HAMPSHIRE FLORA GROUP

ASTERACEAE WORKSHOP

27th September 2009

Introduction

The Asteraceae (or Composite family) is the largest family of dicotyledonous flowering plants in the world, with estimates of species numbers from 22,000 – 28,000. They are also one of the most successful, with a great range of growth forms, from trees to succulents to tiny weeds and even aquatic plants, adapting them to most environments. They grow from the Arctic to the Equator, although particularly prominent in the subtropics and mountainous parts of the tropics. Some species' adaptive success may be due to their ability to produce a battery of chemicals that make them unpleasant or toxic to creatures that try to eat them.

The huge number of species taken into gardens and often developed into many cultivars attests to their attractive, often showy features. Yet the beautiful and elegant structure and arrangement of flowers, even in some of the dingiest weeds, makes them a pleasure to study.

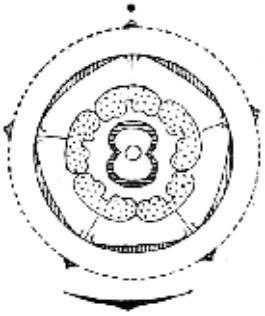
Many species, both ornamental and otherwise, come from Mediterranean or other warm-temperate climate zones. Consequently they are becoming increasingly naturalised in Britain and one needs to be able to track down exotic species that may not be immediately familiar (or may be deceptively similar to plants one already knows). On the other hand, many species used to come in as seed or wool-shoddy contaminants and are now very rarely seen, although some are still listed in the handbooks.

We have tried to make the keys cover as many alien species are possible; this makes them rather more technical than they would have to be for a field guide to native plants only, but it should also mean fewer dead-ends or uncertainties when encountering unusual plants.

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).

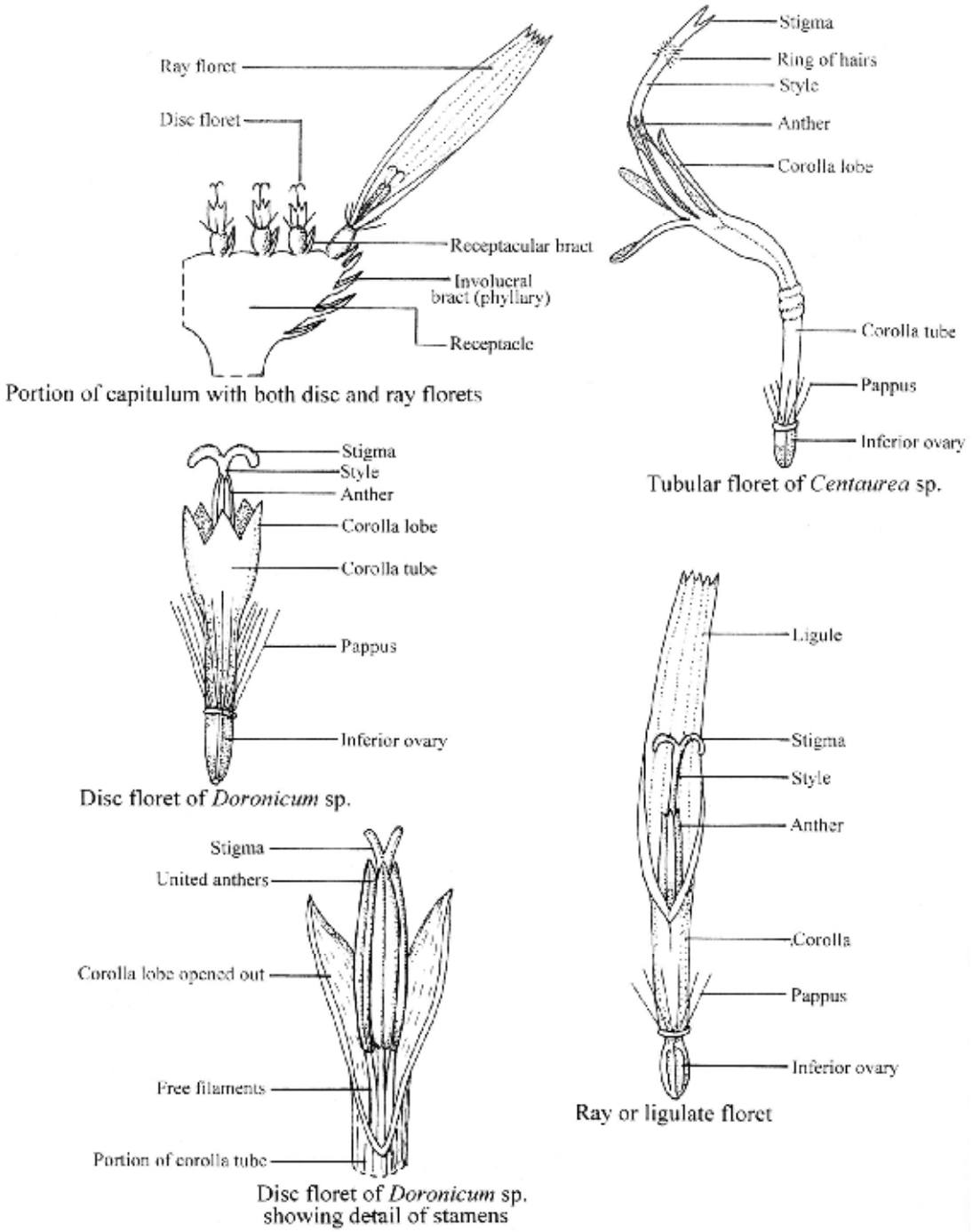
This is not the only family that has such an arrangement, the best example in the British flora being the Dipsacaceae (Teasel and Scabious family) – think of the Scabious genera *Knautia* and *Scabiosa*. Here we must look at differences in the flower structure. Asteraceae have five stamens, which arise 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 they stamens grow free from the base of the flower and not from the corolla.



Plan section of a thistle flower

In other British families with crowded heads of flowers, the florets are usually borne on at least a short stalk.

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**). A few, 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 tricky) identification feature.

The receptacle as a whole 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**. 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 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 ovary is surmounted by the actual calyx of the flower, which however 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.

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**.

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

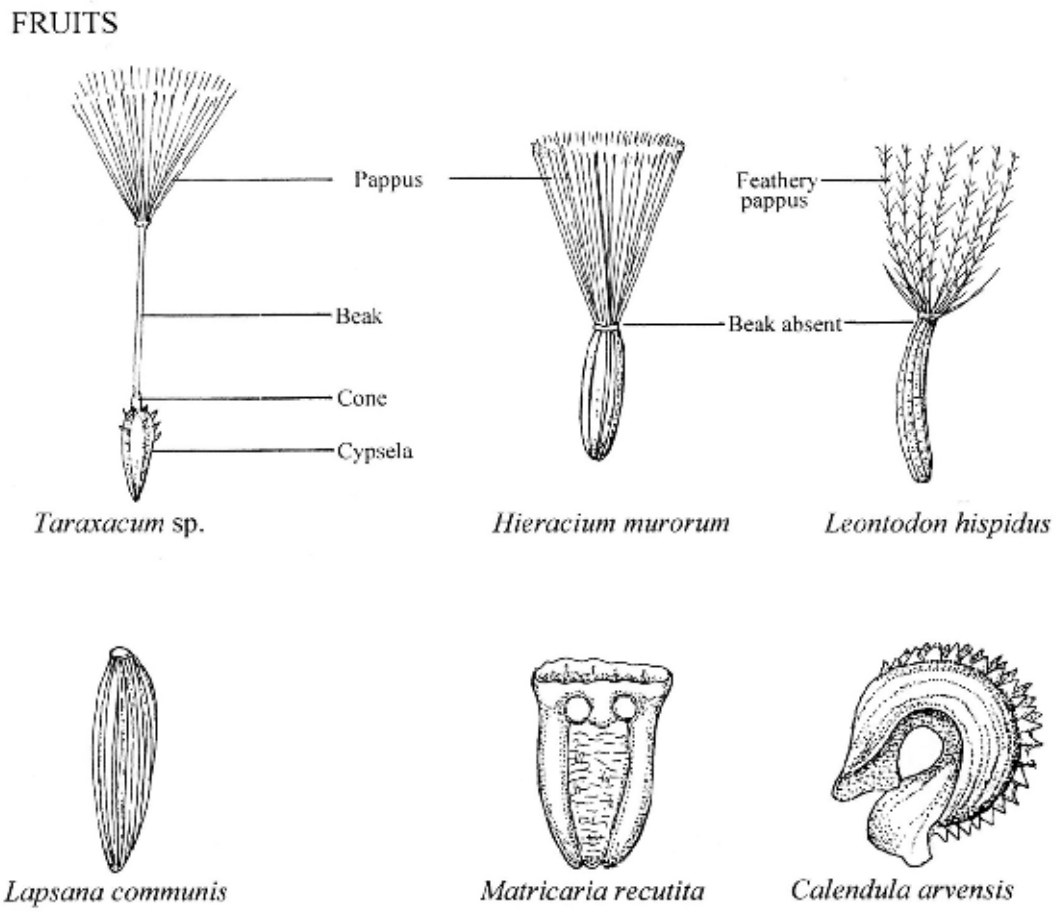
A single style arises from the top of the ovary, and this usually branches at the tip into two stigmas, which may be long and prominent.

As mentioned, the 5 stamens arise from the sides of the corolla tube 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.

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 a number of 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.

Fruit



(Please note that the illustration above has the fruit of *Tripleurospermum inodorum* incorrectly labelled as *Matricaria recutita.*)

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.

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 100 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 **Tribes** that is the conventional way of ordering them.

Seventeen tribes are normally defined, but readers will be relieved to hear that some of these are tropical. 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*, 2nd Edition, as this is what most people will have access to. There are notes on where Sell and Murrell diverge.

Cardueae: Thistles and their ilk

Also known as Cynareae (e.g. Sell and Murrell). Plants have no milky latex; they are often spiny. All the florets are tubular, although it is not unusual for the outermost ones to be longer and to look like ray florets from a distance. The style has a ring of hairs just below where it branches. Anthers have a "tail" and a long appendage at the top. Flower colours most commonly range from red through purple to blue, sometimes white (and albinos often occur), more rarely yellow.

This tribe includes all the species that one is likely to recognise as a thistle or a thistle relative. Amongst the widespread native genera are Burdocks (*Arctium*), Carline Thistles (*Carlina*), Thistles (*Carduus* and *Cirsium*), and Knapweeds (*Centaurea*). We go into more detail on some of these later.

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.

The Milk-thistles (*Silybum*), from the Mediterranean, have boldly marked leaves and very spiny involucral bracts. They turn up occasionally, especially along the coast.

Saw-worts (*Serratula*) completely lack spines (though they are often rather bristly), and resemble the Knapweeds (*Centaurea*); but whereas the Knapweeds have a conspicuous toothed or spiny appendage on their involucral bracts, Saw-worts have entire bracts merely fringed with hairs. On the receptacle itself they have chaffy scales rather than the bristles of Knapweeds.

Lactuceae: dandelion-like flowers

Also known as Cichorieae (e.g. Sell and Murrell). All members of the tribe produce a **latex** (rubbery white or coloured sap) although some (e.g. Dandelions *Taraxacum* and Lettuces *Lactuca*) produce it to a greater degree and others (e.g. most Hawkweeds *Hieracium*) to a lesser. All florets are ligulate and bisexual, and almost all (certainly all natives and common aliens) have 5 lobes at the tip of the ligule. Anthers have "tails" and a long appendage at the top. The style is evenly hairy over its length, including the branches, often with a mixture of long and short hairs. The commonest flower colour is yellow although orange, purple, pink and blue also occur.

This tribe includes all the Dandelion-like and Lettuce-like flowers. Although the number of genera involved isn't huge in Britain (20-25, depending on how many obscure aliens you count), they include several superficially similar ones that give problems to beginners. There are two (Dandelions *Taraxacum* and Hawkweeds *Hieracium*) that are also notoriously difficult for experts, because they are apomictic and give rise to microspecies many of which are found only in isolated populations. A third genus (Mouse-ear Hawkweeds, *Pilosella*) is also challenging, because half the taxa interbreed and give rise to hybrids that are fertile to a greater or lesser degreee, but can spread by stolons; and the other half have arisen by chromosome doubling from the hybrids, gone apomictic (and therefore tend to accumulate variation by mutation) but can still produce fertile pollen and cross with the out-breeding species! You may be relieved to know that, unlike the botanists in the hills and mountains of central and Southern Europe, we have rather few species to contend with.

We deal with the main genera in a later section, so what follows is a mention of some plants that may be less familiar.

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.

Unusually, the Chicories (*Cichorium*) have blue, pink or white flowers. Notice how nicely the typical Composite arrangement of style and anthers is shown off in this plant!

Scorzonera (Viper's Grass and Black Salsify) is unusual in this tribe for having entire (unlobed and untoothed) leaves, a feature it shares with the Goat's-beards (*Tragopogon*). The native species *Scorzonera humilis* is now very rare and only found in Dorset and South Wales. However the Black Salsify *Scorzonera hispanica* has become something of a fashionable vegetable again and may turn up on roadsides and waste ground.

Arctotidae: Treasure-flowers, and other garden escapes and aliens

Flowers of two kinds: tubular disc florets and ligulate, entirely sterile ray florets with 3 or 4 lobes at the apex of the ligule. Anthers have no tails or very short tails and the appendage at the tip usually sits on a "stalk" above the anthers. Ray floret colours vary from cream to orange, occasionally pink or purple, and disc florets from yellow to almost black.

These are all aliens and the ones most likely to turn up in Britain are ornamental.

This is the genus that you are most likely to come across, *Gazania* (Treasureflower). It is naturalising along the Hampshire coast, for instance. While the tribe as a whole may be difficult to separate from ornamental genera in other tribes, this is distinctive for its 4-lobed ligules (though these are not very obvious).

Berkheya (African Thistle) is yet another genus you might mistake for a Thistle; but note its combination of tubular (fertile) and ligulate (sterile) florets.

Gnaphalieae: Cudweeds

We have followed Sell and Murrell rather than Stace in separating this tribe out from the next (Inuleae); otherwise the description becomes so generalised as to be almost useless. Even so, a difficult tribe to characterise, but mostly with papery or chaffy involucral bracts. The only receptacular scales, if they occur, are at the margins and hard to distinguish from the involucral bracts. Flowers either all tubular (in fact all those you are likely to meet in the wild in Britain are so), or tubular and ligulate, white, yellow or brownish. Anthers with tails (sometimes short).

This tribe includes some of the Composites you may get least excited about, including some rather dingy weeds on the face of it; but even these can have their charms on closer examination.

The main native genera are *Filago* and *Gnaphalium* (Cudweeds). Continental botanists tend to split these each into several genera, but the English floras keep them together.

Filago: all annuals; involucral bracts woolly for more than half their length, outermost more or less green; outer florets with receptacular scales. The innermost flowers have a pappus of simple hairs, while the outer flowers have few or none.

Gnaphalium: annuals or perennials; all involucral bracts membranous, glabrous or woolly only in lower half; no receptacular scales. All flowers have a single ring of hairs.

Pearly Everlastings (*Anaphalis*) look as though they have both disc and ray florets. In fact all their flowers are tubular, and the attractive white surrounds are involucral bracts. The native Mountain Everlasting (*Antennaria dioica*) is similar, and as the name implies bears male and female flowers on separate plants.

Inuleae: Fleabanes part 1

Another difficult tribe to characterise, although most British members are well-known and distinctive. Most plants in Britain are yellow-flowered perennials, with a few annuals, and most have both tubular and ligulate flowers, although in some cases the ligules can be very short. They are 3-lobed at the tip, sometimes obscurely so. Involucral bracts are herbaceous. The anthers have tails.

The genus *Inula* comprises perennial herbs. Hairs on the styles are confined to the top of the branches. The pappus is a single row of hairs that are themselves roughly hairy.

The genus is quite diverse in form: here, for instance, are the native Ploughman's Spikenard (*Inula conyzae*); the native Golden Samphire (*Inula crithmoides*); the introduced Elecampane (*Inula helenium*); and the introduced Hairy Fleabane (*Inula oculus-christi)*.

The Fleabanes in genus *Pulicaria* are very similar in general appearance to *Inula*, but have one diagnostic difference; the pappus is made up of an inner ring of hairs, and an outer ring of scales (sometimes fused into a toothed cup).

The commonly planted and sometimes naturalised Yellow Ox-eye (*Telekia*) has only a ring of fused scales, forming a "crown" on top of the achene.

Astereae: Asters, Golden-rods, Fleabanes part 2, and the humble Daisy

Mostly perennial herbs, with some annuals and some shrubs. Flowers are either all tubular or tubular and ligulate, but the ligule can sometimes be very short and inconspicuous and outer florets are then rather thread-like. Flower colour is very diverse. The receptacles have no scales. The involucral bracts are in several overlapping rows, usually herbaceous, and smaller towards the base of the involucre. The anthers lack tails, and the styles are densely hairy towards the tip of the branches. The pappus is usually hairy, sometimes absent or bristly.

The Asters (*Aster*), which are covered in more detail later, and the two genera of Fleabane (*Erigeron* and *Conyza*) are not easy to separate from each other.

The Golden-rods (*Solidago*) have flowers all yellow, both tubular and ligulate although the ligules are often tiny. The pappus has simple, smooth, more or less equal hairs.

Michaelmas Daisies and their relatives have yellow disk florets and ray florets that are white, red, blue or various colours in between. (The rare native Goldilocks Aster *Aster linosyris* has no ray florets.) The pappus hairs are minutely toothed. A difficult genus because of hybridisation and the many introduced cultivated forms of Michaelmas Daisy.

While in some species there is a distinct short outer-row of pappus hairs or scales, we can do no better than quote Peter Sell: “Although they form natural groups, the separation of *Erigeron* and *Conyza* from *Aster* is not possible morphologically and many plants are placed in their genus by the jizz of the plant. That there is a general agreement among authors as to which species belong to which genus is fascinating.” What’s more, native *Erigeron* and alien *Conyza* are beginning to hybridise in Britain.The ligulate florets on *Conyza* may be absent or the ligules very short.

From top to bottom: the introduced *Erigeron karvinskianus*; Blue Fleabane *Erigeron acer*; and the alien weed Canadian Fleabane *Conyza canadensis*.

The Daisybushes (*Olearia*) are evergreen shrubs with flowers very much like Michaelmas Daisies. They are widely grown in milder parts of Britain and are likely to become increasingly common in the wild.

Daisies (*Bellis*) might seem out of place in this tribe; their flowers are more like many of the Anthemidae (Chamomiles, Ox-eye Daisies etc.) and they have no pappus. However their leaves are undivided and their involucral bracts are all green, whereas those of Anthemidae have membranous margins.

Anthemideae: Mugworts and most of the daisy-like flowers

Annual and perennial herbs and a few shrubs. The involucral bracts have membranous margins and a membranous tip. The flowers are either all tubular or tubular and ligulate, and most commonly the disc florets are yellow and the ray florets are white, but there are exceptions. Anthers are without tails. Receptacular scales may be present or absent. The pappus is either absent, or a very short ridge running around the top of the achene.

We deal with many of the daisy-like flowers later, so the following illustrations look at some of the other genera.

Mugworts (*Artemisia*) might be viewed as the "odd men out" in this tribe and are quite distinctive. They have tubular flowers only, with either all flowers hermaphrodite or the outer ones female only. Flower colours are yellow or reddish. They are mostly aromatic plants (some strongly so) with narrowly divided leaves. They have no receptacular scales and no pappus.

Yarrows (*Achillea*) mostly have both tubular and ligulate florets, typically of a single colour or with the disk florets of a rather darker shade; most commonly off-white, but also yellow or pink. The ligules are often few in number and 3-lobed, unlike Tansies (*Tanacetum*), for instance, that are 5-lobed. They have narrow, chaffy receptacular scales and no pappus.

The alien Buttonweeds (*Cotula*) have all flowers tubular but the outermost row is female and in some species has no corolla at all, and the inner are hermaphrodite and, unusually, 4-lobed. There are no receptacular scales and no pappus.

Senecioneae: Ragworts, Butterburs and their ilk

This tribe brings together many of the the Ragwort-like flowers (mostly all-yellow Daisy-like flowers, with or without ray-florets) with the very different Butterburs (*Petasites*) and other genera. They are herbs or shrubs, and the involucral bracts are either in one row and all roughly the same length, or in one main longer row with an outer much shorter row. Where ligules are present they are 3-lobed at the tip. Anthers are almost always without tails. There are no receptacular scales. The pappus is of simple, smooth or minutely toothed hairs.

Yellow-flowered Daisy-like flowers are dealt with below, so the following illustrations cover other genera.

Shrub Ragworts (*Brachyglottis*) are very widely planted, often *en masse* along roadsides, and can be persistent. Florally they are very close to Ragworts (*Senecio*).

Leopard's-banes (*Doronichum*) have broad leaves and relatively few, large flowering heads. Unusually for the tribe, they have two rows of involucral bracts all more or less the same length. They have been grown as garden plants for centuries and several species and hybrids escape.

Colt's-foot (*Tussilago*) is one of the most distinctive members of the tribe and there is only the one species in the genus.

The Butterburs (*Petasites*) are unusual in being more or less dioecious, with male or female flowers on separate plants. "More or less" because the male heads may have a few tubular female flowers around the margin. The Winter Heliotrope *Petasites fragrans* is probably one of the fastest-spreading introductions in southern Britain, now common on damp disturbed roadsides.

Calenduleae: Marigolds

By now you may be growing weary of yellow(ish)-flowered Daisies, but mercifully this tribe in Britain consists of no more than one garden escape and one casual weed. It is very similar to the Senecioneae but there is no pappus.

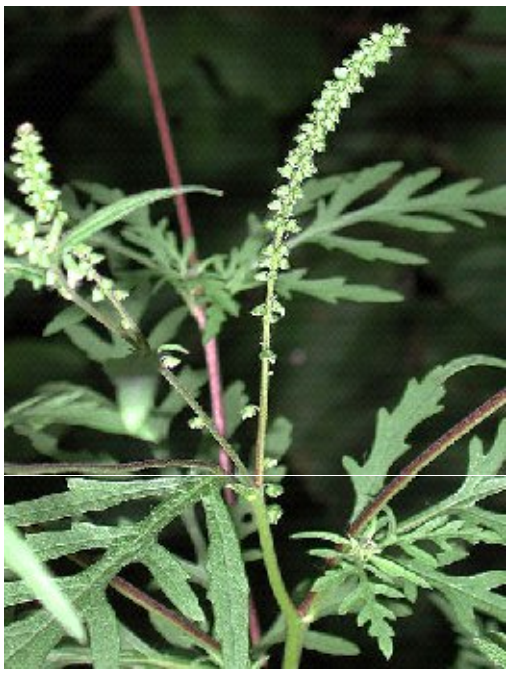
Marigolds (*Calendula*) account for both the species found escaped into the wild in Britain so far, although *Osteospermum* are now also popular garden plants.

Heliantheae: Bur-marigolds and assorted aliens

This tribe includes the Sunflowers (*Helianthemum*), a couple of native species of Bur-marigold (*Bidens*) and a wide range of assorted aliens. It is unusual and distinctive in having plants with mostly opposite leaves, at least in their lower parts. There are one or more rows of involucral bracts, usually green though the innermost may be chaffy. Receptacular scales are usually present. When ligulate flowers are present, they are 3-lobed and often sterile, sometimes female.. Anthers are without tails. The pappus is often absent or minute but can consist of a beak, scales or barbed bristles.

There are numerous showy garden plants in this tribe, including *Rudbeckia*, *Coreopsis*, *Cosmos*, *Dahlia* and *Tagetes* as well as crop plants and some rather weird and wonderful weeds.

The Ragweeds (*Ambrosia*) have an unusual floral regime: they are monoecious – that is, their male and female flowers are borne separately on the same plant and in this case in separate capitula. The male capitula are in racemes at the top of the plant and have several flowers. Unusually for the family, the anthers are more or less separated. The female flowers occur one to a capitulum in leaf axils below. They lack both a corolla and a pappus, but the involucral bracts are joined to the ovary and carry a ring of spines.



The Cockleburs (*Xanthium*) are similarly anomalous, with monoecious capitula but bearing two flowers in the female head. As you can see, the female involucral bracts are armed with beaks or spines.

With the Sunflowers (*Helianthus*) one returns to a more conventional Composite floral arrangement. The ray florets are all sterile and the tubular florets bisexual. The receptacle has scales that partly enclose the achenes. The pappus consists of two awns that quickly drop off.

Galinsoga is a genus of New World weeds that turn up quite frequently. They have just 5 white female ligulate florets, surrounding hermaphrodite yellowish tubular florets. They have a pappus (when present) of scales.

The Bur-marigolds (*Bidens*) include our only native plants in this tribe. Usually they have bisexual tubular flowers alone, but may produce showy sterile ligulate flowers in some forms of several species. They have an outer ring of green involucral bracts and an inner ring of membranous ones. The most striking feature is the pappus which comprises between 2 and 5 solid, barbed bristles.

Eupatorieae: Hemp Agrimonies

The Eupatorieae is another tribe with opposite leaves. Apart from the garden *Ageratum*s which occasionally escape, it is represented by just one species in the wild in Britain. All flowers tubular and hermaphrodite, pink or whitish-purple. The capitula are numerous, small and not obviously Composite-like until close inspection. Involucral bracts in 2 or 3 rows, often flushed pink and membranous at the margins. Receptacle without scales and pappus of 1 row of minutely toothed hairs.

Hemp Agrimonies (*Eupatorium*): all flowers tubular and hermaphrodite, pink or whitish-purple. The capitula are numerous and small and not obviously Composite-like until close inspection. Involucral bracts in 2 or 3 rows, often flushed pink and membranous at the margins. Receptacle without scales and pappus of 1 row of minutely toothed hairs.

In more detail

"Thistles"

Here we look at spiny plants with all flowers tubular. There are a few spiny aliens with some or all of the flowers ligulate: see the previous section for examples.

General key

1a. Flowers occuring each in its own capitulum ..... *Echinops* (Globe Thistlea)
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 8

4a. Pappus of feathery hairs (*Cirsium*)..... 5
4b. Pappus otherwise or non-existent..... 6

5a. Upper stem with few small leaves; capitula nodding ..... *Cirsium eristhales* (Yellow Thistle)
A very rare alien from central-southern Europe
5b. Upper stem with large leaves overtopping the capitula ..... *Cirsium oleraceum* (Cabbage Thistle)
A rare alien, quite common on the immediate Continent

6a. 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)
6b. Capitula surrounded by leaves or large outer involucral bracts; prominent spines on involucral bracts, edges to leaves with small or weak spines..... 7

7a. Pappus of two rows of rigid hairs; flowers yellow ..... *Cnicus benedictus* (Blessed Thistle)
A rare casual
7b. Pappus absent; flowers deep orange..... *Carthamus tinctorius* (Safflower)
A rare casual

8a. Pappus hairs feathery..... 9
8b. Pappus hairs not feathery..... 11

9a. Innermost involucral bracts with a spine abruptly delimited from the base; often clusters of spines at leaf base and midrib ..... *Cynara cardunculus* (Cardoon)
A rare garden escape
9b. Involucral bracts, if spiny, then gradually narrowed into spine..... 10

10a. Outer involucral bracts leaf-like; inner membranous, pale yellow within and resembling ligulate flowers; flowers "everlasting"..... *Carlina* (Carline Thistles)
10b. All involucral bracts linear-lanceolate to ovate ..... *Cirsium* (Thistles)

11a. Leaves with sharp spines..... 12
11b. Leaves without spines 14

12a. Receptacle glabrous, although achene pits fringed with teeth ..... *Onopordon* (Scotch Thistles)
12b. Receptacle densely hairy or bristly..... 13

13a. Stem leaves running down the stem in a spiny wing; involucral bracts untoothed but with a terminal spine *Carduus* (Thistles)
13b. Leaves variegated; stem leaves not running down the spine, stems not spiny; outer involucral bracts with spine-tipped lobes..... *Silybum marianum* (Milk Thistle)

14a. Flowers always hermaphrodite and of the same size; tip of involucral bract membranous but not separated from the rest by a constriction..... *Acroptilon repens* (Russian Knapweed)
A very rare alien
14b. 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.

General key

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 maculatus* (Spotted Golden-thistle)
Very rare casual
2b. Plant not thistle-like, leaves not spiny 3

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

4a. Leaves all basal; stalks much swollen below the capitulum ..... *Arnoseris minima* (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 communis* (Nipplewort)
5b. Capitula 4-5mm in diameter; outer involucral bracts enfolding achenes, spreading like a star in fruit
..... *Rhagadiolus stellatus* (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 ..... *Leontodon autumnalis* (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 hieracioides* (Hawkweed Ox-tongue)
11b. Outer involucral bracts broadly ovate, much broader than inner, cordate at base
..... *Picris echioides* (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. Thistly plant with strongly spiny leaves; receptacular scales present and enclosing achenes; pappus hairs 4 or less, rigid and barbed..... *Scolymus hispanicus* (Golden-thistle)
A rare casual
13b. Leaves not or weakly spiny; receptacular scales usually absent; pappus hairs numerous 14

14a. Achenes distinctly flattened 15
14b. Achenes not flattened, or slightly flattened 17

15a. Achenes with a distinct narrow beak or at least markedly narrowed at the top 16
15b. Achenes without a beak and not, or scarcely, narrowing at the top.....*Sonchus* (Sow-thistles)

16a. Involucral bracts in several rows of varying length; pappus hairs in 2 rows of equal length .....*Lactuca* (Lettuces)
16b. Involucral bracts in two unequal rows, outer conspicuously shorter than inner; pappus hairs in 2 rows of unequal length .....*Mycelis muralis* (Wall Lettuce)

17a. Stems without leaves or scales or stolons, smooth and conspicuously hollow; capitulum always 1 per stem .....*Taraxacum* (Dandelions)
17b. Stems with leaves or scales, or else with srolons; capitula often more than 1 per stem..... 18

18a. Inner achenes with pappus of rigid hairs swollen and minutely bristly at base .....*Tolpis barbata*
A rare casual
18b. Pappus all of soft hairs not swollen at base 19

19a. Receptacle with long silky hairs at least as long as the flowers arising from the margins of the achene-pits .....*Andryala integrifolia*
A very rare, perhaps vanishing, casual
19b. Receptacle without hairs, or hairs short..... 20

20a. Pappus hairs pure white..... 21
20b. Pappus hairs yellowish to pale brown 22

21a. Plant with long thin rhizomes and whitish tubers; capitulum never more than 1 per stem; involucral bracts in several rows.....*Aetheorhiza bulbosa* (Tuberous Hawk's-beard)
A rare but persistent garden weed
21b. 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)

22a. Involucral bracts in two rows, the outer shorter than the inner; achenes narrowed or beaked at top..... 23
22b. Involucral bracts in several rows; achens widening towards a truncate top..... 24

23a. Perennial herb; keaves lobed but never deeply dissected; achenes unbeaked, slightly narrowed towards top; pappus of 1 row of stiff brittle brownish hairs..... *Crepis paludosa* (Marsh Hawk's-beard)
A plant of wet places in northern Britain
23b. Annual or occasionally longer-lived herb; stem leaves deeply dissected especially near the base; inner achenes slender and finely beaked, outer stout and shortly beaked or unbeaked; pappus of 2 rows of dirty white hairs ..... *Crepis foetida* (Stinking Hawk's-beard)
Now a very rare native on shingle and a very rare casual elsewhere

24a. 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)
24b. 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)

Most people will learn to separate the main native genera of these plants without too much difficulty, without needing a key. *Crepis* (Hawk's-beards) and one group of *Hieracium* (Hawk's-beards) can give problems at first glance, but they can always be unambiguously separated on the basis of their involucral bract arrangements.

The main trio that can cause trouble is *Leontodon* (Hawkbits), *Hypochaeris* (Cat's-ears) and *Crepis* (Hawk's-beards). There are several reasons for this: the superficial similarities of several species (and sometimes their habitats); the exceptional variability in at least two of the species (*Leontodon autumnalis* and *Crepis capillaris*); and the fact that *Leontodon* really falls into two different groups, making it difficult to describe without over-generalising. In fact Sell and Murrell have separated *Leontodon autumnalis* into a separate genus, *Scorzonerioides*. Worldwide, *Leontodon* and *Picris* can be difficult to separate, but fortunately in Britain the latter are usually easily distinguished by their leafy stems as well as their different hair structure. On young or rabbit-munched plants of *Picris hieracioides*, basal leaves can look like *Leontodon hispidus*. But the hairs on the leaf still work well and the characteristic more or less entire, wavy edges of the basal leaves are distinctive once known.

Here are some hints to make it easier.

- Only *Leontodon hispidus* and *Leontodon saxatilis* have forked hairs on their leaves and stems.
- All species except *Leontodon hispidus* and *Leontodon saxatilis* can have branched stems.
- *Crepis* have leaves on the stem and these are often clasping at the base, especially in the middle of the stem. *Hypochaeris* and *Leontodon autumnalis* have small scale-like bracts on the stem; the other *Leontodon* have none.
- *Hypochaeris* have receptacular scales; *Leontodon* never do although the receptacle may be hairy. Amongst the *Crepis*, only the vanishingly rare *Crepis foetida* may have scales, although many species can have hairs around the achene pits.
- *Crepis* have simple pappus hairs; *Leontondon* have feathery pappus hairs; *Hypochaeris* have outer achenes scabrid or weakly feathery, the inner feathery.

Crepis capillaris, Leontodon autumnalis, Hypochaeris radicata

White and yellow "daisies"

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

General key

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

2a. Leaf-lobes linear to thread-like ..... *Cosmos bipinnatus* (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 bipinnata* (Spanish Needles)

4a. At least the central flowers with a pappus of hairs 5
4b. Pappus a membranous rim, scales, bristles or absent 11

5a. Outer involucral bracts broader than inner and leafy..... *Callistephus chinensis* (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 10

7a. Involucral bracts in a series of rows, innermost longest 8
7b. Involucral bracts in 1 main row, sometimes with smaller basal ones 9

8a. Capitula 25-30mm in diameter; involucral bracts broadly rounded at apex, pale green at base and darker green in upper third, with minute glandular hairs; ray florets 6-12
..... *Aster schreberi* (Nettle-leaved Michaelmas Daisy)
Very rarely naturalised
8b. Capitula 10-16mm in diameter; involucral bracts narrowed to a more or less acute apex, uniform green except for reddish-purple tips, eglandular; ray florets 10-16 ..... *Aster cordifolius* (Blue Wood Aster)
Occasional persistent garden escape

9a. Leaves pinnately veined; involucral bracts in one main row, with small ones at base of capitulum
..... *Senecio smithii* (Magellan Ragwort)
Rarely naturalised, mainly in the extreme North
9b. Leaves palmately veined; capitula without small basal involucral bracts ..... *Pericallis hybrida* (Cineraria)
A popular but frost-sensitive pot plant, naturalised in SW

10a. Involucral bracts uniformly green, or greener at tip than at base; ligules more than 1mm wide
..... *Aster* (Michaelmas Daisy)
10b. Involucral bracts greener at base than tip; ray florets less numerous than disc florets; ligules more than 1mm wide..... *Erigeron* (Fleabanes)
10c. Involucral bracts greener at base than at tip; ray florets usually more numerous than disc florets but often obscure, ligules less than 1mm wide and often very short..... *Conyza* (Fleabanes)

11a. Receptacular scales or bristles present 12
11b. Receptacular scales and bristles absent (sometimes short fringe of hairs round achene pit) 13

12a. Corolla of disc florets with a small pouch at base, hiding the top of the ovary from one direction
..... *Chamaemelum* (Chamomiles)
12b. Corolla of disc florets without a pouch, not hiding the top of the ovary ..... *Anthemis* (Corn Chamomiles)

13a. Pappus of 1-8 barbed persistent bristles and minute incurved scales ..... *Calotis cuneifolia* (Purple Bur-daisy)
Very rare casual
13b. Pappus a minute rim or absent..... 14

14a. Robust garden perennials; leaves deeply pinnately divided; receptacle conical; pappus entirely absent
..... *Chrysanthemum* (garden Chrysanthemums)
14b. Not as above 15

15a. Rosette plant; capitula solitary on leafless stems..... *Bellis* (Daisies)
15b. Flowering stems with leaves 16

16a. Stem leaves shallowly to deeply toothed or lobed but not divided to midrib, the teeth simple 17

16b. Stem leaves pinnately lobed or divided to midrib or nearly so, the lobes also divided 19

17a. Ligules less than 10mm long..... *Tanacetum* (Tansies)
17b. Ligules longer than 10mm..... 18

18a. Tubular part of ligulate flower not winged; coming into flower late (September onwards)
.....*Leucanthemella serotina* (Autumn Ox-eye Daisy)
A fairly frequent garden escape
18b. Tubular part of ligulate flower with 2 narrow transparent rings..... *Leucanthemum* (Ox-eye Daisies)

19a. Terminal leaf segments lanceolate to ovate, flat..... *Tanacetum* (Tansies)
19b. Terminal leaf segments linear or thread-like, not flattened or hardly so 20

20a. Achenes with 4-5 ribs, without resin glands; scented especially when fresh
.....*Matricaria* (Scented Mayweeds)
20b. 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 give 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" charater
- The achenes of *Chamaemelum* are very faintly ribbed only on the inner face only; *Tripleurospermum* achenes are also ribbed on the inner face only, but also bear resin glands on the outer face.



Anthemis arvensis, Matricaria recutita, Tripleurospermum maritimum

Life has become more complicated with *Anthemis* (Corn Chamomiles) lately because of the introduction of alien species as components of wild flower mixes, and other naturalising species. Here is a key to the daisy-like species.

Anthemis key

1a. At least the outer receptacular scales toothed at tip..... 2
1b. Receptacular scales not toothed at tip..... 3

2a. Capitula 40-63mm in diameter; achenes unribbed or faintly ribbed.....*A. punctata* (Sicilian Chamomile)
Garden plant naturalised mostly near the coast
2b. Capitula 15-35mm in diameter; achenes with quite thick obtuse ribs .....*A. ruthenica* (Eastern Chamomile)
So far a rare casual, but to be looked out for

3a. Receptacle with scales only towards centre, scales linear; achenes with bumps on ribs
.....*A. cotula* (Stinking Chamomile)
3b. Receptacle with scales all over, scales oblong or oblanceolate; achenes striate or with smooth ribs
..... 4

4a. Leaves with short ultimate segments; achenes not compressed, with 9-10 ribs; receptacular scales becoming rigid in fruit .....*A. arvensis* (Corn Chamomile)
4b. Leaves with longer, pectinate (comb-like) ultimate segments; achenes compressed, striate only with 2-3 lines on each face; receptacular scales becoming rigid in fruit ..... *A. austriaca* (Austrian Chamomile)
Turning up in 'wild flower' seed mixes in agricultural and municipal plantings, where it masquerades as *A. arvensis*

The Scentless Mayweeds (*Tripleurospermum*) are another awkward group, especially as they appear to hybridise and produce fertile offspring with introgression where they come together at the coast. You will almost certainly find tricky intermediates here. Sell and Murrell put them all into a single species.

Tripleurospermum key

1a. Annual; ribs on inner face of mature achene separated by at least 1/3 of the achene width; resin glands on outer face 1.5 times as long as broad, almost circular in outline ..... *T. inodorum* (Scentless Mayweed)
1b. Biennial or perennial; ribs on inner face of mature achene almost touching; resin glands usually twice as long as broad .....2 (*T. maritimum,* Sea Mayweed)

2a. Stems without purplish coloration, or only near the base; leaves with segments 0.6 – 1.0mm wide
..... *T. maritimum* subsp. *maritimum*
2b. Stems purplish-red to at least half way; leaves with densely packed segments 0.5 – 0.6mm wide
..... *T. maritimum* subsp. *vinicaule*

Ox-eye Daisy key

1a. Tubular part of ligulate flower not winged; coming into flower late (September onwards)
.....*Leucanthemella serotina* (Autumn Ox-eye Daisy)
A fairly frequent garden escape
1b. Tubular part of ligulate flower with 2 narrow transparent rings; coming into flower earlier 2

2a. Leaves up to 15cm; capitula 60-100mm in diameter; involucral bracts 11-15mm long
.....*Leucanthemum* x *superbum* (Shasta Daisy)
A frequent garden escape
2b. Leaves 1-8cm; capitula 25-75mm in diameter; involucral bracts 6-8mm long
.....*Leucanthemum vulgare* (Ox-eye Daisy)

Exploring some of the tricky groups

Burdocks

Let's be frank: Burdocks (*Arctium*) are a mess! First, the plants themselves show a lot of variation between and within the main forms described, and some of those forms also seem to be intermediate between others. Plants normally self-fertilise, leading to populations with local forms; but they are also capable of interbreeding within all the taxa described here. Secondly, there is no universal agreement on how they should be treated taxonomically and characterised.

The features that are generally agreed to be important are:

- Whether the basal leaf stems are solid or hollow
- The form of the inflorescence (a "free-form" raceme or a rather even-topped corymb)
- The length of the peduncles
- The dimensions of the involucre (measured on **ripe fruiting material**)
- The relative lengths of the corolla and its surrounding bracts

Other features not universally agreed on are the colour of the involucral bracts, and the arrangement of smaller clumps of heads in the raceme.

First, let's start with the traditional treatment: this is a synthesis of those used by Franklin Perring and in later editions of Clapham, Tutin and Warburg.

1a. Petioles solid; heads few, in a terminal more or less corymbose cluster; peduncles 3-10cm; fruiting involucre 35mm or more in diameter ..... *A. lappa*
1b. Petioles hollow; heads few-many in racemes with the top either a solitary head or a cluster of 2-4; peduncles absent or not more than 4cm; fruiting involucres up to 35mm in diameter 2

2a. Fruiting involucres 15-18mm long x 15-25mm broad; florets longer than surrounding involucral bracts ..... *A. minus*
2b. Fruiting involucres 20-25mm long x 30-35mm broad; florets about as long as surrounding involucral bracts 3

3a. Peduncles 1-4cm; involucre straw-coloured..... *A. pubens*
3b. Peduncles usually less than 1cm; involucre green or tinged with dark purple..... *A. nemorosum*

An alternative taxonomy developed by the continental botanist Duistermaat was taken up by Stace for the second edition of the *New Flora*. (The first edition followed the above.)

1a. Petioles of basal leaves solid, at least at base; inflorescence corymbose; peduncles of the terminal parts of the inflorescence at least 2.5cm long; involucres 20-33mm long x 30-47mm broad ..... *A. lappa*
1b. Petioles of basal leaves hollow, at least at base; inflorescence racemose to subcorymbose, if peduncles more than 2cm long then racemose; involucres 19-24mm long x 15-40mm broad 2

2a. Capitula at the ends of the inflorescence sessile; middle involucral bracts 1.7-2.5mm wide; involucre exceeding the corolla by 1.2-6.0mm; capitula 19-29mm long x 27-40mm broad ..... *A. nemorosum*
2b. Capitula at the ends of the inflorescence pedunculate or sessile; middle involucral bracts up ro 1.6mm wide; involucre shorter or longer than corollas; capitula 11-24mm long x 15-32mm broad..... *A. minus*

You will notice that this key does away with *A. pubens*, some putative individuals of which might key out under *A. lappa* here, but most under *A. minus*. Duistermaat and

Stace mention the existence of hybrids of these two species but discount them as the origin of *A. pubens*.
This treatment has proved problematic when applied to British material at least, and it is likely that future Floras will revert to earlier treatments.

Sell and Murrell have decided that all these taxa should be sunk under the one species *Arctium lappa*. Aside from that, they follow more traditional lines. It is worth quoting them at length: "There is continuous variation in size of capitulum between the large-headed subsp. *lappa* and the small-headed subsp. *minus*. In this account subsp. *lappa, nemorosum* and *minus* are narrowly defined and the remainder put in subsp. *pubens*. It is probable that subsp. *pubens* originated from hybridisation between subsp. *lappa* and subsp. *minus* with possible backcrossing with both parents. Thus, subsp. *pubens* is extremely variable and tends to form distinct local populations which are kept constant by predominant self-pollination. Much of subsp. *nemorosum* is outside the [*?geographical / ecological*] range of the other subspecies but comes in contact with subsp. *minus* where intermediates are difficult to separate from subsp. *pubens*… We do not understand the classification of Duistermaat (1996), whose conclusions differ radically from outs." This approach seems to be a practical one for naming material in Hampshire, at least, although it raises questions over giving subspecific status to *pubens*, in particular. It particularly overcomes the problem, quite frequently encountered in the wild, of plants with solid petioles or very small hollows that clearly do not match *lappa* fully. Many plants of the arable chalklands and river valleys of Hampshire are difficult to name and fall into this broad rather informal definition of *pubens*.

1a. Petioles solid 2
1b. Petioles hollow 3

2a. Capitula 30-43mm broad; involucral bracts green, glabrous or slightly arachnoid* -hairy and with minute glandular hairs ..... *A. lappa* subsp. *lappa*
2b. Capitula 20-25mm broad; involucral bracts usually tinted brownish-red, often very arachnoid-hairy ..... *A. lappa* subsp. *pubens*

3a. Capitula 15-25mm broad, subsessile or on peduncles up to 8mm; involucral bracts 7-15mm ..... *A. lappa* subsp. *minus*
3b. Capitula 20-40mm broad, sessile or on peduncles up to 40(-120)mm; involucral bracts 6-19mm 4

4a. Peduncles 5-40(-120)mm ..... *A. lappa* subsp. *pubens*
4b. Peduncles up to 8mm or capitula sessile ..... *A. lappa* subsp. *nemorosum*

* = cobwebby

Hardheads

Stace gives a single species for Hardheads or Common Knapweed, that being *Centaurea nigra* L., and comments that attempts to separate them into distinct taxa have not been successful in Britain.

However that has not tried many distinguished botanists trying, and it is worth summarising some of this treatment. The situation is complicated by two factors:

- All taxa occur in both rayed (i.e. with long marginal tubular florets) and unrayed forms.

- The “ghost in the machine”: The French Hardheads or Brown Knapweed *Centaurea jacea* used to occur as an introduction or casual in Britain. It now seems to have disappeared; but there has been debate about how much southern populations of Hardheads have been affected by introgression with this species. It would mainly manifest itself in the teeth of the bract appendage being irregular in length, and perhaps in the paler colour of the appendage.

The treatment in Clapham, Tutin and Moore is as follows.

1a. Stem stout, conspicuously swollen beneath the heads; appendages of involucral bracts concealing the pale basal parts of the bracts adjacent; teeth of appendages about equalling the undivided central portion .....*C. nigra* subsp. *nigra*
1b. Stem slender, not much swollen beneath the heads; appendages of involucral bracts not completely concealing the pale basal parts of the bracts adjacent; teeth of appendages longer than the undivided portion ..... *C. nigra* subsp. *nemoralis*

The consensus is that while there is a great range of intermediates between these, subsp. *nigra* is particularly the plant of the north and west, although its range extends over the whole of Britain, while subsp. *nemoralis* is almost restricted to the southern half of Britain.

Sell and Murrell follow the treatment by Dostal in *Flora Europea* and other Continental authors. This recognises two species and a number of subspecies.

1a. Involucre 15-20mm broad; appendages of involucral bracts more or less concealing the pale basal parts of the bracts adjacent; teeth of appendages about equalling the undivided central portion 2
1b. Involucre 9-14mm broad; appendages of involucral bracts not completely concealing the pale basal parts of the bracts adjacent; teeth of appendages longer than the undivided central portion 3

2a. Outer flowers scarcely longer than inner.....*C. nigra* subsp. *nigra*
2b. Outer flowers much longer than inner.....*C. nigra* subsp. *rivularis*

3a. Outer flowers scarcely longer than inner.....*C. debeauxii* subsp. *nemoralis*
3b. Outer flowers much longer than inner.....*C. debeauxii* subsp. *thuillieri*

Again, *C. debeauxii* is a plant of southern Britain particularly on lighter soils, and *C. nigra* is predominantly the plant of northern and western Britain, and in the south would mostly be found on damper soils. One could expect it to be widespread in the New Forest. The rayed form of *C. debeauxii* (subsp. *thuillieri*) is much commoner than the rayed form of *C. nigra* (subsp. *rivularis*), and in some places in Hampshire is the predominant form.

There is an entire book devoted to the British Knapweeds (see the References section). Whether you will feel much wiser after reading it is a moot point.

If you think you have a hard time in Britain with this group, just remember that there are 221 species recognised in *Flora Europaea*, many of them with numerous subspecies.

Hawkweeds

These two genera (*Hieracium* and *Taraxacum*) are among the most challenging groups in the family, because they reproduce apomictically (without sexual fusion),

populations thereby tending to perpetuate small variations accumulated through genetic mutation (known as "microspecies"). In each case hundreds of taxa are described for Britain alone, and the differences can be very subtle.
Space doesn't permit covering these two groups adequately in this workshop. With a little practice *Hieracium* can be put into **Sections** even if individual species can't be named. For further guidance see some of the works mentioned in the next section.

If you are planning to collect Hawkweeds then you must be systematic about it and judicious in your collecting.

- Don't collect from small populations; the whole stem, with basal leaves, is needed, but if you cut with a pruning knife at the top of the tap-root the plant will regenerate. (Think of it as coppicing!)
- Don't collect from damaged, diseased or browsed plants.
- Don't collect from sites with known rarities.
- Collect at first flowering. In practice this means that the species with 0 or 1 stem leaves should be collected by early June (April in the case of one or two species in Hampshire!); those with 2-8 stem leaves by early July; and the rest when they first flower, which can be as late as August or September in the case of *H. sabaudum*, for instance.
- Make notes **in the field** of the following characteristics, and make sure they stay with the right plant (a tied-on labelling system is the best way):
    - Colour and marking of leaves (both surfaces)
    - Colour of styles
    - Diameter of open flowers, to the tips of the ligules
    - Shape of buds

Asters

Britain has only two native species of *Aster*, which are distinctive plants (and one of them is rare). However they have been joined by a vast range of escaped plants loosely known as "Michaelmas Daisies". The number of species involved is not huge, but there are hybrids and many cultivars.

The most complete treatment for Britain will now be found in Sell & Murrell (see the References section). However the following key by Yeo for the *Plant Crib 1998* covers the taxa that are most widely naturalised, and those that are most likely to be confused. Because of the range of cultivars, the ligule colouring is probably not one of the best diagnostic characters to have chosen. Stace covers much the same area and has some simple illustrations; his keys and Sell's use colouring of the involucral bracts as a character, which can be tricky but helps to resolve some of the uncertainties arising from below. Nevertheless, expect to be baffled from time to time, especially by plants in the *A.* x *versicolor* and *A. novi-belgii* area.

1a. Inflorescence branches and involucre densely glandular-hairy; ray-florets reddish or pink... *A. novae-angliae*
1b. Inflorescence branches and involucre not glandular-hairy; ray-florets usually bluish or whitish..... 2

2a. Lower leaves tapering into a long, distinctly winged petiole, middle and upper leaves sessile, more or less clasping, all glaucous on both surfaces; involucral bracts whitish with a diamond of green in the tip, closely appressed; ray-florets violet-blue .....*A. laevis*
2b. Lower leaves sessile or with unwinged petioles; leaves at most somewhat pruinose (bloomed) beneath 3

3a. Upper leaves more or less distinctly auricled and clasping 4
3b. Upper leaves not or very slightly auricled and clasping 5

4a. Middle stem leaves mostly 2.5-5 times as long as wide; all involucral bracts erect and more or less appressed; ray-florets finally bluish; sometimes white initially ..... *A.* x *versicolor*
4b. Middle stem leaves mostly 4-10 times as long as wide; outer involucral bracts loosely spreading or recurved; ray-florets usually violet-blue..... *A. novi-belgii*

5a. Leaves usually (indistinctly) auricled; involucral bracts up to 7mm long, somewhat loosely appressed; ray-florets initially white then violet-blue ..... *A.* x *salignus*
5b. Leaves without auricles; involucral bracts less than 5.5mm long, all appressed; flower-heads like daisies, the ray-florets white ..... *A. lanceolatus*

Here is a simplified version of Sell's key covering the same taxa and several similar ones.

1a. Upper stem leaves not clasping the stem 2
1b. Upper stem leaves more or less clasping 4

2a. Involucral bracts with inrolled tips ..... *A. pilosus*
2b. Involucral bracts with flat tips 3

3a. Leaves of inflorescence much reduced and almost bract-like ..... *A. dumosus*
3b. Leaves of inflorescence not reduced ..... *A. lanceolatus*

4a. Stem and leaves more or less glaucous, especially the leaves beneath..... *A. laevis*
4b. Stem and leaves green 5

5a. Involucral bracts 8-12mm long; upper leaves often strongly auricled and clasping 6
5b. Involucral bracts 2-8mm long 7

6a. Involucral bracts narrowly elliptical or broadly spathulate, shortly acute at apex ..... *A. foliaceus*
6b. Involucral bracts linear to narrowly linear-lanceolate, with a long, narrow acute apex..... *A. puniceus*

7a. Involucral bracts whitish with a green centre in upper half..... 8
7b. Involucral bracts wholly or mainly greenish in upper half 9

8a. Capitula 15-20mm broad; involucral bracts oblong or oblong-lanceolate; ligulate flowers 8-11mm long ..... *A. concinnus*
8b. Capitula 30-50mm broad; involucral bracts linear or linear-lanceolate; ligulate flowers 17-25mm long ..... *A.* x *versicolor*

9a. Middle stem leaves mostly 2.5 – 5 times as long as broad, conspicuously clasping; outer involucral bracts usually ½ to ¾ as long as inner ones ..... *A.* x *versicolor*
9b. Middle stem leaves mostly 4-10 times as long as broad, usually ony semi-clasping; outer involucral bracts nearly as long as inner ones..... 10

10a. Outer involucral bracts widest at or just above the middle, with conspicuous green apical half, loosely or unevenly appressed ..... *A. novi-belgii*
10b. Outer involucral bracts widest below the middle, the inner rather neatly appressed, the outer often lax ..... *A.* x *salignus*

References and aids to further study

If you are still getting to grips with the family as a whole, the following two popular field guides are good. Both have good keys and descriptions, although the illustrations in Streeter often leave something to be desired.
Rose & O'Reilly, *The Wild Flower Key*, 2nd edition, Warne 2006
Streeter, *Collins Flower Guide*, Collins 2009.

Technical illustrations of many of the native plants are available in the following.
Ross-Craig, *Drawings of British Plants* parts XV – XVIII, Bell & Sons 1960-63
Butcher, *A New Illustrated British Flora*, part 2, Leonard Hill Books, 1961

About 80 alien species are illustrated in:
Clement, Smith & Thirlwell, *Illustrations of Alien Plants of the British Isles*, BSBI 2005

The standard current floras for field use are these. A third edition of the *New Flora* is imminent and it will have significant taxonomic and naming changes. One great virtue of these books is the very full coverage of escapes and introductions. Coverage of the big apomictic genera is minimal.
Stace, *New Flora of the British Isles,*, 2nd edition, CUP 1997
Stace, *Field Flora of the British Isles*, CUP 1999

For vegetative identification the following is now essential:
Poland & Clement, *The Vegetative Key to the British Flora,* BSBI 2009

Helpful notes and keys to many of the trickier groups are to be found in the following. Unfortunately none of the Asteraceae sections of this work are available for download yet from the BSBI web site.
Rich & Jermy, *Plant Crib 1998*, BSBI 1998

If you are wanting to start getting acquainted with the big apomictic genera then the following are a useful way in.
Clapham, Tutin & Moore, *Flora of the British Isles,* 3rd edition, CUP 1987 and 1989
Clapham, Tutin & Warburg, *Excursion Flora of the British Isles*, 3rd edition, CUP 1981

Also of value for *Hieracium* is the account in the following, which includes more than just maps.
Perring & Sell, *Critical Supplement to the Atlas of the British Flora,* BSBI 1968

If you want to become a serious Asterophile then the following will be essential, notwithstanding their horrendous cost. Sell & Murrell contains the only comprehensive up-to-date account of British *Hieracium*. Form a committee to badger your local library to hold copies.
Sell & Murrell, *Flora of Great Britain and Ireland*, vol. 4, CUP 2006
Tutin et al., *Flora Europaea*, vol. 4, CUP 1976

Lovers of Dandelions are well served by:
Dudman and Richards, *Dandelions*, BSBI Handbook 9, 1997

Anyone interested in the genus *Aster* is recommended to visit the NCCPG collection at:
The Picton Garden, Old Court Nurseries, Colwall, Malvern, Worcestershire, WR13 6QE
which is open daily from 2pm to 5pm through August to early October.

Acknowledgements

The illustrations of floral structures and fruits (pp. 4 and 7) are taken from Hickey M. and King, C. (2000), *The Cambridge Illustrated Glossary of Botanical Terms*, Cambridge University Press. This book is an indispensable reference work and should be on the shelves of all botanists whatever their level of expertise.

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