (**actinomorphic**). These are known as **tubular florets**. Where a flowering head has both forms, they occur in the middle of the head and are often referred to as **disc florets**.

The other form has part of the corolla as a flat strap (the **ligule**) sitting on top of a tubular part which may be very short (to the point of being hardly visible). These are known as **ligulate florets**. The tip of the ligule ends in 3 or 5 lobes. Sometimes the strap-shaped portion itself is very short, but the floret can always be recognised as having only mirror symmetry (**zygomorphic**). Where a flowering head has both forms, these occur round the outside of the head and are referred to as **ray florets**.

*Erigeron karvinskianus, showing both tubular (disc-) and ligulate (ray-) florets*

Tubular flowers are most commonly bisexual but sometimes male or sterile. Ligulate flowers are most commonly female or sterile but can be bisexual.

*Tube florets of Leucanthemum x superbum, showing exserted styles*

*Ligulate florets of Erigeron karvinskianus (L), Crepis capillaris (R)*

A single style arises from the top of the ovary, and this usually divides at the tip into two branches which may be long and prominent and which bear any stigmas present.

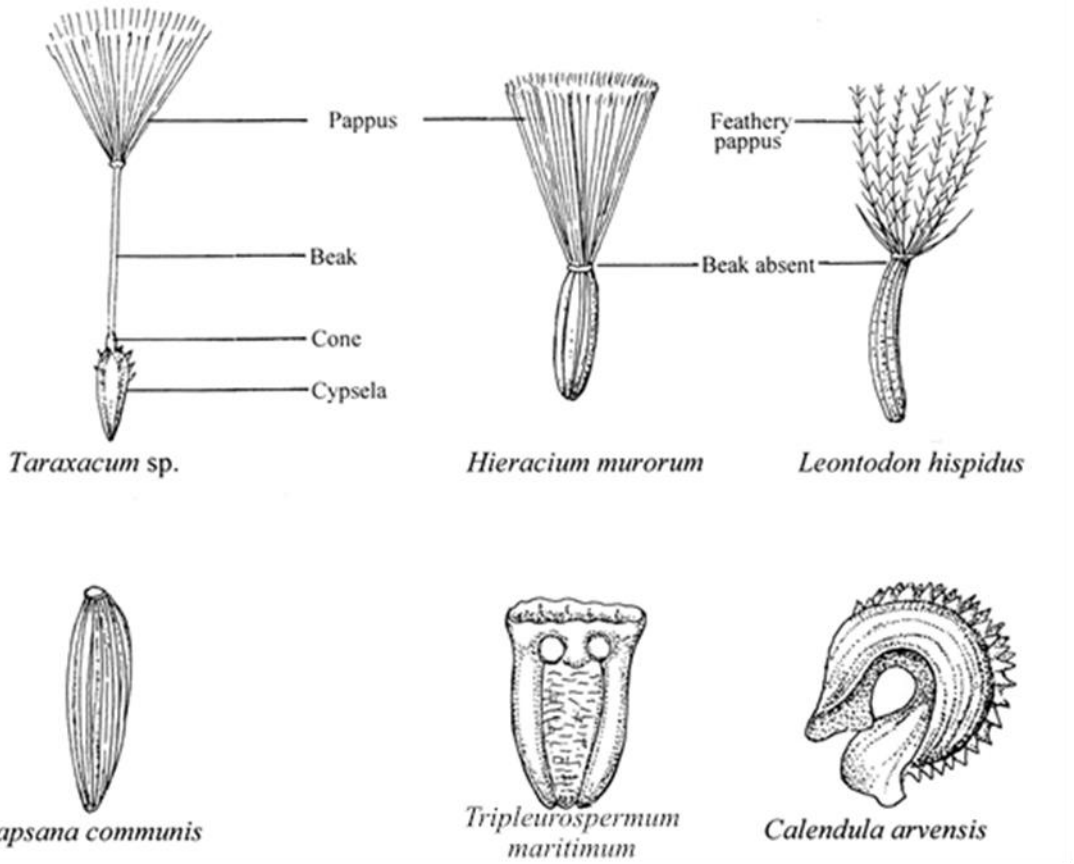
As mentioned, the 5 stamens arise from the sides of the corolla tube; the filaments are free, and the anthers come together to form a ring around the style. Anthers often have tails below, giving them a **sagittate** (arrowhead-like) shape, and may also have a short appendage on top.

*Cutaway of Leucanthemum x superbum disc floret to show stamen filaments free, anthers fused around style*

In hermaphrodite flowers the development of the style and anthers follows a characteristic pattern, with variations in some species. The anthers ripen before the stigmas, shedding pollen into the tube that they form together. At this stage the style is still short and the two style branches are pressed together, concealing the receptive stigma surfaces. The style has hairs on its outer surface and as it grows up through the ring of anthers, this carries pollen up into the outside world where visiting pollinators can reach it. The style arms open, revealing the stigmas whose surfaces are then available for pollination from outside. But at the last stage, the arms may then curl backwards to such an extent that the stigmas can collect pollen from their own flower. If the species is self-compatible (and by no means all are), and has not already been cross-fertilised, this is a strategy to ensure seed set in the absence of an external pollinator.

This 'selfing' mechanism should not be confused with **apomixis**, which is the production of viable seed without any sexual reproduction at all. This occurs in several genera, most notably the Hawkweeds (*Hieracium*) and Dandelions (*Taraxacum*) which are almost entirely apomictic in the present era. The result is that genetic mutations are accumulated in small populations without ever being diluted by the normal processes of genetic recombination, giving rise to hundreds of "microspecies". The study of these is one of the most challenging but fascinating pursuits of field botany.

## Fruits



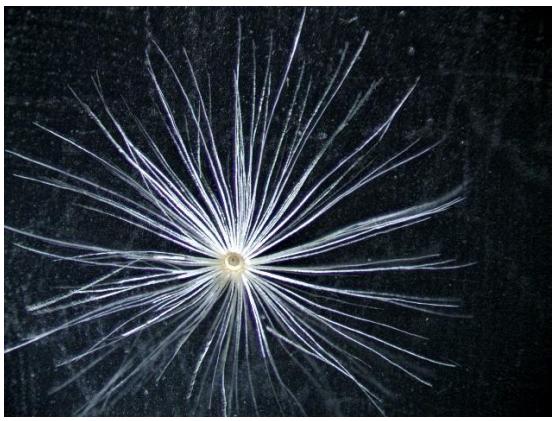

The fruits of Composites are often referred to as achenes, in other words a dry, one-seeded fruit that is **indehiscent** (does not split open). A more precise term which you will sometimes see used is **cypsela**, which is an achene where the single fruit is in a structure formed from two **carpels**. The fact that the style bears two stigmas suggests that will be the case, but if you slice across the middle of many Composite fruits you will find thickenings in the internal wall surfaces that make this clear.

Achenes often have sculpturing, particularly of longitudinal ridges or angles, although many thistles and their relatives have more or less smooth achenes. They may also be wrinkled transversely; or **muricate** (with short, hard projections; in the case of Dandelions they may extend into short conical spines); or tuberculate (with small domed projections). Some are hairy or bristly on their surface. One native genus (the Mayweeds *Tripleurospermum*) has resin glands on the achene surface.

The achene is sometimes prolonged at the top into a **beak**; this is part of the achene itself and distinct from the pappus. Dandelions are a classic example, and here the base of the beak is thickened into a **cone**.

The **pappus**, if present, represents the calyx of the flower and by fruiting time it may be conspicuous and distinctive. Pappi take many forms. They may be no more than an obscure ridge at the top of the achene; they may make a distinct horny rim; they may be membranous scales; bristles, sometimes barbed; or hairs. The hairs, if they occur, may be simple, rough, bristly, shortly branched or feathery. Different types of pappus elements may occur on the same plant, and the elements may be arranged in one or more ranks.

*Feathery pappus hairs of a Leontodon*



*Simple pappus hairs of a Carduus*

# The main groupings

## How the Composites are broken down

With such a huge family of plants, we need a systematic way of breaking them down by morphological and other features. Even in the relatively limited flora of Britain, they occupy almost 120 pages in the terse and somewhat abridged (for Asteraceae) Stace *New Flora of the British Isles*, and 500 pages in the Sell and Murrell *Flora of Great Britain and Ireland*. With many garden outcasts and weeds turning up from various parts of the world, it's useful to have a framework to fit them into.

If you are asked to think of typical members of Asteraceae, Thistles, Daisy-like plants and Dandelion-like plants will no doubt come to mind first. After a bit of thought, you'll probably add Mugworts and Cudweeds. As it turns out, this isn't too far away from the systematic breakdown into **Subfamilies** and **Tribes** that is the conventional way of ordering them.

Three subfamilies are defined for the British flora, and in crude terms they break down like this:

- **Carduoideae**: anything whose flower heads look vaguely like a Thistle
- **Cichorioideae**: anything whose flower heads look vaguely like a Dandelion
- **Asteroideae**: anything whose flower heads look vaguely like a Daisy (and a lot which don't)

Note that Christenhuz et al. (2017) still define three subfamilies, but two of these are tropical and all the above three are lumped into the other. But the breakdown to three is used by Stace, and it's useful for getting your head around the family. Other world conspectuses, for example Byng (2014) and Mabberley (2017), recognise up to 12 subfamilies including these three.

Here is a more formal breakdown of the characters of the subfamilies.

| **ASTERACEAE** | **Constant traits** | **Common traits** | **Exceptions** |
|---|---|---|---|
| **CARDUOIDEAE** | White latex absent | | |
| | Stem leaves spiral or 0 | | |
| | All florets tubular | | |
| | All florets bisexual | | |
| | Filaments joined to back of anthers ('dorsifixed') | | |
| | Each style branch with 1 stigmatic area | | |
| | | Leaves spiny | *Arctium, Saussurea, Serratula, Rhaponticum, Acroptilon, Centaurea* |
| | | Florets pink, red, purple, blue or white | *Cirsium oleraceum, Centaurea* (some), *Carthamus* |
| **CICHORIOIDEAE** | Stem leaves spiral or 0 | | |
| | All florets bisexual | | |
| | Filaments joined to back of anthers ('dorsifixed') | | |
| | Each style branch with 1 stigmatic area | | |

| ASTERACEAE | Constant traits | Common traits | Exceptions |
|---|---|---|---|
| **CICHORIOIDEAE (cont.)** | | White latex present (may be hard to detect) | Tribe Arctotideae |
| | | Leaves not spiny | *Scolymus, Sonchus* (some) |
| | | Florets yellow to orange on upper face | *Cichorium, Catananche, Tragopogon* (some), *Geropogon, Lactuca* (some), *Cicerbita, Arctotis* |
| | | Florets all ligulate | Tribe Arctotideae |
| **ASTEROIDEAE** | White latex absent | | |
| | Filaments joined to base of anthers ('basifixed') | | |
| | Each style branch with 2 stigmatic areas | | |
| | | Stem leaves 0 or all spiral | *Ambrosia, Euphrosyne, Helianthus, Guizotia,* ***Sigesbeckia, Galinsoga, Bidens, Coreopsis, Cosmos, Dahlia, Eupatorium, Ageratum***<br>**Bold** have all leaves opposite |
| | | Leaves not spiny | *Oleaster* (some), *Xanthium* (leaf base, some) |
| | | Inner florets tubular, outer ligulate | Tribe Gnaphalieae, *Tanacetum* (some), *Artemisia, Santolina, Achillea maritima, Oncosiphon, Senecio* (some), *Delairea, Homogyne, Euphrosyne, Xanthium, Bidens* (some), Tribe Eupatoriae |

Most members of the family have at least some flowers in the capitulum **bisexual** (having both stamens and pistil), even if others (for example ray-florets or marginal florets) are female only or sterile. Only Subfamily Asteroideae has members where **monoecious** (M) flowers (male and female in separate flowers on the same plant) or **dioecious** (D) flowers (male and female on separate plants) occur exclusively. The table below lists the genera where these occur.

| | |
|---|---|
| *Antennaria* | D |
| *Anaphalis* | D |
| *Calotis* (not always) | M |
| *Baccharis* (some female-only capitula) | M |
| *Cotula (dioica)* | D |
| *Tussilago* | M |
| *Petasites* | D |
| *Calendula* | M |
| *Ambrosia* | M |
| *Euphrosyne* | M |
| *Xanthium* | M |

Anything likely to turn up in the wild in Britain will likely be a member of 15 Tribes of these subfamilies. The bad news is that writers don't always agree on their naming or their boundaries. Here we use the classification given in Stace's *New Flora of the British Isles*, 4th Edition (with the addition of the Bahieae which gives us one non-native species), as this is what most people will have access to.

## A quick tour of the tribes

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **CARDUOIDEAE** | CYNAREAE<br><br>A very atypical member of this tribe is the genus *Echinops* (Globe Thistles). They are often grown in gardens and escape quite frequently. Although the flowers are in globular heads, each head is made up of many capitula, just one flower to each. It is still placed as a Composite because the one-flowered capitula, the flowers and the fruit have all the characteristic features of the family. | *Echinops, Carlina, Arctium, Saussurea, Carduus, Cirsium, Galactites, Onopordum, Cynara, Silybum, Serratula, Rhaponticum, Centaurea, Carthamus*<br><br>  |
| **CICHORIOIDEAE** | CICHORIEAE<br><br>At first glance you might think that Golden-thistles (*Scolymus*) are true Thistles, but note that they have all their florets strap-shaped (ligulate), not tubular, and they have latex. They can turn up from bird seed but don't persist. | *Scolymus, Cichorium, Catananche, Arnoseris, Lapsana, Hypochaeris, Scorzoneroides, Leontodon, Picris, Helminthotheca, Scorzonera, Tragopogon, Sonchus, Lactuca, Cicerbita, Mycelis, Taraxacum, Crepis, Pilosella, Hieracium*<br><br>  |

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **CICHORIOIDEAE (cont.)** | ARCTOTIDEAE<br><br>All species in this tribe look as if they should belong in the next subfamily; the most distinctive diagnostic feature is the presence of only one stigmatic lobe on each style branch. | *Arctotheca, Arctotis, Gazania, Berkheya*<br><br>  |
| **ASTEROIDEAE** | GNAPHALIEAE<br><br>This tribe includes all the Cudweeds, which have recently gone through a major 'genus explosion', and several non-native genera of Everlasting-flower. Flower colours are typically white to muted yellows and browns. | *Filago, Logfia, Antennaria, Anaphalis, Omalotheca, Gnaphalium, Gamochaeta, Pseudognaphalium, Laphangium,Helicrhysum, Xerochrysum, Plechostachys, Cassinia*<br>  |
| | INULEAE<br><br>The Fleabane tribe is rather diverse and not very distinctive. Flower size varies greatly but most have rayed all-yellow flowers. | *Inula, Limbarda, Dittrichia, Pulicaria, Buphthalmum*<br>  |

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **ASTEROIDEAE (cont.)** | ASTEREAE<br><br>Ray-florets, where present, come in a wide range of colours which include purples and blues | *Grindelia, Calotis, Solidago, Euthamia, Aster, Symphyotrichum, Galatella, Tripolium, Chrysocoma, Erigeron, Felicia, Callistephus, Olearia, Baccharis, Bellis*<br>  |
| | ANTHEMIDEAE<br><br>This tribe includes many of the white-liguled "Daisy-like" flowers (but not Daisies). The least representative genus is *Artemisia*, with generally dull flowers and wispy ray-florets. | *Tanacetum, Artemisia, Santolina, Achillea, Chamaemelum, Anthemis, Cota, Glebionis, Ismelia, Mauranthemum, Leucanthemella, Coleostephus, Leucanthemum, Chrysanthemum, Oncosiphon, Matricaria, Tripleurospermum, Cotula*<br>  |
| | SENECIONEAE<br><br>Characterised by having either one row of involucral bracts at the same level or two with the outer shorter. Except for *Homogyne* and some *Petasites,* flowers have ray-florets and are mostly yellow all over. The tribe includes several genera with palmately veined leaves. | *Senecio, Jacobaea, Pericallis, Delairea, Tephroseris, Brachyglottis, Sinacalia, Ligularia, Doronicum, Tussilago, Petasites, Homogyne*<br>  |

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **ASTEROIDEAE (cont.)** | CALENDULEAE<br><br>A distinctive aroma. Found in Britain as cultivated for their bright colours, and as garden outcasts. Only the ray florets produce achenes, which in Calendula are a distinctive curved shape. | *Calendula, Osteospermum*<br>  |
| | HELIANTHEAE<br><br>A tribe where lower stem leaves are often opposite. *Ambrosia* and *Xanthium* are monoecious with male and female flowers in separate capitula with atypical floral structures. All genera are introductions. | *Ambrosia, Euphrosyne, Xanthium, Rudbeckia, Helianthus*<br>  |
| | MILLERIEAE<br><br>Leaves all or mostly opposite. A tribe often characterised by rather few ray-florets. Those found in Britain are all annuals. | *Guizotia, Sigesbeckia, Galinsoga*<br>  |

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **ASTEROIDEAE (cont.)** | COREOPSIDEAE<br><br>Another tribe with all or mostly opposite leaves and few or no ray florets. Apart from *Bidens*, genera are usually garden escapes or outcasts. The pappus is usually absent or composed of bristles. | *Bidens, Coreopsis, Cosmos, Dahlia*<br>  |
| | TAGETEAE<br><br>Represented by one genus, mostly now as impersistent garden outcasts or escapes, with a strong aroma. Involucral bracts are fused to form a lobed sheath. | *Tagetes*<br>  |
| | BAHIEAE<br><br>A former wool alien now very rarely seen. The achenes are highly distinctive. | *Schkuhria*<br>  |

| SUBFAMILY | TRIBE | GENERA |
|---|---|---|
| **ASTEROIDEAE (cont.)** | HELENIEAE<br><br>Garden outcasts that occasionally establish. Flowers are yellow to purplish-brown, and leaves are alternate. | *Gaillardia, Helenium*<br>  |
| | EUPATORIEAE<br><br>A small distinctive tribe. Leaves are opposite; capitula are small and borne in dense, often flattish panicles. Florets are all tubular. | *Eupatorium, Ageratum*<br>  |

## Tribal attributes

You will probably be appreciating by now that with such a large and diverse family, there is no simple demarcation to be drawn between its tribes, and often even within its genera. The following table summarises many of the main traits of the family and will give you an idea of whether a feature is found or not in any tribe in this country, and if so, how frequent it is. Hopefully this will help you not to misplace something that is totally unfamiliar and speed up identification.

■ found in all genera of the tribe

□ found in many genera of the tribe

▫ found in few genera of the tribe

| | CYNAREAE | CICHORIEAE | ARCTOTIDEAE | GNAPHALEAE | INULEAE | ASTEREAE | ANTHEMIDEAE | SENECIONEAE | CALENDULEAE | HELIANTHEAE | MILLERIEAE | COREOPSIDEAE | TAGETEAE | BAHIEAE | HELENIEAE | EUPATORIEAE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trees or shrubs | | | | ▫ | ▫ | ▫ | ▫ | ▫ | | | | | | | | |
| Perennials | □ | □ | □ | □ | □ | □ | □ | □ | □ | □ | | □ | | | ■ | □ |
| Biennials | □ | □ | □ | | | | □ | □ | | ▫ | | | | | | |
| Annuals | ▫ | ▫ | □ | □ | ▫ | ▫ | □ | □ | ■ | □ | ■ | □ | ■ | ■ | □ | □ |
| Latex present | | ■ | | | | | | | | | | | | | | |
| Stem leaves absent | | □ | | | | ▫ | | □ | | | | | | | | |
| Stem leaves all alternate | ■ | □ | ■ | ■ | ■ | □ | ■ | □ | ■ | □ | | | | | ■ | |
| Stem leaves all opposite | | | | | | ▫ | | | | □ | □ | ■ | | | | ■ |
| Stem leaves opposite at base | | | | | | | | | | □ | ▫ | ▫ | ■ | ■ | | |
| Leaves spiny | □ | ▫ | | | | | | | | | | | | | | |
| Leaves pinnately veined | ■ | ■ | ■ | ■ | ■ | ■ | ■ | □ | ■ | □ | ■ | ■ | ■ | ■ | ■ | |
| Leaves palmately veined | | | | | | | | □ | | □ | | | | | | □ |
| Leaves simple, unlobed | ▫ | □ | ▫ | ■ | ■ | ■ | ▫ | □ | ■ | □ | ■ | ▫ | | | ■ | □ |
| Leaves lobed | □ | □ | ▫ | | | ▫ | ▫ | □ | | □ | | □ | ■ | ■ | ▫ | □ |
| Leaves dissected | ▫ | ▫ | □ | | | | □ | □ | | ▫ | | □ | | | | |
| Capitula borne singly | □ | □ | □ | ▫ | ▫ | □ | □ | □ | ■ | □ | | ■ | ■ | | | |
| Capitula in compound inflorescences | □ | □ | ▫ | □ | ■ | □ | ▫ | □ | | □ | ■ | □ | | ■ | ■ | ■ |
| Receptacle flat or nearly so | ■ | □ | ■ | □ | □ | □ | □ | □ | ■ | □ | ▫ | ■ | ■ | ■ | | ■ |
| Receptacle domed, conical or cylindrical | ▫ | ▫ | | ▫ | ▫ | ▫ | □ | ▫ | | □ | □ | | | | ■ | ▫ |
| Involucral bracts in one row | | ▫ | | | | | | □ | ■ | □ | | | | ■ | | |
| Involucral bracts in two rows (outer may be small) | | □ | ▫ | | | □ | ▫ | □ | ■ | ▫ | ■ | ■ | | | ■ | ■ |
| Involucral bracts at >2 heights | ■ | □ | □ | ■ | ■ | □ | ■ | | | ▫ | | | | | ■ | ■ |
| Involucral bracts fused into a tube | | | | | | | | | | | | | ■ | | | |
| Flowers 1 or 2 in a capitulum | ▫ | | | | | | | | | □ | | | | | | |
| Flowers more numerous | □ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Florets all tubular | ■ | | ▫ | ■ | | ▫ | □ | □ | | ■ | | ▫ | | ▫ | | ■ |
| Florets all radiate | | ■ | | | | ▫ | | | | | | ▫ | ▫ | | | |
| Florets in both forms present | | | □ | ▫ | ■ | □ | □ | □ | ■ | □ | ■ | ■ | ■ | ■ | ■ | |
| Tube-florets white, red, blue or purple | □ | | ▫ | ▫ | | | ▫ | ▫ | | | | ▫ | | | □ | ■ |
| Tube-florets bright yellow or orange | ▫ | | □ | ▫ | ■ | □ | □ | □ | ■ | ▫ | ■ | ■ | ■ | ■ | □ | |
| Tube-florets otherwise coloured | | | ▫ | □ | | ▫ | ▫ | | □ | ■ | | ▫ | □ | | □ | |
| Ray-florets red, blue or purple | | ▫ | | | | □ | | □ | | | | | | | | |
| Ray-florets white | | ▫ | ▫ | | | ▫ | □ | □ | | | □ | ▫ | | | | |
| Ray-florets yellow to orange | | □ | □ | | ■ | □ | ▫ | □ | ■ | □ | ▫ | □ | ■ | ■ | ■ | |
| Ray-florets otherwise coloured | | | ▫ | | | | ▫ | | □ | | | □ | □ | | □ | |
| Anthers wih long linear basal tails | ■ | | ■ | □ | □ | | | | □ | | | | | | | |
| Anthers with sagittate basal tails | | □ | | □ | □ | | | | □ | ▫ | | | | | ▫ | |
| Anthers with short basal tails | | □ | □ | | | | ▫ | ▫ | | | ■ | | | | | |
| Anthers without basal tails | | | ■ | | | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Style arms narrow, linear | ■ | □ | □ | | ■ | | | | | □ | □ | □ | □ | □ | □ | ■ |
| Style arms oblong, truncate or lobed | | ▫ | □ | ■ | | ■ | ■ | ■ | ■ | □ | □ | □ | □ | □ | □ | □ |
| Pappus 0 | ▫ | ▫ | | | | ▫ | □ | ▫ | ■ | □ | □ | ▫ | | | | |
| Pappus a membranous ring | | ▫ | | | | | ▫ | | | ▫ | | | | | | |
| Pappus of scales | ▫ | ▫ | ■ | | ▫ | | | | | | □ | | ■ | ■ | ■ | □ |
| Pappus of bristles | | ▫ | | | | ▫ | | | | ▫ | | ■ | | | ■ | |
| Pappus of hairs | ■ | □ | | ■ | □ | □ | | □ | | | | ▫ | | | | □ |
| Receptacular scales and hairs 0 | | □ | □ | ■ | □ | ■ | □ | ■ | ■ | | | | ■ | ■ | | ■ |
| Receptacle pit toothed / lobed at margin | | | □ | | ▫ | □ | | | | | | | | ■ | □ | |
| Receptacular hairs or bristles | □ | ▫ | □ | | | | | | | | | | | | □ | |
| Receptacular scales | □ | ▫ | | ▫ | | | □ | | | ■ | ■ | ■ | | | | |

# Key to groups of similar genera

## "Thistles"

Here we include all spiny plants with tubular florets only

1a. Flowers occurring each in its own capitulum ..... *Echinops* (Globe Thistles)
1b. More than one flower in each capitulum ..... 2

2a. Spines only on involucral bracts, at least some with a hooked tip ..... *Arctium* (Burdocks)
2b. Spines elsewhere, or if only on involucral bracts then not hooked at tip ..... 3

3a. Corolla yellow or orange ..... 4
3b. Corolla blue, purple, mauve, pink or white ..... 7

4a. Pappus of feathery hairs (*Cirsium*) ..... *Cirsium*
4b. Pappus otherwise or non-existent ..... 5

5a. Capitula not surrounded by leaves or large outer involucral bracts; involucral bracts with a distinct membranous appendage; spines confined to involucral bracts ..... *Centaurea* (Star-thistles)
5b. Capitula surrounded by leaves or large outer involucral bracts; prominent spines on involucral bracts, edges to leaves with small or weak spines ..... 6

6a. Pappus of two rows of rigid hairs; flowers yellow ..... *Cnicus* (Blessed Thistle)
A rare casual
6b. Pappus absent; flowers deep orange ..... *Carthamus tinctorius* (Safflower)
A rare casual

7a. Pappus hairs feathery ..... 8
7b. Pappus hairs not feathery ..... 10

8a. Innermost involucral bracts with a spine abruptly delimited from the base; often clusters of spines at leaf base and midrib ..... *Cynara* (Cardoon)
A rare garden escape
8b. Involucral bracts, if spiny, then gradually narrowed into spine ..... 9

9a. Outer involucral bracts leaf-like; inner membranous, pale yellow within and resembling ligulate flowers; flowers "everlasting" ..... *Carlina* (Carline Thistles)
9b. All involucral bracts linear-lanceolate to ovate ..... *Cirsium* (Thistles)

10a. Leaves with sharp spines ..... 11
10b. Leaves without spines ..... 13

11a. Receptacle glabrous, although achene pits fringed with teeth ..... *Onopordum* (Scotch Thistles)
11b. Receptacle densely hairy or bristly ..... 12

12a. Stem leaves running down the stem in a spiny wing; involucral bracts untoothed but with a terminal spine ..... *Carduus* (Thistles)
12b. Leaves variegated; stem leaves not running down the spine, stems not spiny; outer involucral bracts with spine-tipped lobes ..... *Silybum* (Milk Thistle)

13a. Flowers always hermaphrodite and of the same size; tip of involucral bract membranous but not separated from the rest by a constriction ..... *Acroptilon* (Russian Knapweed)
A very rare alien
13b. Outer flowers male-sterile and sometimes enlarged; tip of involucral bract membranous, separated from the base by a constriction and often toothed or spiny ..... *Centaurea* (Knapweeds)

If you are trying to decide between a *Cirsium* and a *Carduus*, then a couple of shortcuts are:

- *Cirsium* pappus hairs are feathery; *Carduus* are simple.
- If the leaves aren't decurrent into a spiny wing then it's definitely a *Cirsium*; if they are, then it could be either.

Many thistles produce white colour variations, none more so than the Marsh Thistle *Cirsium palustre*.

## Yellow-flowered "dandelions"

This is probably the Composite group that gives beginners most problems in even getting down to the right genus; in general, until you are familiar with the general recognition features of certain plants, you will need good fruiting material. The key below covers all plants with only yellow ligulate flowers, including introductions.

1a. Pappus of scales or a raised rim, or absent ..... 2
1b. At least the central flowers with a pappus of hairs ..... 6

2a. Thistle-like plant with spiny leaves ..... *Scolymus* (Golden-thistle)
Very rare casual
2b. Plant not thistle-like, leaves not spiny ..... 3

3a. Pappus of scales ..... *Hedypnois* (Scaly Hawkbit)
A rare casual
3b. Pappus a raised rim, or absent ..... 4

4a. Leaves all basal; stalks much swollen below the capitulum ..... *Arnoseris* (Lamb's Succory)
A probably extinct native
4b. Stem leaves present; stalks not much swollen below the capitulum ..... 5

5a. Capitula 10-30mm in diameter; outer involucral bracts not enclosing achenes, not spreading in fruit ..... *Lapsana* (Nipplewort)
5b. Capitula 4-5mm in diameter; outer involucral bracts enfolding achenes, spreading like a star in fruit ..... *Rhagadiolus* (Star Hawkbit)
A very rare casual

6a. Pappus on at least some achenes feathery ..... 7
6b. Pappus on all achenes simple, and smooth or finely toothed ..... 13

7a. Stem leaves absent; scale-like bracts may be present on stem ..... 8
7b. Obvious stem leaves present ..... 10

8a. Membranous receptacular scales present ..... *Hypochaeris* (Cat's-ears)
8b. No receptacular scales ..... 9

9a. Stems often branched, with scale-like bracts; hairs on stem and leaves unforked; often more than one capitulum on stem ..... *Scorzoneroides* (Autumn Hawkbit)
9b. Stems unbranched, without bracts; hairs on stem and on leaves (if present) forked at tip; capitula solitary on stem ..... *Leontodon* (other Hawkbits)

10a. Abundantly hairy, with at least some of the hairs anchor-shaped (glochidiate); leaves toothed or lobed ..... 11
10b. Glabrous, or if hairy then no hairs anchor-shaped; leaves long, narrow, untoothed ..... 12

11a. Outer and inner involucral bracts all similar, lanceolate ..... *Picris* (Hawkweed Ox-tongue)
11b. Outer involucral bracts broadly ovate, much broader than inner, cordate at base ..... *Helminthotheca* (Bristly Ox-tongue)

12a. Involucral bracts always more than 10 and in several rows ..... *Scorzonera* (Viper's Grasses)
12b. Involucral bracts usually less than 10 and in one row ..... *Tragopogon* (Goat's-beards)

13a. Achenes distinctly flattened ..... 14
13b. Achenes not flattened, or slightly flattened ..... 16

14a. Achenes with a distinct narrow beak or at least markedly narrowed at the top ..... 15
14b. Achenes without a beak and not, or scarcely, narrowing at the top ..... *Sonchus* (Sow-thistles)

15a. Involucral bracts in several rows of varying length; pappus hairs in 2 rows of equal length ..... *Lactuca* (Lettuces)
15b. Involucral bracts in two unequal rows, outer conspicuously shorter than inner; pappus hairs in 2 rows of unequal length ..... *Mycelis* (Wall Lettuce)

16a. Stems without leaves or scales or stolons, smooth and conspicuously hollow; capitulum always 1 per stem ..... *Taraxacum* (Dandelions)
16b. Stems with leaves or scales, or else with srolons; capitula often more than 1 per stem ..... 17

17a. Inner achenes with pappus of rigid hairs swollen and minutely bristly at base ..... *Tolpis*
A rare casual
17b. Pappus all of soft hairs not swollen at base ..... 18

18a. Receptacle with long silky hairs at least as long as the flowers arising from the margins of the achene-pits ..... *Andryala*
A very rare, perhaps vanishing, casual
18b. Receptacle without hairs, or hairs short ..... 19

19a. Pappus hairs pure white ..... 20
19b. Pappus hairs yellowish to pale brown ..... 21

20a. Plant with long thin rhizomes and whitish tubers; capitulum never more than 1 per stem; involucral bracts in several rows ..... *Aetheorhiza* (Tuberous Hawk's-beard)
A rare but persistent garden weed
20b. Plant without rhizomes; usually more than 1 capitulum per stem; involucral bracts in 2 rows, the outer shorter than the inner ..... *Crepis* (Hawk's-beards)

21a. Involucral bracts in two rows, the outer shorter than the inner; achenes narrowed or beaked at top ..... *Crepis* (Hawk's-beards)
21b. Involucral bracts in several rows; achenes widening towards a truncate top ..... 22

22a. Plant usually with stolons; leaves always without a distinct stalk; ligules often with a reddish stripe on the underside; achenes less than 2.5mm long, ribbed and each rib projecting separately shortly above the top; pappus hairs mainly in 1 row with a few shorter ones ..... *Pilosella* (Mouse-ear Hawkweeds)
22b. Plant never with stolons; leaves usually distinctly stalked at least towards base; ligules yellow, rarely with greenish colouring; achenes 2.5 – 5.0mm, ribs coming together at the top into an obscure rim; pappus hairs in two rows ..... *Hieracium* (Hawkweeds)

## Yellow and white “daisies”

This key covers all Composites with yellow disc florets and white ray florets, some of which are quite un-Daisylike.

1a. At least basal leaves opposite ..... 2
1b. All leaves alternate ..... 4

2a. Leaf-lobes linear to thread-like ..... *Cosmos* (Mexican Aster)
A showy-flowered garden escape with broad ray-florets, more usually pink
2b. Leaf-lobes lanceolate to ovate ..... 3

3a. Capitula less than 7mm in diameter excluding ligules; pappus of scales ..... *Galinsoga* (Gallant Soldiers)
3b. Capitula more than 7mm in diameter excluding ligules; pappus of strong barbed bristles ..... *Bidens* (Spanish Needles)

4a. At least the central flowers with a pappus of hairs ..... 5
4b. Pappus a membranous rim, scales, bristles or absent ..... 10

5a. Outer involucral bracts broader than inner and leafy ..... *Callistephus* (Chinese Aster)
Garden escape, usually grown as a double or semi-double and in many ligule colours including white
5b. Outer involucral bracts similar to or smaller than inner ..... 6

6a. At least the larger leaves truncate to cordate at base ..... 7
6b. Leaves all wedge-shaped at base ..... 9

7a. Involucral bracts in a series of rows, innermost longest ..... *Symphyotrichum* (Blue Wood Aster)
7b. Involucral bracts in 1 main row, sometimes with smaller basal ones ..... 8

8a. Leaves pinnately veined; involucral bracts in one main row, with small ones at base of capitulum ..... *Senecio* (Magellan Ragwort)
Rarely naturalised, mainly in the extreme North
8b. Leaves palmately veined; capitula without small basal involucral bracts ..... *Pericallis* (Cineraria)
A popular but frost-sensitive pot plant, naturalised in SW

9a. Involucral bracts uniformly green, or greener at tip than at base ..... *Symphyotrichum* (Michaelmas Daisy)
9b. Involucral bracts greener at base than tip ..... *Erigeron* (Fleabanes)

10a. Receptacular scales or bristles present ..... 11
10b. Receptacular scales and bristles absent (sometimes short fringe of hairs round achene pit) ..... 12

11a. Corolla of disc florets with a small pouch at base, hiding the top of the ovary from one direction ..... *Chamaemelum* (Chamomiles)
11b. Corolla of disc florets without a pouch, not hiding the top of the ovary ..... *Anthemis* (Corn Chamomiles)

12a. Pappus of 1-8 barbed persistent bristles and minute incurved scales ..... *Calotis* (Purple Bur-daisy)
Very rare casual
12b. Pappus a minute rim or absent ..... 13

13a. Robust garden perennials; leaves deeply pinnately divided; receptacle conical; pappus entirely absent ..... *Chrysanthemum* (garden Chrysanthemums)
13b. Not as above ..... 14

14a. Rosette plant; capitula solitary on leafless stems ..... *Bellis* (Daisies)
14b. Flowering stems with leaves ..... 15

15a. Stem leaves shallowly to deeply toothed or lobed but not divided to midrib, the teeth simple..... 16
15b. Stem leaves pinnately lobed or divided to midrib or nearly so, the lobes also divided ..... 18

16a. Ligules less than 10mm long .....*Tanacetum* (Tansies)
16b. Ligules longer than 10mm ..... 17

17a. Tubular part of ligulate flower not winged; coming into flower late (September onwards) ..... *Leucanthemella* (Autumn Ox-eye Daisy)
A fairly frequent garden escape
17b. Tubular part of ligulate flower with 2 narrow transparent rings..... *Leucanthemum* (Ox-eye Daisies)

18a. Terminal leaf segments lanceolate to ovate, flat .....*Tanacetum* (Tansies)
18b. Terminal leaf segments linear or thread-like, not flattened or hardly so ..... 19

19a. Achenes with 4-5 ribs, without resin glands; scented especially when fresh .....*Matricaria* (Scented Mayweeds)
19b. Achenes with 2 strong ribs on the inner face and two resin glands near the top on the outer face; unscented or slightly scented..... *Tripleurospermum* (Scentless Mayweeds)

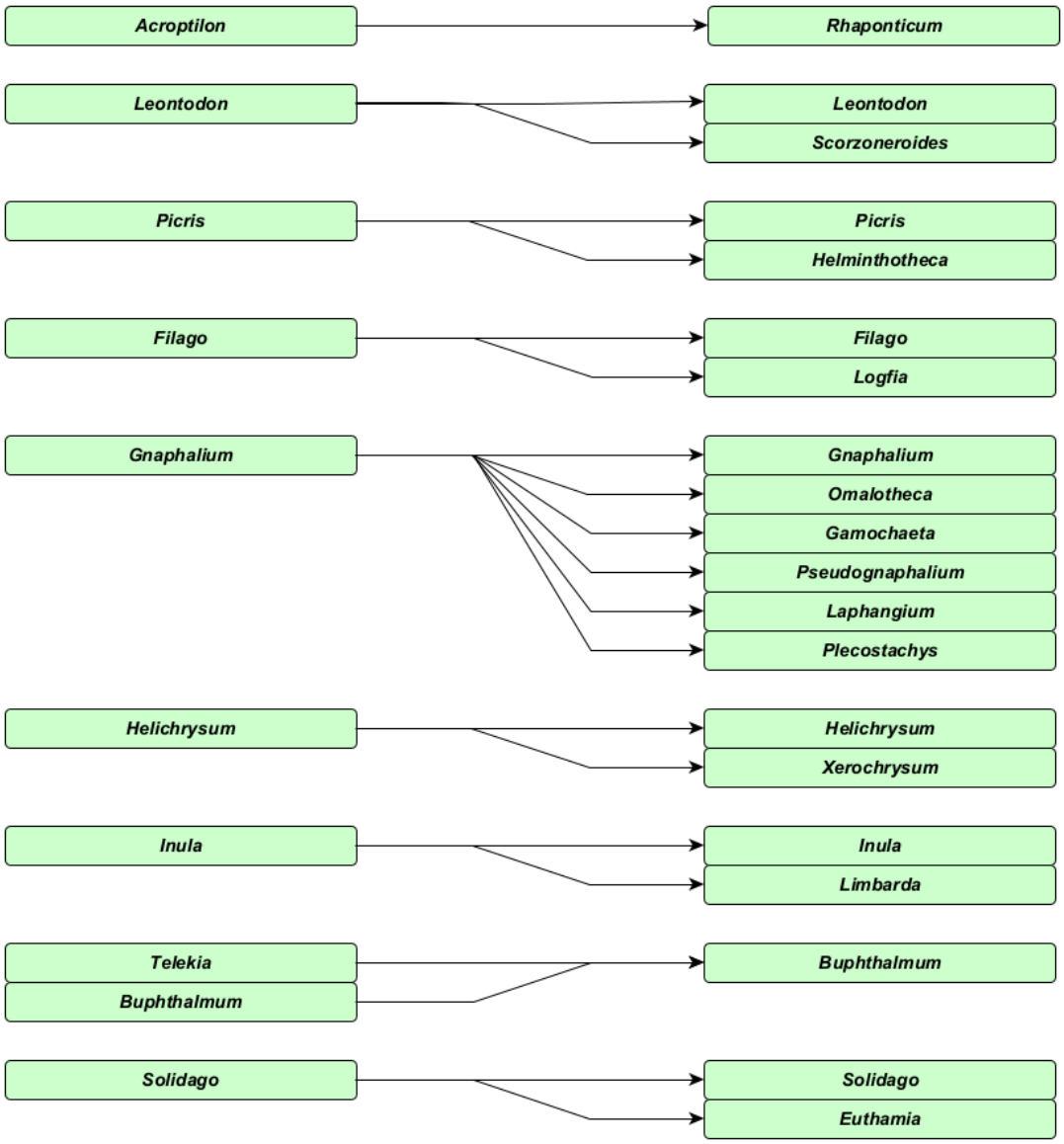
The groups that are likely to present most problems here are the Mayweeds and Chamomiles, with finely divided leaves and medium-sized flowers; and the Ox-eye Daisies, with lobed or toothed leaves and large flowers.

Here are some hints for the Mayweeds and Chamomiles:

- *Chamaemelum* and *Anthemis* have receptacular scales; *Matricaria* and *Tripleurospermum* don't
- *Matricaria* has a hollow receptacle; the others don't
- Only *Chamaemelum* has a "baggy" extension to its tubular florets
- *Anthemis* leaves tend to have a degree of regularity to the way their pinnate divisions are held, which is a useful "jizz" character
- The achenes of *Chamaemelum* are very faintly ribbed on the inner face only; *Tripleurospermum* achenes are also ribbed on the inner face only, but bear resin glands on the outer face.

## Recent name changes in Asteraceae

Recent molecular and evolutionary work on the Asteraceae has taken its toll of traditional genus names, as in other families. Clive Stace has been fairly conservative in adopting new names, and in some respects we are now just catching up with other parts of the world in realigning our classification. Below is a guide to what has changed between the first edition of Stace (1991) and the fourth (2019). At the generic level the pace of change is likely to slow down considerably now, so it is a good time to get your head around these changes.

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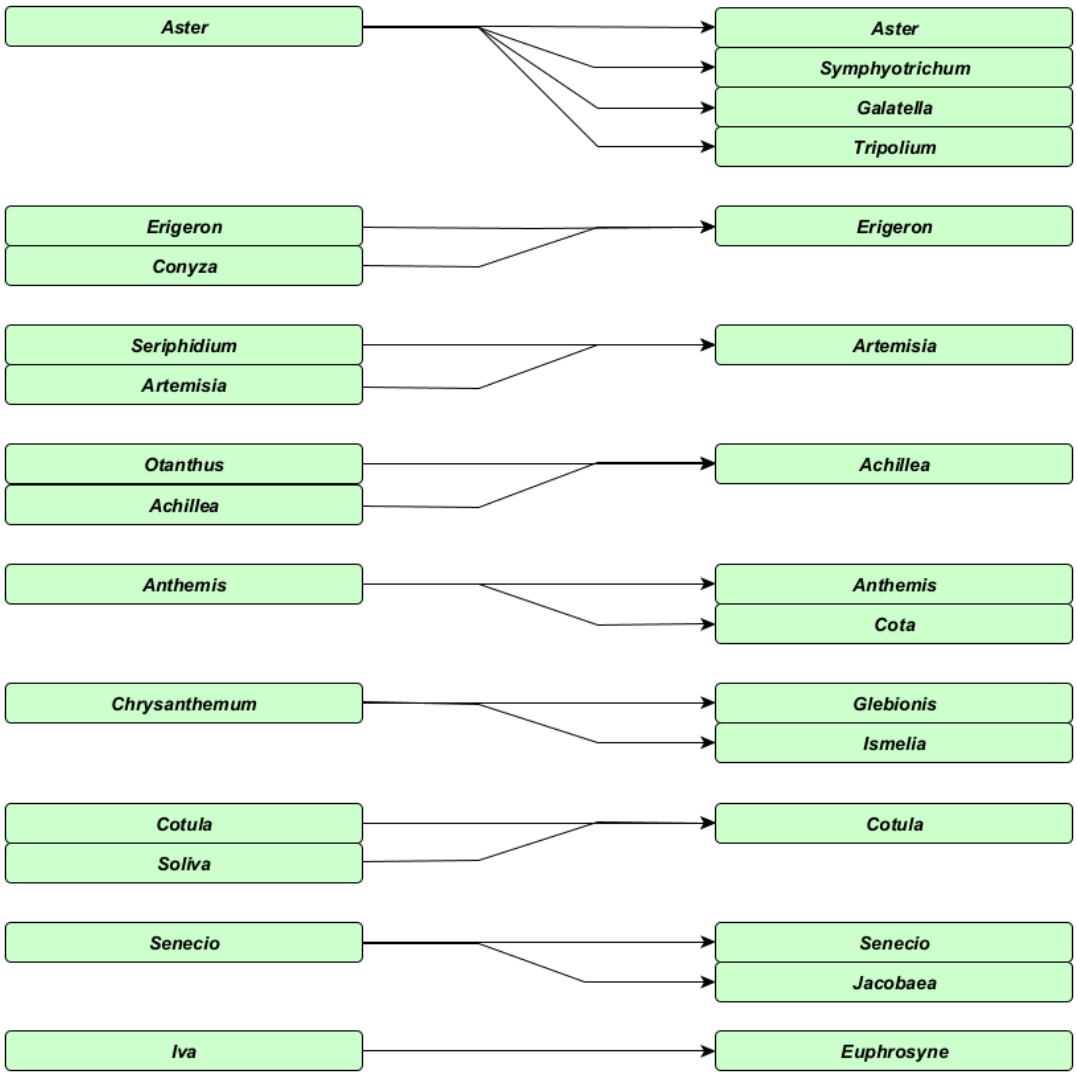
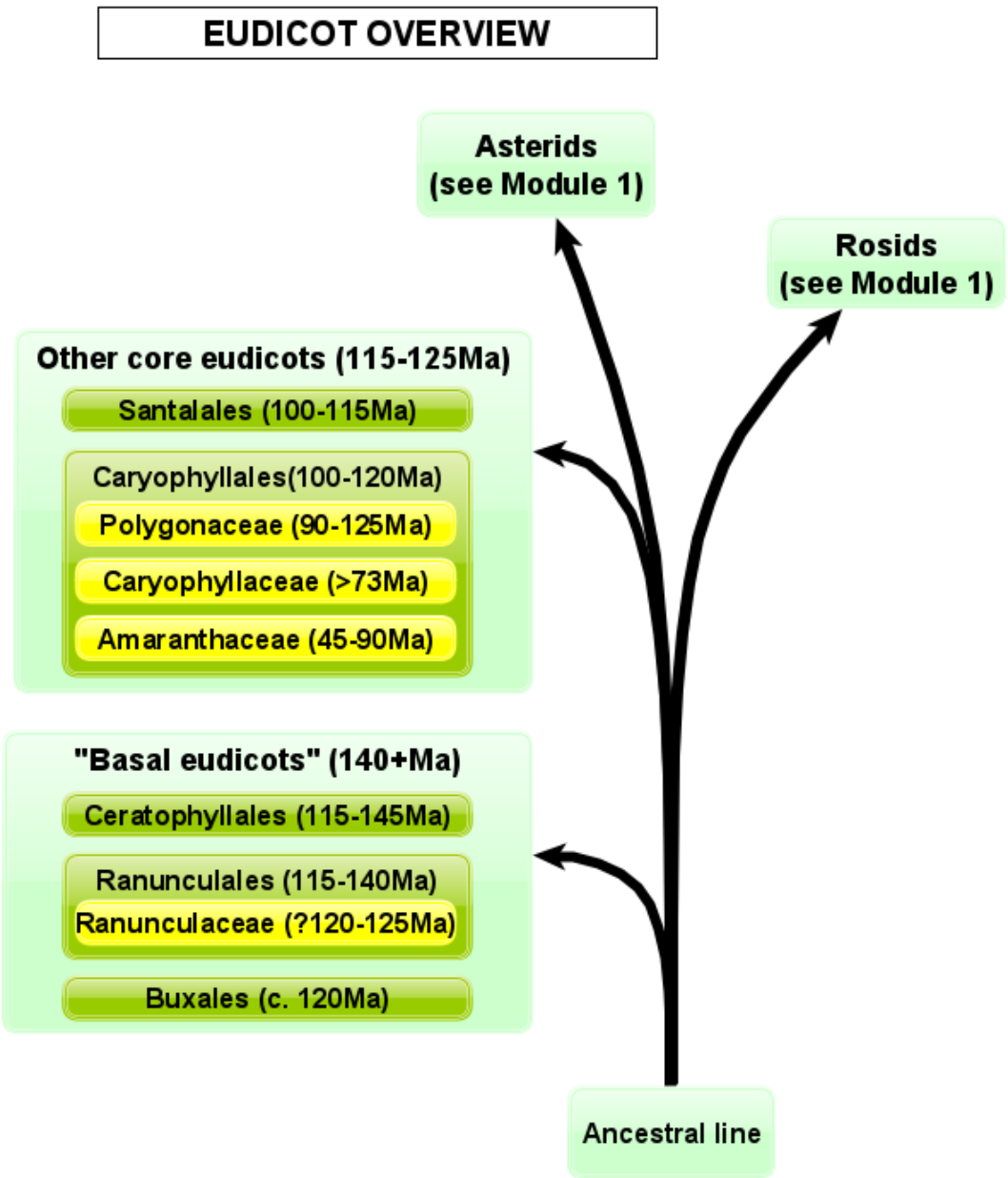

Aster
Aster
Symphyotrichum
Galatella
Tripolium
Erigeron
Conyza
Erigeron
Seriphidium
Artemisia
Artemisia
Otanthus
Achillea
Achillea
Anthemis
Anthemis
Cota
Chrysanthemum
Glebionis
Ismelia
Cotula
Soliva
Cotula
Senecio
Senecio
Jacobaea
Iva
Euphrosyne

# Order Caryophyllales: its place in the other core eudicots




The "other core eudicots" are a bit of a mixed bag whose present members started to diverge from the common ancestral line with the Asterids quite early. As we saw in Module 3, there are only three orders in the grouping, one of which (Berberidopsales) does not occur in Britain, and one of which (Santalales) has just two species here.

That leaves the **Caryophyllales**, a much larger order of roughly 12,000 species worldwide. Defining families through ancestry relationships is challenging in

this order, and the current arrangement of families is a bit of a compromise between new evidence and botanical tradition. Typical (though not universal) traits of the order are: attachment of the ovules (**placentation**) within the ovary to a central free-standing column (free-central) or pedestal (free-basal); presence of betalain pigments, particularly prominent in families such as the Amaranthaceae (think beetroot or purple amaranth!) but absent from Caryophyllaceae, whose colouring (where it occurs) comes from anthocyanins; and a large proportion of stress-tolerant plants. The last include species tolerant of salt, drought (especially through succulence), low levels of nutrients, especially nitrogen (often carnivorous) and high levels of nitrogen (for instance, in many members of the Amaranthaceae). For an overview of the whole order, refer to the Module 3 workshop notes.

## Distinguishing features of Amaranthaceae and Polygonaceae

These families fall into different subsections of the order but have many morphological similarities. They can usually be distinguished with a little attention to detail.

| Feature | Amaranthaceae | Polygonaceae |
|---|---|---|
| Succulence | Occurs in some family members | Does not occur |
| Stipules | Absent | Stipules fused as sheaths around stems, sometimes rather short and inconspicuous (**ochreae)** |
| Perianth | Always of 1 whorl of 1-5 tepals, or absent | Tepals often in 2 whorls, mostly 5 or 6, rarely 3 or 4 |
| Stamens | 1-5 | 6-9, most commonly 6 or 8, rarely fewer |

# Docks and Knotweeds: Polygonaceae

Worldwide this is not a very large family, with about 1200 species of which we have roughly 9% recorded as native or naturalised. The most distinctive feature of the subfamily Polygonoideae, to which all our plants belong, is the tubular **ochrea** formed of fused stipules sheathing the stem; in some taxa this is very short and needs to be looked for carefully.

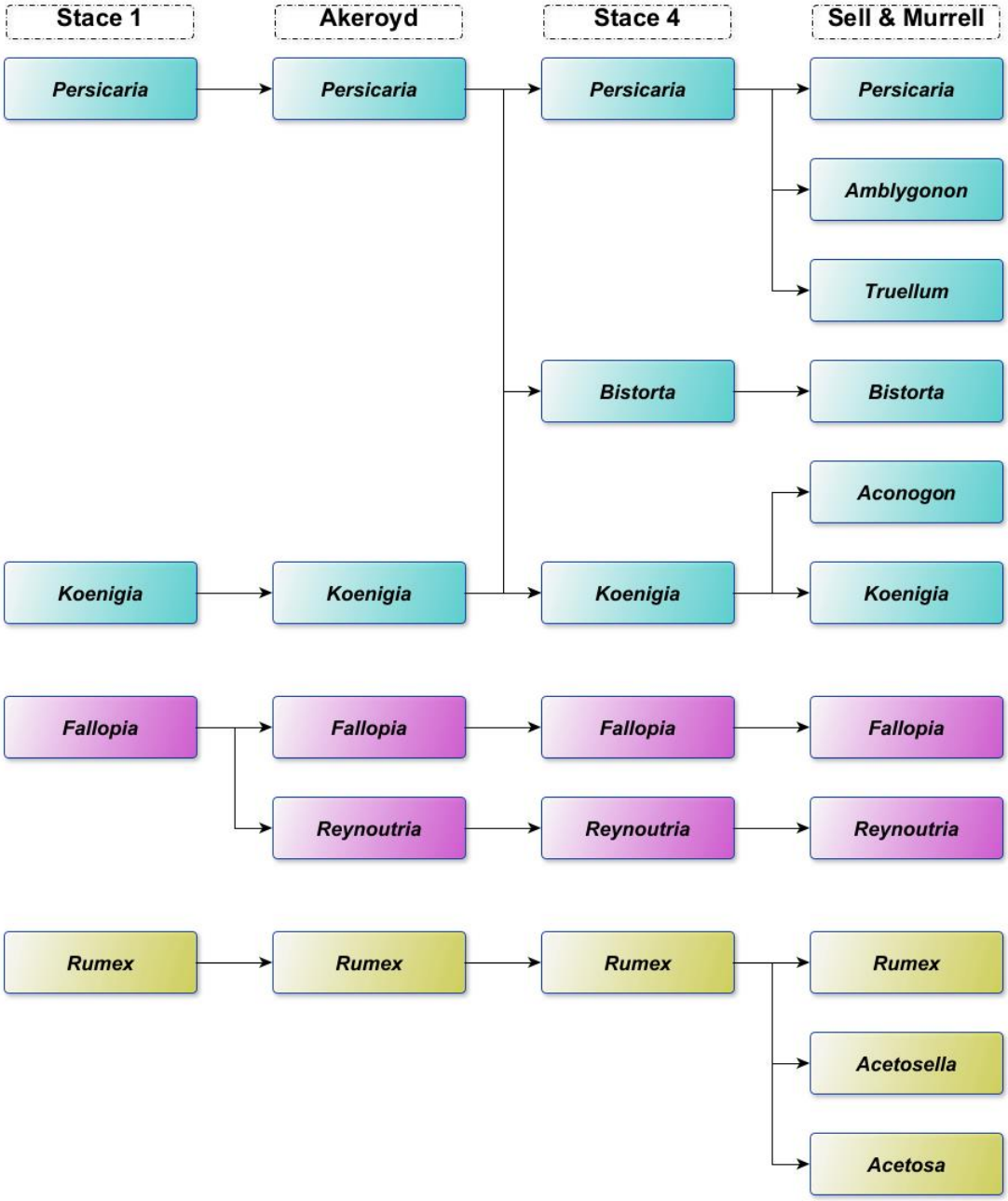
## Genus reassignments in the family

There have been some genus splits in the family through successive British works of reference, mostly as a result of better molecular knowledge. Most of these are reasonably straightforward but Sell & Murrell (2018) has complicated matters by treating what many authors would currently consider subgenera as separate genera, following older traditions; likewise with *Rumex*. The diagram below illustrates the changes.

*Koenigia* was augmented by Stace (2019) by joining the original single native species with a number of very different-looking non-native species previously in *Persicaria*. Sell & Murrell (2018) reserve *Koenigia* for the native one and assign the rest of these to a genus *Aconogon,* which Stace maintains cannot be justified on molecular evidence.

Most of the non-native (and invasive) perennials that Stace formerly placed in *Fallopia* are now split to *Reynoutria*. This has been established practice elsewhere for some time.

For the rest of this section we shall follow the Stace 4 genus names, with the addition of *Oxygonum* and *Emex* which are not covered by Stace.




'Akeroyd' refers to edition 2 of BSBI Handbook 3, *Docks and Knotweeds of Britain and Ireland*.

## Family traits

| Constant traits | Common traits | Exceptions |
|---|---|---|
| Stipules fused to form sheaths at nodes (ochreae) | | |
| Leaves alternate or subopposite | | |
| Leaves simple | | |
| Ovary superior | | |
| Flowers actinomorphic (radial symmetry) | | |
| Flower colours muted tones of green, brown, pink or white | | |
| Ovary one-celled, with one ovule | | |
| Fruit an achene | | |
| | Leaves entire (but may be wavy) | *Oxygonum*, *Rumex* (some) |
| | Leaves pinnately veined | *Fagopyrum*, *Rheum, Oxyria* |
| | Flowers in racemes, simple or branched, or panicles | *Persicaria* (some), *Koenigia* (1 sp.), *Polygonum* |
| | Perianth segments 4 or 5 | *Koenigia islandica* (3), *Rheum*, *Rumex*, *Emex* (6) |
| | Fruits trigonous (sometimes weakly so) | *Persicaria* (some)*, Oxygonum*, *Oxyria* |

# A key to genera

**1** Small annual; leaves subopposite; tepals 3; rare montane plant ..... ***Koenigia***
**1'** Annual or perennial; leaves alternate; tepals usu. >3 ..... **2**

**2** Perennial herb; leaves kidney-shaped; montane ..... ***Oxyria***
**2'** Leaves not kidney-shaped ..... **3**

**3** Leaves palmately veined ..... **4**
**3'** Leaves pinnately veined ..... **5**

**4** Leaves ≥40cm, ±palmately lobed; tepals , in 2 whorls; stamens 9 ..... ***Rheum***
**4'** Leaves <15cm, hastate, sagittate or unlobed; tepals <6; stamens 8 ..... ***Fagopyrum***

**5** Three outer tepals joined, with stiff spreading spiny hairs..... **6**
**5'** Tepals without spiny hairs..... **7**

**6** Spines on the margins of the tepals ..... ***Oxygonum***
**6'** Spines terminal on tepal..... ***Emex***

**7** Outer tepals small; inner tepals enlarged, enfolding the achene and often with a tubercle when fruiting; all or most flowers bisexual ..... ***Rumex*** **subgenus Rumex**
**7'** All tepals without tubercles; flowers dioecious, or effectively so (i.e. one or other sex abortive on a plant) ..... **8**

**8** Tepals 6, with no or vestigial tubercles at fruiting; plant fully dioecious ..... ***Rumex*** **subgenus Acetosa**
**8'** Tepals 5, lacking tubercles; plant functionally dioecious..... **9**

**9** Stigmas finely divided (20x loupe); flowers effectively dioecious (one or other sex aborted on a plant) ..... **10**
**9'** Stigmas small, capitate or club-shaped; flowers fully bisexual..... **11**

**10** Sprawling or climbing plant, woody at base; leaves <2cm, rounded at base ..... ***Muehlenbeckia***
**10'** Plant with erect hollow herbaceous stems dying back in winter; leaves >2cm, truncate or cordate at base ..... ***Reynoutria***

**11** Stems may twine; 3 outer tepals strongly keeled or winged..... ***Fallopia***
**11'** Stems never twine; 3 outer tepals at most feebly keeled ..... **12**

**12** Flowers all in axillary clusters of 6 or fewer flowers..... ***Polygonum***
**12'** Inflorescences mostly >6-flowered, at least some terminal..... **13**

**13** At least some anthers exserted from tepals or partially so; basal leaves present at flowering time ..... ***Bistorta***
**13'** Anthers occasionally exserted from tepals or partially so; basal leaves absent at flowering time ..... ***Persicaria***
**13''** Anthers not exceeding tepals; basal leaves absent at flowering ..... **14**

**14** Flowers in branched panicles ..... ***Koenigia***
**14'** Flowers in tight heads, cylindrical or tapering unbranched inflorescences ..... ***Persicaria***

## Some illustrative features of the genera

### *Persicaria maculosa* Gray

Annuals or perennials

Ochreae tubular, truncate, ciliate: variable in shape and hairiness in genus

Tepals 4(-5) (A): constant for genus

Anthers not exserted (A, B): characteristic for genus

Style branches 2 (C): 1-3 in genus

Stigmas capitate (C): capitate or clavate in genus

Achene trigonous (D): trigonous or discoid in genus


### *Koenigia islandica* (All.) T.M. Schust. & Reveal

(*Koenigia* subgenus Koenigia)

Leaves subopposite (C)

Ochreae with triangular lobes (C): tubular, long-acuminate or lobed in genus

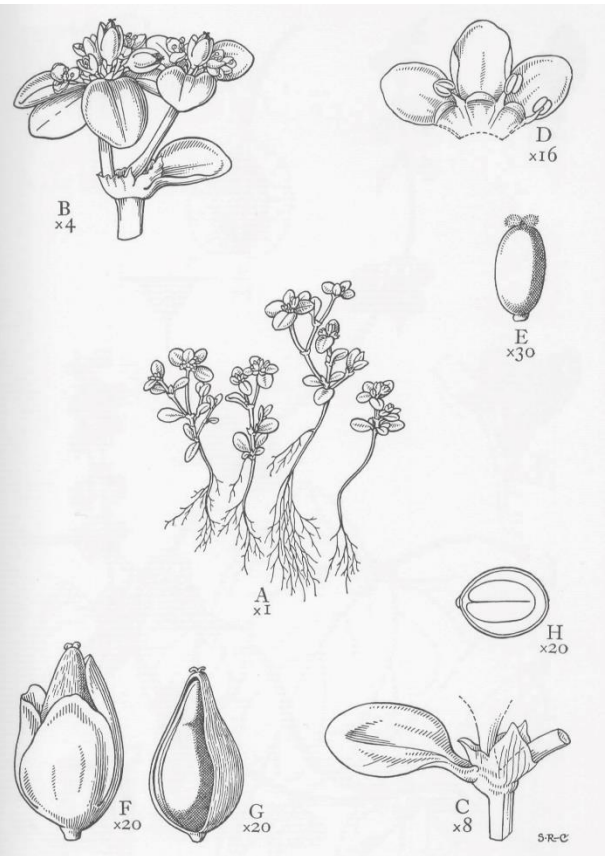
Tepals 3 (D, F): 5 in rest of genus

Stamens 3 (D): 3 or 8 in genus

Styles 2 (E,F): 3 in rest of genus

Stigmas capitate (E,F)

Achene bluntly trigonous (G): bluntly trigonous to triquetrous and somewhat keeled in genus



***Koenigia campanulata*** (Hook. F.) T.M. Schust. & Reveal

(*Koenigia* subgenus Aconogonon)

Leaves alternate (A): typical for genus

Ochreae lobed (A)

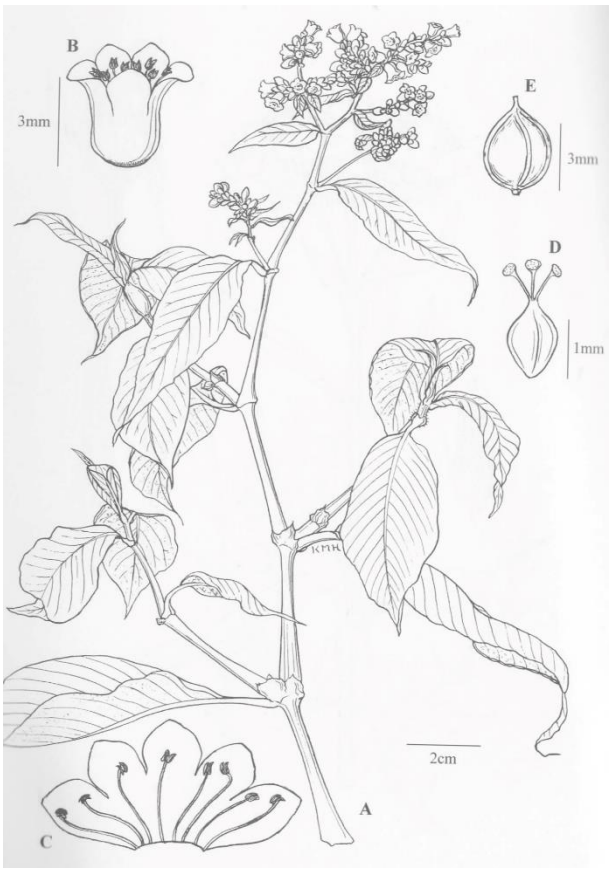
Tepals 5 (B,C): typical for genus; fused exceptionally far for this genus

Stamens 8 (C): typical for genus

Styles 3(D): typical for genus

Stigmas capitate (D)

Achene triquetrous, keeled (E): bluntly trigonous to triquetrous and somewhat keeled in genus




***Bistorta amplexicaulis*** (D. Don) Greene

Large prominent ochreae (A): typical for genus

Inflorescence a spike-like composite of few-flowered cymes (A): typical for genus

Tepals 5 (B,C): constant for genus

Stamens 8 (B,C): constant for genus

Styles 3 (D): constant for genus

Stigmas minute, capitate: typical for genus

Achene trigonous (D): constant for genus

## *Oxygonum alatum* Burch.

Annual herb: annual and perennial herbs in genus

Leaf outlines very variable in many species

Inflorescences long racemes of clusters of 1-5(-15) flowers

Flowers monoecious and bisexual together

Tepals 5 (1): characteristic for genus

Stamens 8 (1): constant for genus

Styles 3 (1): 2 or 3 in genus

Achenes trigonous with spines at apex (2): characteristic for genus


## *Fagopyrum cymosum* (Trevir.) Meisn.

Palmately veined leaves (A): constant for this genus

Ochreae truncate or oblique (A,B): typical for genus

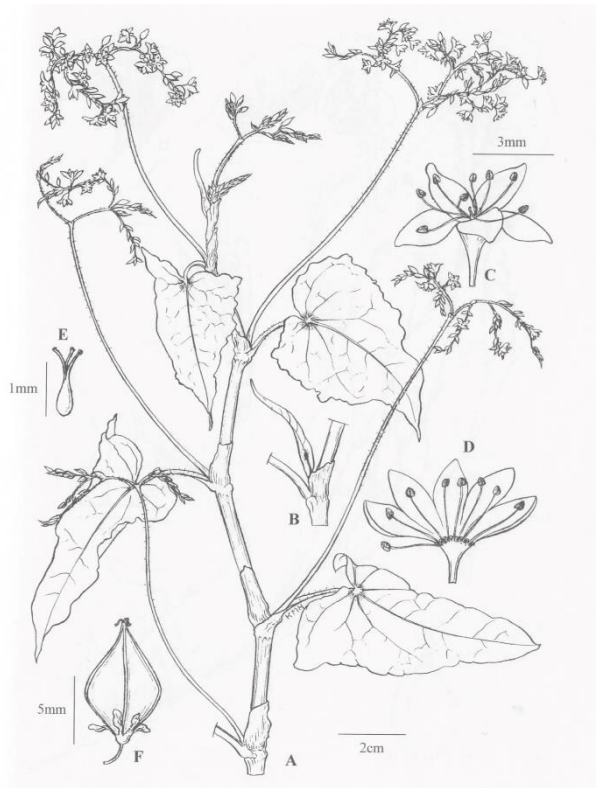
Tepals 5 (C,D): constant for genus

Stamens 8 (C,D) : constant for genus

Styles 3 (E): constant for genus

Stigmas small, capitate (E): constant for genus

Achene trigonous (F): constant for genus



## *Polygonum maritimum* L.

Perennial herb, woody below: annuals and perennials in genus

Ochreae sheathing, silvery / brown, tubular, laciniate (C): characteristic for genus

Inflorescence a 1-6 flowered axillary clusters (B): constant for genus

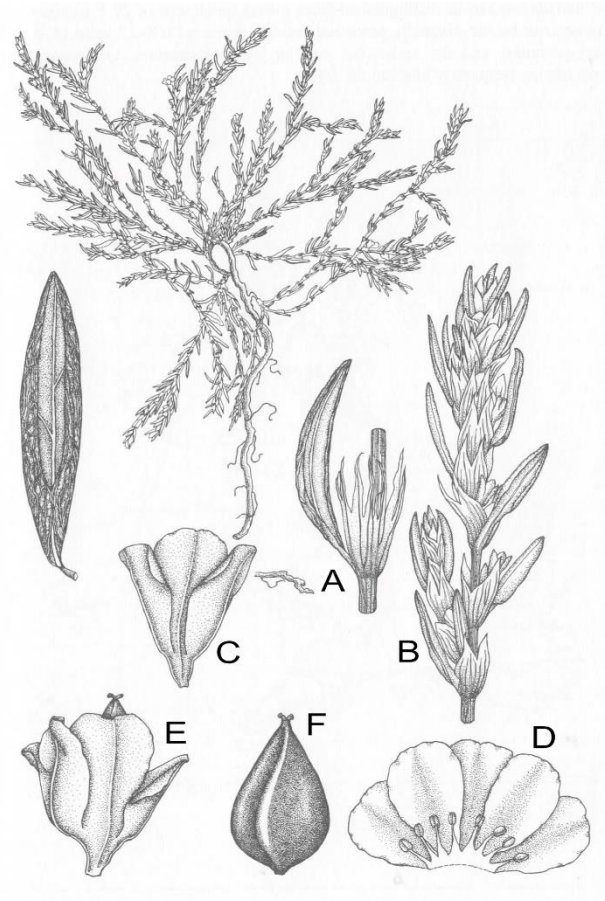
Tepals 5 (D): constant for genus

Stamens 6-8 (D): 5-8 for genus

Styles 3 (despite E,F): constant for genus

Stigmas capitate, small: constant for genus

Achenes weakly trigonous (F): constant for genus




## *Fallopia baldschuanica* (Regel) Holub

Clockwise twining habit(A): typical for genus

Ochreae sheathing only at base: typical for genus

Tepals 5 (C): constant for genus

Stamens 8 (C): constant for genus

Styles 3; constant for genus, but in this case small and non-obvious (C)

Stigmas capitate (C): constant for genus

Outer tepals enlarging to enclose fruit, winged or keeled (E): constant for genus

Achene trigonous (F): constant for genus

## *Muehlenbeckia complexa* (A. Cunn.) Meisn.

Perennials, often woody

Ochreae short and tubular (D): characteristic for genus

Dioecious (E,F): bisexual, monoecious or dioecious in genus

Tepals 5 (E,F): constant for genus

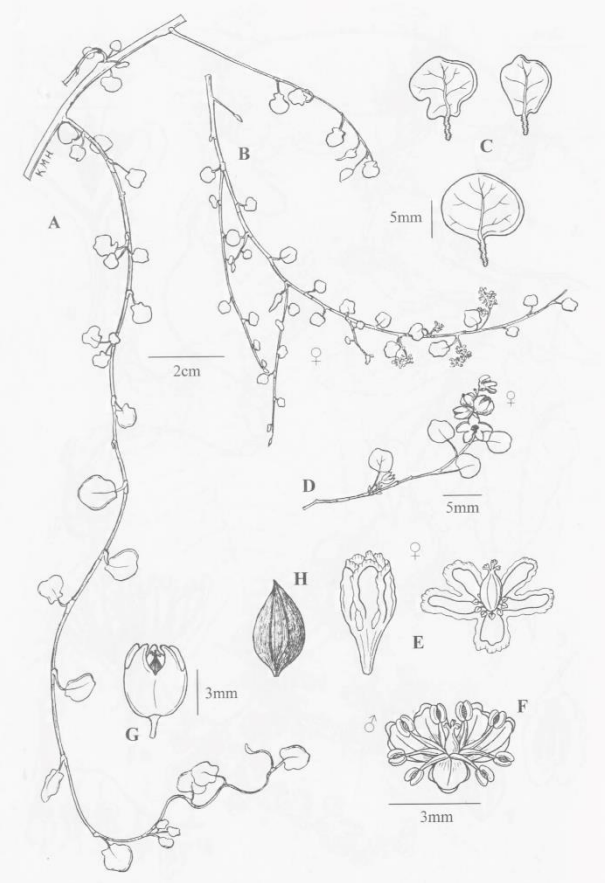
Stamens 8 (F): 8-9 in genus

Styles 3 (E): constant for genus

Stigmas fimbriate (E): constant for genus

Tepals persistent and semi-succulent, more or less enclosing achene (G): constant for genus

Achene trigonous (H): globular to triquetrous in genus




## *Reynoutria sachalinensis* (F. Schmidt) Nakai

Herbaceous non-climbing perennials

Ochreae short (≤3mm), cylindrical (A): constant for this genus

Tepals 5 (C,D): constant for this genus

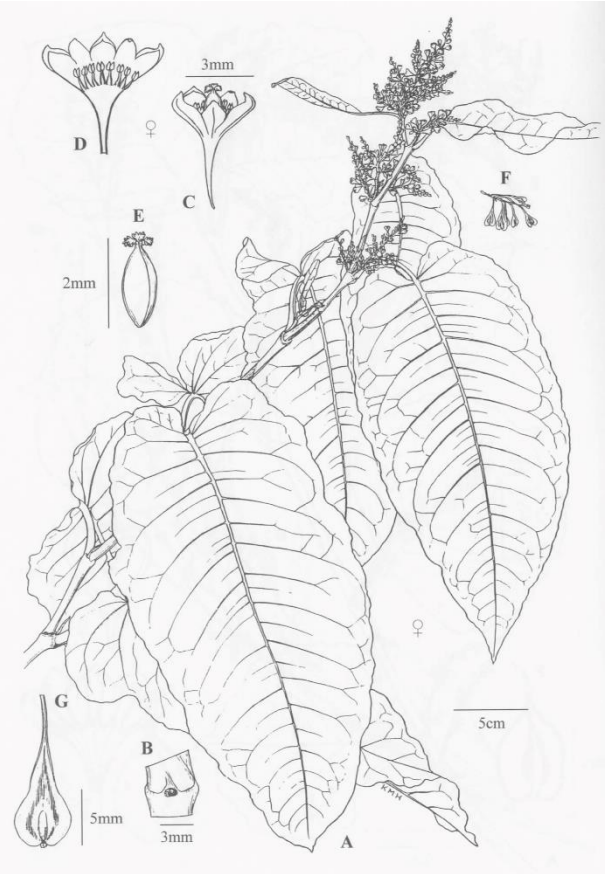
Stamens 8 (D): constant for this genus

Styles 3 (E): constant for this genus

Stigmas divided, fimbriate (E): constant for this genus

Tepals enclosing fruit, winged and keeled (G) to greater or lesser degrees: constant for this genus

Achenes trigonous (E): constant for this genus



## *Rheum palmatum* L.

Perennial herbs

Ochreae large and sheathing: constant for genus

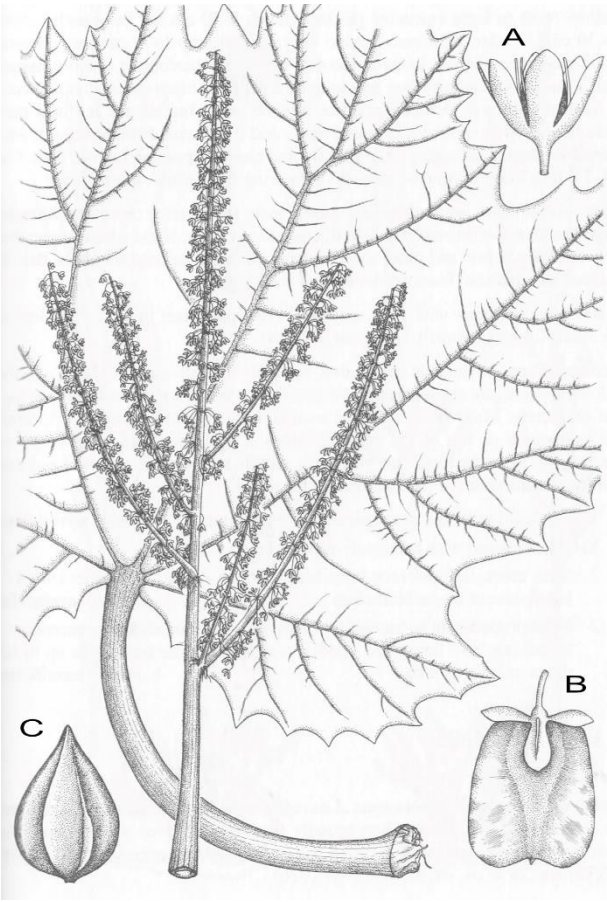
Tepals 6 (A): constant for genus

Stamens 9: characteristic for genus

Styles 3: constant for genus

Stigmas capitate, papillose: constant for genus

Fruit an achene, 3-angled with broad membranous wings (B): constant for genus




## *Rumex acetosella* L. (*Rumex* subgenus Acetosa)

Perennial herbs

Dioecious: constant for genus

Leaves hastate (A): variously lobed in subgenus

Ochreae conspicuous, fimbriate (B): fimbriate, bifid or fringed in subgenus

Inflorescences terminal or axillary panicles of whorled clusters: characteristic for subgenus

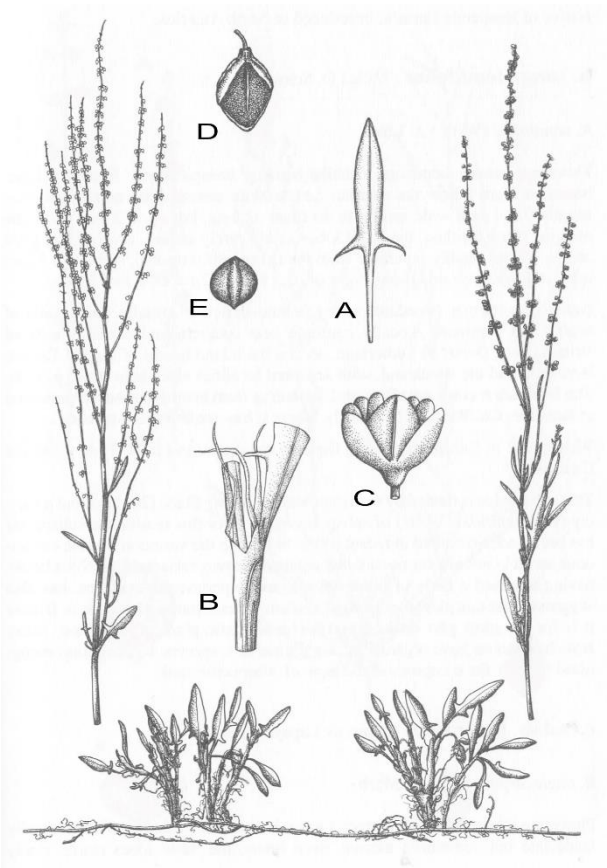
Tepals 6 (C), scarcely enlarging in fruit and unwinged (D): typically enlarging and winged in subgenus

Tepals without tubercles (D): characteristic for subgenus

Stamens 6, occasionally more: constant for genus

Styles 3, divided: constant for genus

Achenes trigonous (D): various in subgenus



## *Rumex conglomeratus* Murray (*Rumex* subgenus Rumex)

Perennial herb: annual to perennials in subgenus

Flowers bisexual: constant in subgenus

Leaves ±lanceolate: leaves never hastate or sagittate in subgenus

Inflorescences in whorls on branched panicles (A): panicles branched or rarely simple in subgenus

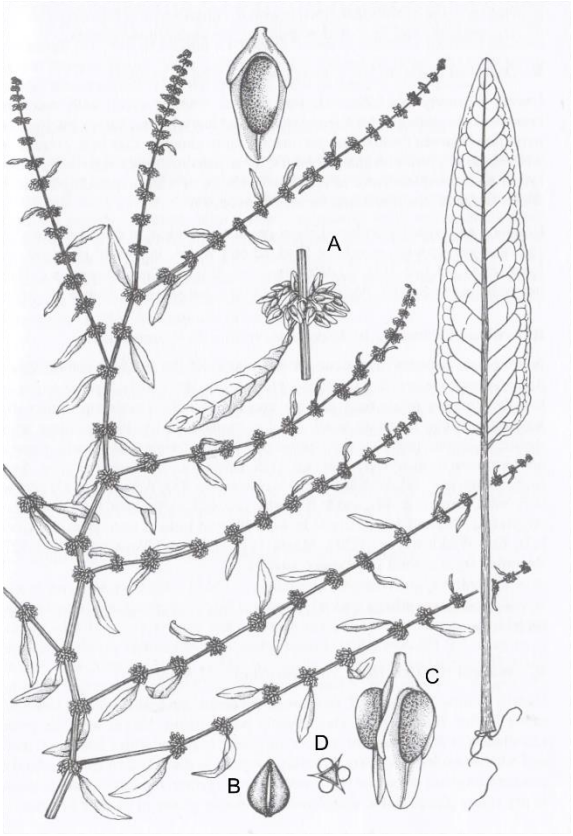
Tepals 6: constant for subgenus

Stamens 6: stamens (1-)6(-9) in subgenus

Stigmas 3, feathery: constant in subgenus

Inner tepals enlarging in fruit, usu. all with tubercules (C,D): 0-3 tubercules in subgenus

Achenes acutely trigonous: trigonous in subgenus




## *Oxyria digyna* (L.) Hill

Single-species genus

Dioecious perennial

Leaves kidney-shaped, mostly at base

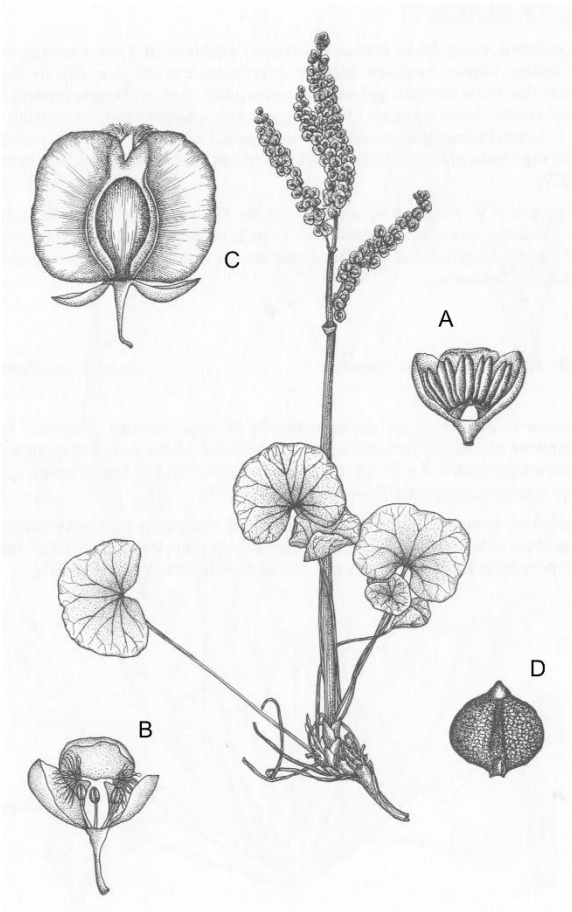
Tepals 4 (A)

Stamens 6 but some often reduced (A)

Styles 2 (B)

Stigmas red, feathery (B)

Achenes biconvex (D), fringed with a broad membranous wing (C)



*Emex spinosa* (L.) Campd.

This genus is now being subsumed into Rumex, despite significant morphological differences

Monoecious annuals

Leaves rounded or cordate at base

Ochreae membranous (A), quickly becoming tattered

Inflorescence of terminal (male) and axillary (female) clusters of flowers

Tepals 6, fused at base in female flowers

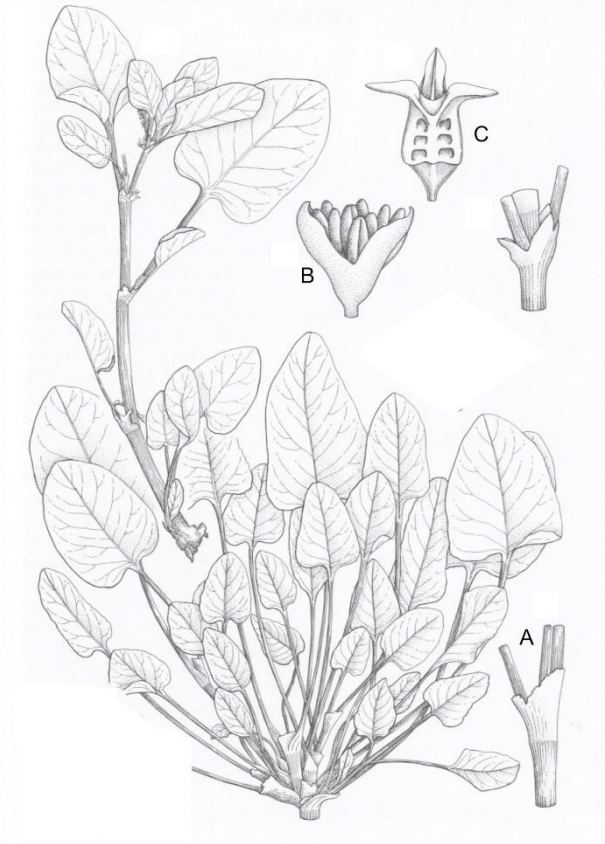
Stamens 4-6 (B)

Styles 3, very short

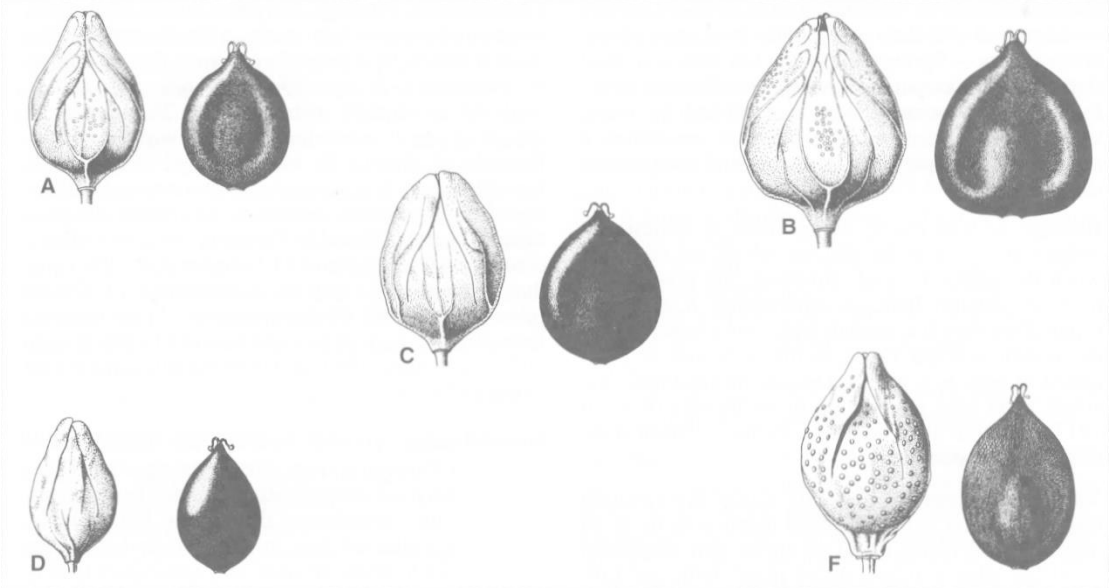
Stigmas feathery

Tepals at fruiting spiny, with spreading tips (C)

Achenes ovoid or somewhat trigonous

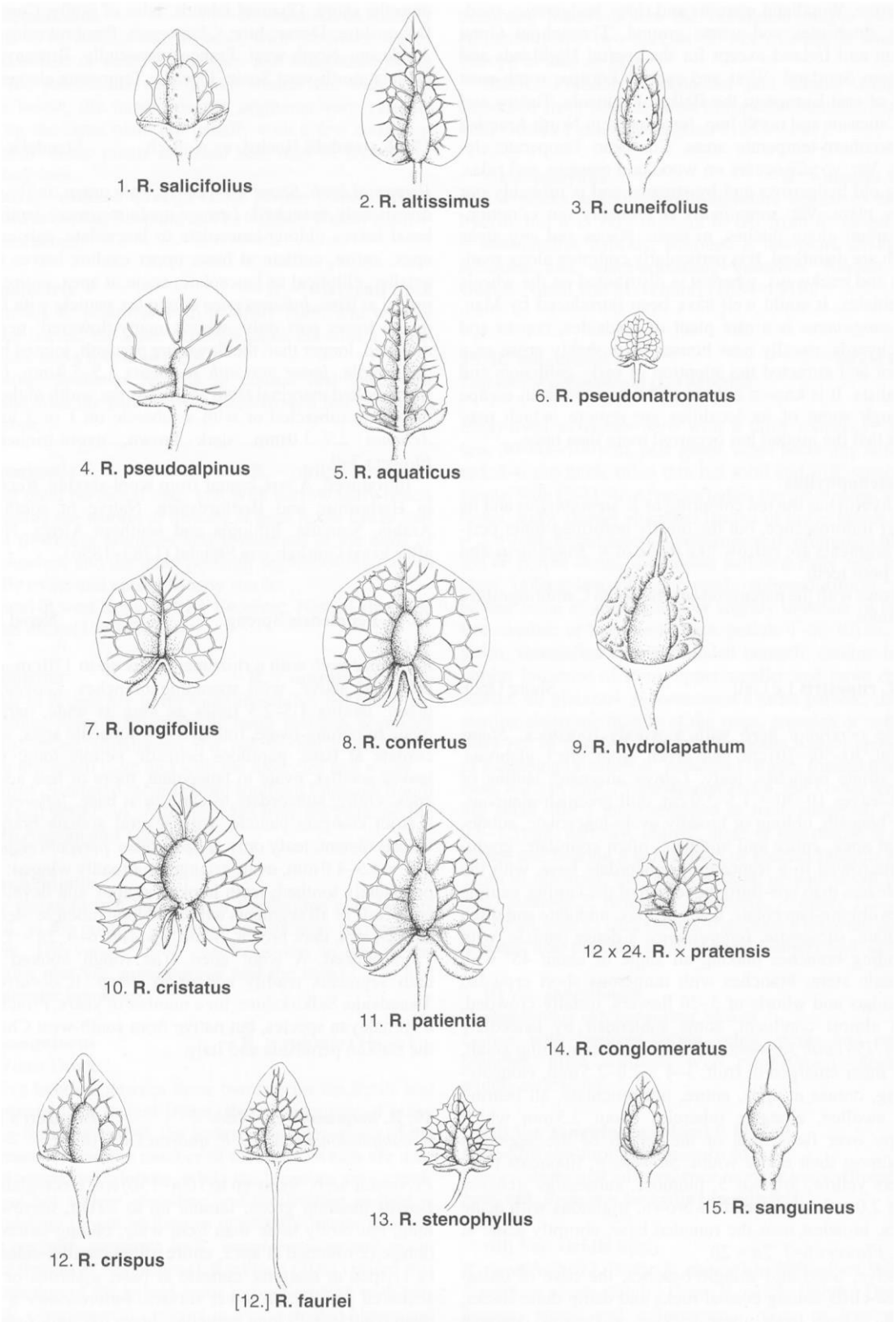



## Synoptic illustrations of fruits

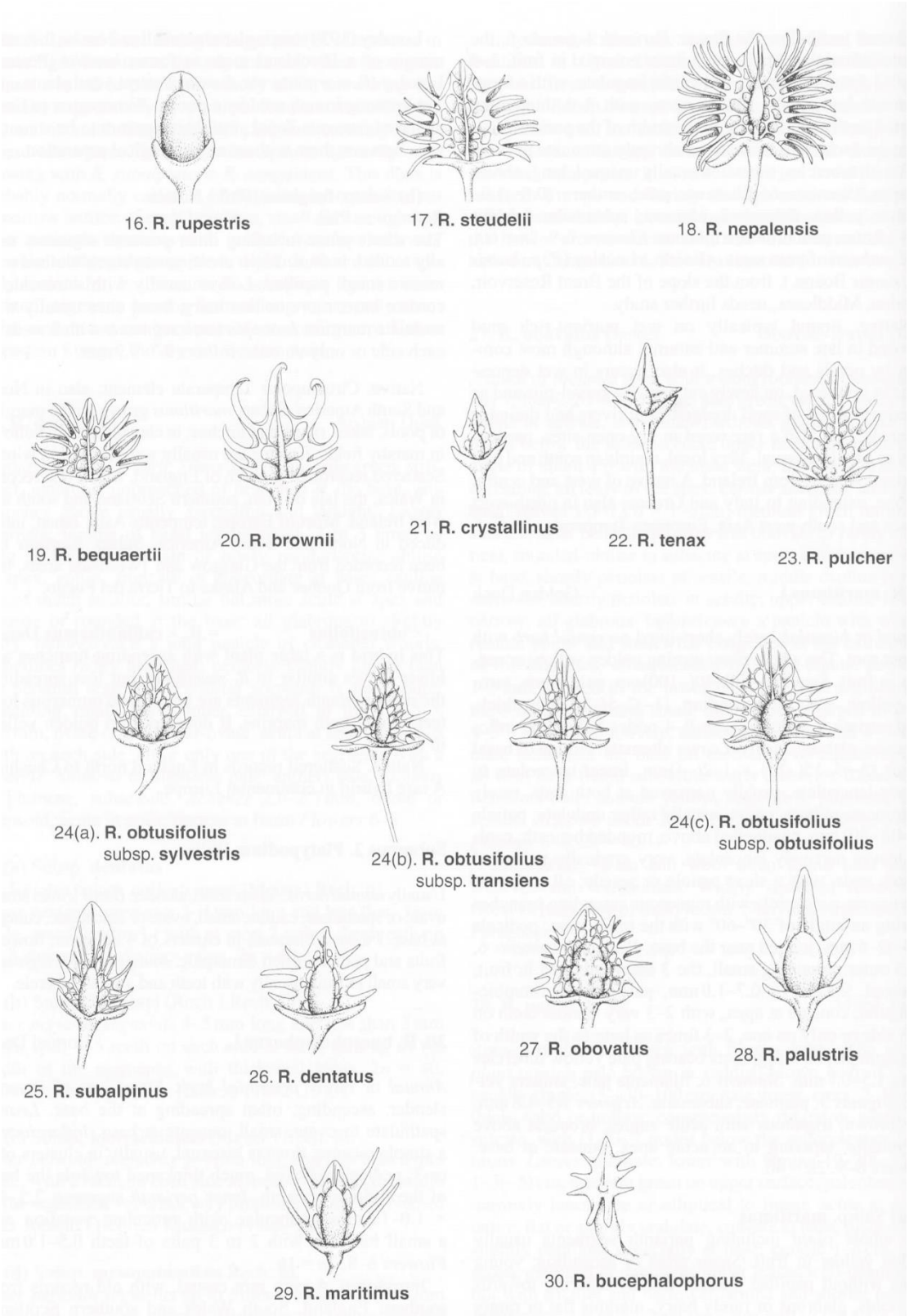



***Persicaria fruits and achenes***

***A, B**: P. lapathifolia – **C**: P. maculosa – **D**: P. minor – **F**: P. hydropiper*




***Fruits of Rumex: Sheet 1***




***Fruits of Rumex: Sheet 2***

# Goosefoots and their relatives: Amaranthaceae

This section will be added in a later issue. Meanwhile, there is a fuller guide to the family produced for an earlier dedicated workshop on the Hants Plants web site:
(https://hantsplants.uk/assets/documents/guides/Amaranthaceae%20Workshop%20Notes.pdf)

This now needs updating for current ideas on taxonomy but should still be useful. Like many of the workshop notes for individual families, it includes keys down to species level.

# References and further reading

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**p. 7**: adapted from Hickey & King, *Common Families of Flowering Plants*

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**p. 40**: *Persicaria maculosa* from Butcher, *A New Illustrated British Flora*, vol. 1
*Koenigia islandica* from Ross-Craig, *Drawings of British Plants,* fasc. XXVI

**p. 41**: *Persicaria campanulata, Bistorta amplexicaulis* from Clement, Smith and Thirlwell, *Illustrations of Alien Plants of the British Isles*

**p.42**: *Oxygonum alatum* from Hooker, *Icones Plantarum* vol. 14
*Fagopyrum cymosum* from Clement, Smith and Thirlwell, *Illustrations of Alien Plants of the British Isles*

**p. 43**: *Polygonum maritimum* from Akeroyd, *Docks and Knotweeds of Britain and Ireland*
*Fallopia baldschuanica* from Clement, Smith and Thirlwell, *Illustrations of Alien Plants of the British Isles*

**p. 44**: *Muehlenbeckia complexa, Reynoutria sachalinensis* from Clement, Smith and Thirlwell, *Illustrations of Alien Plants of the British Isles*

**p. 45**: *Rheum palmatum, Rumex acetosella* from Akeroyd, *Docks and Knotweeds of Britain and Ireland*

**p. 46**: *Rumex conglomeratus, Oxyria digyna* from Akeroyd, *Docks and Knotweeds of Britain and Ireland*

**p. 47**: *Emex spinosa* from Akeroyd, *Docks and Knotweeds of Britain and Ireland*
*Persicaria* fruits adapted from Jonsell ed., *Flora Nordica* vol. 1

**pp. 48-49**: *Rumex* fruits from Sell & Murrell, *Flora of Great Britain and Ireland*, vol. 1