HAMPSHIRE FLORA GROUP WORKSHOPS: DEVELOPING IDENTIFICATION SKILLS

MODULE 2: RANUNCULACEAE AND THE ROSIDS

The Buttercup Family: Ranunculaceae

If you have read the first module in this series, you will know that the Ranunculaceae are part of the order Ranunculales, which in turn is part of a looser grouping sometimes referred to as the "Basal Eudicots". On the one hand, this group diverged from other Eudicot lineages quite early (more than 140 million years ago), and some members retain features of the yet more primitive flowering plants that preceded them. On the other, they have had plenty of time to evolve, specialise, and develop what are traditionally thought of in other groups as more "advanced" traits.

Let's recap and expand on this distinction.

"Less advanced"	**"More advanced"**
Floral parts not strongly differentiated	Floral parts such as sepals, petals, stamens, nectaries well differentiated
Indeterminate number of perianth segments	Fixed number of perianth segments
Floral parts spirally arranged, or radially symmetrical (actinomorphic) and 3-merous	Floral parts mirror symmetrical (zygomorphic)
Perianth segments free	Perianth segments fused at least at base
Carpels free (apocarpous)	Carpels fused (syncarpous)

One topic we haven't covered much in Module 1 is the sexual reproductive parts of plants. In this and the following modules, it's important to have a good grasp of the terminology in order to recognise what we're dealing with and avoid making classification mistakes. We shall introduce terms as we come to them.

***Perianth segments** are the non-sexual organs that surround the sexual parts of the flower: typically a **calyx** made up of individual **sepals** or forming a tube, and a **corolla** made up of individual **petals** or a lobed or unlobed tube. If corolla and calyx are not really distinct, the perianth segments are often referred to as **tepals**. Sometimes the non-sexual parts are not that well-differentiated from the sexual, and petal-like structures can bear pollen-bearing **anthers**.*

***Carpels** are the basic units of seed production capable of pollination, comprising an **ovary**, a **style** (or in some cases where the carpels are fused, a share in a style) which is the pathway for pollen growth into the ovary, and a **stigma** (the landing pad for the pollen, where it germinates). The ovary can hold a single **ovule** or many ovules, each of which can develop into a seed. As we shall see in later modules, the living arrangements for the ovules in the ovary are an important part of plant recognition and classification.*

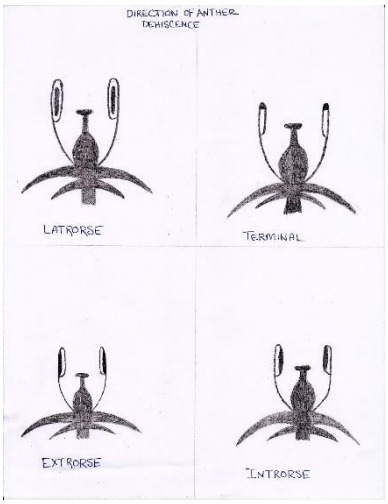
The Ranunculaceae are one of the two important Ranunculales families in terms of their numbers in the British flora, along with Papaveraceae, the Poppy family. They both seem to show a bewildering range of variation in their forms, especially now that the latter has been enlarged to include what was formerly the Fumariaceae or Fumitory family.

Ranunculaceae characteristics

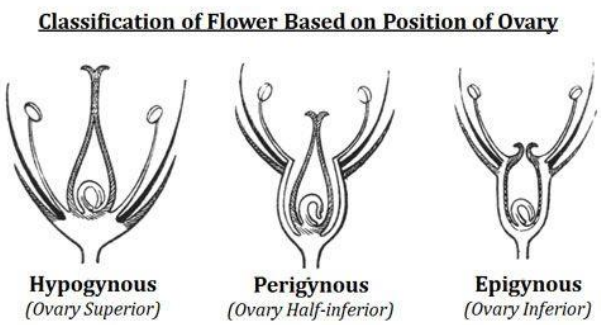
However, the Ranunculaceae have a few characters that are common to all or nearly all British family members.

Trait	Exceptions
Plants are herbs	Woody climbers: *Clematis*
Leaves alternate / spiralled	Leaves opposite: *Clematis*
Petals free or absent	
Stamens 5-many	
Anthers extrorse (opening away from the centre of the flower)	
Ovary superior (placed above the perianth segments)	
Carpels free	Carpels fused at least at base: some *Helleborus*, *Nigella, Aconitum*
Fruit a group of follicles or achenes	Fruit a berry: *Actaea* Fruit a capsule: *Nigella*

Anther opening



Ovary position



*An **achene** is a dry one-seeded fruit from a single carpel*

*A **follicle** is a dry many-seeded fruit from a single carpel which opens along a line to release seeds.*

The previous table, and others like it to follow, is a useful tool for a process of **elimination**. If you have a plant that shows characters outside the mainstream traits and it can't be matched to any of the exceptional genera, then you are dealing with a different family.

With that under our belt, we can now look at how the British genera fall out under the more variable characters of the family. There are a couple of extra useful characters that are either present or absent: stipules and nectaries.

***Stipules** are small leafy, scaly or sometimes spiny outgrowths at the base of a leaf stalk, usually in pairs.*

***Nectaries** are nectar-secreting glands that can occur on various parts of a plant. In this family they are found on the perianth segments, or even **are** the petals.*

Floral formulae

It's also time to introduce a convenient shorthand for describing flower structure, the **floral formula**.

The floral formula is an inventory of the various parts of the flower (perianth and sexual parts) with ornamentations on some of the symbols to denote positioning, fusion, and so on. There are different conventions for floral formulae, some more complicated than others. I am going to try to keep things as simple as I can.

• **5**	An exact count of parts
• **4-5**	A range of typical values for the count
• **2+3**	5 altogether, two different from the other three
• **∞**	Lots
• **4-5[-∞]**	An exceptional extension to the range
• **(5)**	A count of lobes, where the parts are fused
• **K**	Calyx parts (e.g. K5 = 5 free sepals)
• **C**	Corolla parts (e.g. (C4) = 4 fused petals)
• **P**	Perianth parts (where there is no distinction or only one whorl)
• **A**	Stamens (= "androecium")
• **A***	Staminodes lacking anthers
• **G**	Carpels (= "gynoecium")
• **Ĝ**	Means "ovary inferior"
• **G**	Means "ovary superior"
• **⊕**	Actinomorphic flower (radial symmetry)
• **Φ**	Zygomorphic flower (mirror symmetry)

So, for instance, the general formula for the whole Ranunculaceae family is:

⊕ or Φ K[0-]3-8 C[0]1-∞ A[1]∞ G[1-]3-∞

or, "Actinomorphic or zygomorphic; sepals usually 3-8, sometimes less or none; petals 1-many, sometimes absent; stamens one or many; ovary superior; carpels 3-many, occasionally less".

That seems so broad that one might wonder how we ever get plants into a family. In fact, the genus ancestry relationships within the family are still being worked out. But if we see how it breaks down by genus (Britain only), it becomes rather more tractable. The floral formulae in this table, and in others to follow, are often partial and provide the instances where the genus defines the flower more closely than the family.

<table>
<tr><th colspan="5">Trait</th><th>Genera</th></tr>
<tr><td rowspan="6">Single-seeded ovary forming heads of achenes; all ⊕</td><td rowspan="3">2 distinct whorls (sepals and petals)</td><td colspan="2">Nectaries absent</td><td></td><td>Adonis K5-8 C3-∞</td></tr>
<tr><td rowspan="2">Nectaries present</td><td>Stipules always absent</td><td></td><td>Ficaria K3 C7-12[-∞]
Myosurus K5 C[0-]5[-7] A5-10</td></tr>
<tr><td>Stipules absent or present</td><td></td><td>Ranunculus K5 C[0-]5[-∞]</td></tr>
<tr><td rowspan="3">1 whorl of usu. petal-like tepals</td><td colspan="2">Leaves opposite</td><td></td><td>Clematis P4[-∞]</td></tr>
<tr><td rowspan="2">Leaves alternate</td><td>Flowers with involucral bracts, 1-few in inflorescence</td><td></td><td>Anemone P5-20
Hepatica P6-10
Pulsatilla P6</td></tr>
<tr><td>Flowers without involucral bracts, usu. many in inflorescence</td><td></td><td>Thalictrum P4 G2-15</td></tr>
<tr><td rowspan="6">Multi-seeded ovary;
⊕ or Φ</td><td rowspan="2">Flowers Φ</td><td colspan="3">Perennials; upper sepal forming a hood</td><td>Aconitum K1+4 C2+{0-8} G(3[-5])</td></tr>
<tr><td colspan="3">Annuals; upper sepal with long spur</td><td>Consolida K5 C(2)+2 G1</td></tr>
<tr><td rowspan="4">Flowers ⊕</td><td colspan="3">Flowers numerous in dense raceme; fruit a berry</td><td>Actaea K[3]4[-5] C[0]4-6 G1</td></tr>
<tr><td rowspan="3">Flowers solitary or in ± loose cymes</td><td colspan="2">Fruit a capsule</td><td>Nigella K5 C5 (G5)</td></tr>
<tr><td rowspan="3">Fruit a head of follicles</td><td>Petals 0</td><td>Caltha P5-8[-10] G5-15</td></tr>
<tr><td>Petals conspicuous, spurred</td><td>Aquilegia K5 C5 A∞ A*10 G5-10</td></tr>
<tr><td>Petals reduced to tubular nectaries</td><td>Trollius K5-15 C5-15 G∞
Helleborus K5 C5-12 (G2-5)
Eranthis K6 C6 G6</td></tr>
</table>

Cautions

*In some Trollius the nectary-petals are **very** obvious!*

Probably the main confusion you are likely to have in this family is deciding what types of perianth segment your plant has. For instance, in some species of *Trollius*, including our native one, nectary-petals will not be at all obvious. In *Aquilegia* the sepals are coloured and prominent and look like (admittedly different) petals.

An added complication is added by the presence of a whorl of bracts just below solitary flowers in several genera. In some cases (for instance *Anemone*) these are obviously leaf-like and separated

to a degree from the flower. In *Hepatica* they look exactly like sepals and are positioned exactly like sepals.

The most likely families to be confused with the Ranunculaceae are these.

- **Paeoniaceae** share many of the same floral traits. The showy flowers are likely to be enough to distinguish them, but there are two other good characters to separate them: Paeony leaves are sheathing, unlike any Ranunculaceae, and Paeony stamens come to maturity from the margins towards the centre of the flower while in the Buttercup family they develop outwards.
- **Rosaceae** is a diverse family which shares a high stamen count as a character, and superficially some members have fruits resembling the heads of achenes found in Ranunculaceae. Most Rosaceae have stipules, a feature found only in *Caltha*, *Thalictrum* and the Batrachian *Ranunculus* (Water-crowfoots) among the Ranunculaceae.
- **Saxifragaceae** is also diverse and can have some similar traits. However, in Britain only the garden escape *Rodgersia* can have more than 10 stamens. The fruit are formed of follicles, but in all native and introduced genera in Britain these are 2 in number, which is rare in Ranunculaceae. Although some can be fused only at their base, most Saxifragaceae follicles are joined to a greater extent, forming a capsule.
- **Hypericaceae** also have conspicuously large numbers of stamens, but all members have opposite leaves, and are unlikely to be confused with *Clematis*. Most have their stamens fused at the base into 3 or 5 bundles, not a character found in Ranunculaceae. Fruits are capsules or berries, features only found in the distinctive genera *Actaea* and *Nigella* in British Ranunculaceae.

The Pea Family: Fabaceae

With this family we move into one of the major groupings (the Rosids), most of whose members have free petals and stamens usually equalling or exceeding the petals in number. Fabaceae are within the order Fabales. In Britain all members of the order are zygomorphic, and the only other British family is the Polygalaceae (Milkwort family). We shall say more about the differences between these families later.

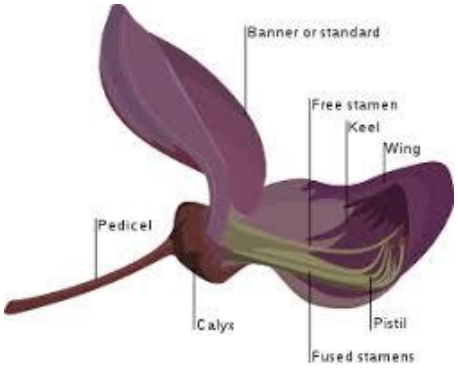
Worldwide this is a large family (16,000-19,000 members, depending on whom you ask) which under current taxonomy is very diverse in form. It is made up of six subfamilies, many of which have in the past been treated as separate families. Three of them don't occur in Britain at all; two appear only as planted trees; and a third (Faboideae) includes all our native species and the vast majority of introduced ones.

It will no doubt come as a relief to know that once we set aside the two subfamilies which are only found in Britain as planted trees, the rest of the family has a range of consistent and quite distinctive characters.

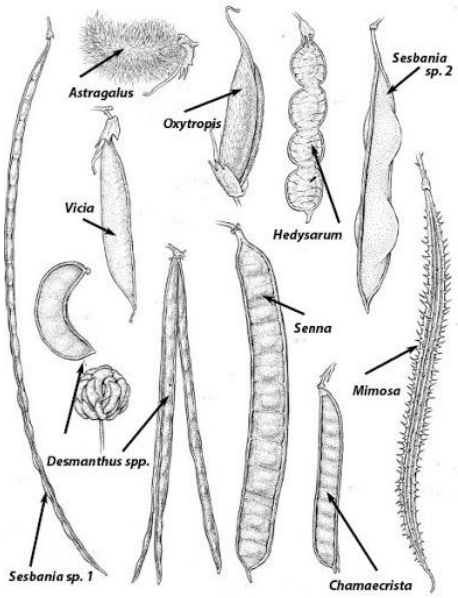
Fabaceae (Faboideae) characteristics

Trait	**Exceptions**
Leaves alternate	
Stipules present (but may be tiny, or fall early)	Stipules 0: some *Cytisus*; some *Genista*; *Ulex*
Flowers zygomorphic	
Sepals fused at least at base and usually for much of their length into a 5-lobed calyx	Calyx with minute teeth and appearing simply 2-lipped: *Ulex*
Petals 5, arranged as 1 + 2 free + 2 fused	
Stamens 10, arranged as 1 free + 9 fused	All stamens free: *Thermopsis* All stamens fused: Tribe Genisteae (*Lupinus, Laburnum, Cytisus, Spartium, Genista, Ulex*) 10th stamen partly fused to others: *Galega*
Ovary superior	
Carpel 1, many-seeded	
Style 1, with capitate stigma	
Fruit a legume (pod)	Fruit an inflated legume, opening at apex: *Colutea*

If you want to express the common arrangement of the subfamily as a floral diagram, it would be:
Φ (K5) C1+2+(2) A(9)+1 G1



*There is standard terminology for the petals of a plant in this sub-family, best shown by an illustration. The **standard** is the uppermost and outermost petal. The **wings** are the two free petals at the side. The **keel** is made up of the two fused lower petals.*



***Legume**: a pod opening either along sutures into two valves (lengthways, undivided halves) or across the pod into one-seeded units. Some legumes have the structure that suggests they will open lengthways, but actually don't. Geometrically, legumes come in many different and sometimes bizarre shapes, but topologically they are all the same.*

Recognition features

For such a large family it would be hard (but not impossible! – see, for instance, Thomas, Busti & Maillard (2016)) to construct a readable feature matrix such as the one provided here for orientation in the Ranunculaceae, and generally it's better to use an artificial dichotomous key like those provided in the standard Floras which can deal with a range of exceptions and uncommon features.

However, it's worth pointing out some of the plant parts that deserve special attention in this Family.

Stipules

Most members of the family have stipules, and stipule features can be an important aspect of determining to species level in some genera. It's just a question of whether you can see them, or recognise them when you do see them. Here are some of the issues.

- Stipules are absent: some ***Cytisus***; some ***Genista***; ***Ulex***
- Stipules are minute: most ***Cytisus***; some ***Genista***; some ***Ornithopus***; most ***Lotus***
- Stipules are spines: ***Robinia***; ***Caragana***
- Stipules look like wings on leaf-stalks: ***Arachis***
- Stipules look like basal leaflets, or replace leaflets: ***Hymenocarpus***; some ***Lathyrus***
- Basal leaflets look like stipules: ***Lotus***
- Stipules fall off early: ***Anthyllis***

Beware that some books consider the two lower leaflets of *Lotus* to be stipules, but this is not generally accepted now.

Several genera of culinary bean (*Glycine, Vigna, Phaseolus*) have **stipels** (similar to stipules, but below individual leaflets and often prominent).

Calyx

All members of our part of the family have essentially the same structure for the calyx: 5 sepals fused, at the base at least, into a tube. One would expect the sepals to manifest themselves as five lobes (often teeth), and so they do in many cases. However, the teeth themselves can vary from prominent (e.g. some *Lathyrus*) to minute (e.g. *Ulex*). Some species have all the teeth more or less equal in length, others grade gently in length, others have two distinctly shorter than the other three (e.g. some *Lathyrus*).

Most members of the tribe Genisteae have a two-lipped calyx, and this is usually more noticeable than the lobes.

- In ***Lupinus*** the number and disposition of lobes is very variable between species.
- ***Laburnum***, ***Cytisus*** *and* ***Ulex*** have 2 lobes on the upper lip, 3 (very small in *Cytisus*) on the lower. All lobes are vanishingly minute in *Ulex*.
- ***Genista*** has a deeply divided upper lip and a 3-lobed lower lip.
- ***Spartium*** has a lip split on one side and 5 short lobes.

Cautions

Most of these have been dealt with above, and there are few other families in the British flora (native or introduced) with which one can confuse this one. It is worth mentioning the two other subfamilies which may be seen in plantings here.

CERCIDOIDEAE ***Cercis*** **(Judas-tree)**	Upper petal is innermost and overlapped by the wings; all 10 stamens free
MIMOSOIDEAE	Flowers actinomorphic; petals fused into tube at base; stamens numerous and forming a tuft
Paraserianthes **(Albizia)**	Stamens fused at base; flowers tuft-like, not in globose clusters
Acacia **(Wattles and Blackwoods)**	Stamens free at base; flower-clusters globose

Also, for comparison, here are the floral formulae for "standard" Fabaceae and for Polygalaceae, the only other British member of the Fabales order. I leave you to decode the differences!

Fabaceae: **Φ (K5) C1+2+(2) A(9)+1 G1**

Polygalaceae: **Φ K3+2 (C2+1) (A8) (G2)**

The Rose Family: Rosaceae

Here we have a family that worldwide is considerably smaller than the Fabaceae, if we consider only "mainstream" species: somewhere under 3,000 species. But it has an exceptionally high number of difficult and critical genera (a quarter of all the roughly 40 genera represented in Britain fall into this category), and if one adds the microspecies in apomictic genera the total goes up by many thousands.

Couple this with an exceptional diversity of form and some rather special floral features, and there is no doubt that this is one of the most difficult families to know in its entirety. It requires many workshops of its own and decades of experience! Our aim in this session will be to concentrate on the few features that are reasonably constant through the family, and a few more that are rather distinctive and give rise to a lot of variability.

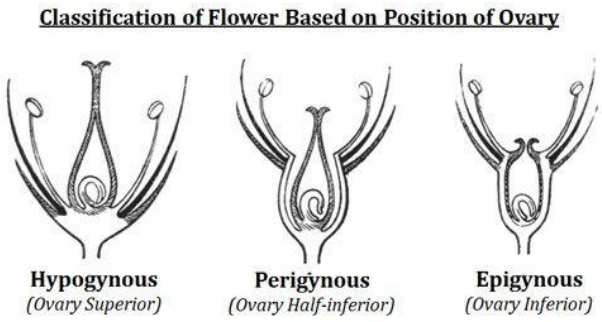
Rosaceae characteristics

Trait	**Exceptions**
Stipules present (but may fall early)	*Spiraea; Aruncus; Holodiscus*
Flowers ⊕	
Hypanthium developed	Hypanthium small: *Pyracantha*
Sepals [4-]5[-10], free	
Petals [4-]5[-10], free	

***Hypanthium**: an enlargement of the **receptacle** (the fleshy termination of the stalk on which the floral parts sit): usually cup, bell or tube shaped but sometimes simply flat and spreading or convex.*

Ovary and fruit

With this in mind, it's time to revise our look at the ovary position in flowers.



So far, we've talked about superior and inferior ovaries; and the two families we've looked at have had superior ovaries. Rosaceae has mostly inferior or semi-inferior ovaries, and here these involve the hypanthium extending all or part way up the sides of the ovaries so that the perianth segments and stamens are borne partly or wholly above them. In these cases, the hypanthium may partially or wholly enfold the ovaries (as shown for the inferior ovary above) or be free from its sides (as in the half-inferior ovary picture). Superior ovaries occur in some family members, where the hypanthium is not concave or poorly developed.

Now we need to consider the variety of fruit development in the family. In the Rosaceae, quite a few of these family-specific structures arise from the way in which the hypanthium extends dramatically at fruiting time around or under a head of free or fused carpels.

***Achene**: a dry one-seeded fruit comprising one carpel.*

***Berry**: a fleshy fruit with the seeds enclosed in pulp.*

***Capsule**: a dry fruit formed from several joined carpels, opening to release the seeds (dehiscent)*

***Drupe**: A fleshy fruit containing one or more seeds, each in a hard shell (a 'stone' or 'pip').*

***Follicle**: a dry many-seeded fruit that opens along a line (suture).*

***Hip**: a hollow "false fruit" formed from the receptacle surrounding a cluster of achenes.*

***Pome**: a fruit formed from a core of several united carpels embedded in the fleshy receptacle.*

We can now break down the family by fruit types.

Fruit type	Variants	Genera
Single achene	Achene enclosed in dry hypanthium	*Alchemilla; Aphanes*
Cluster of achenes	Achenes exposed	*Holodiscus; Filipendula; Kerria; Potentilla; Dasiphora; Comarum; Sibbaldia; Waldsteinia; Geum; Dryas*

Fruit type	Variants	Genera
	Many achenes on a much enlarged receptacle that ruptures the hypanthium	*Fragaria*
	2 achenes enclosed in a hard, sometimes bristly hypanthium	*Agrimonia; Aremonia; Sanguisorba; Poterium; Acaena*
Single follicle		*Neillia; Stephanandra*
Cluster of follicles		*Sorbaria; Physocarpus; Spiraea; Aruncus*
Berry	Composed of multiple drupelets	*Rubus*
Drupe		*Prunus; Crataegus*
Cluster of drupes		*Oemleria*
Pome	Apple-like	*Cydonia; Chaenomeles; Pyrus; Malus; Sorbus; Aronia; Eriobotrya; Pyracantha*
	Berry-like	*Amelanchier*
Hip	With inner pome and fleshy hypanthium	*Cotoneaster*
	Achenes partially covered by fleshy hypanthium	*Photinia*
	Many achenes enclosed in a fleshy hypanthium (hip)	*Rosa*

Epicalyx

Some genera possess an **epicalyx**, a ring of bracts under the calyx.

Trait	Genera
Epicalyx absent	*Sorbaria; Physocarpus; Neillia; Spiraea; Aruncus; Holodiscus; Kerria; Dryas; Prunus; Oemleria; Cydonia; Chaenomeles; Pyrus; Malus; Sorbus; Aronia; Photinia; Cotoneaster; Pyracantha; Amelanchier; Mespilus; Crataegus; Rubus; Waldsteinia; Agrimonia; Sanguisorba; Poterium; Acaena; Rosa*
Epicalyx present	*Potentilla; Dasiphora; Comarum; Sibbaldia; Fragaria; Geum; Aremonia; Alchemilla; Aphanes*

Floral parts

Genera which depart from the common '**K5 C5 A10-20[-∞]**' floral pattern are noted below.

Trait	Genera
Sepals 4	*Sanguisorba; Poterium; Acaena; Alchemilla; Aphanes*
Sepals 4-5	*Potentilla*
Sepals 5-6	*Filipendula*
Sepals 7-10	*Dryas*
Petals 0	*Sanguisorba; Poterium; Acaena; Alchemilla Aphanes*
Petals [0]5	*Sibbaldia*
Petals 4-5	*Potentilla*
Petals 5-6	*Filipendula*
Petals 5-8	*Rubus*
Petals 5[-∞]	*Geum*
Petals 7-10	*Dryas*
Stamens 1-2	*Aphanes*
Stamens 2	*Acaena*
Stamens 4	*Sanguisorba; Alchemilla*
Stamens [4]5[10]	*Sibbaldia*

Cautions

With such a wide variety of form in the family, the possibilities for mis-identification are wide even ignoring the critical genera, especially with some of the introduced species. A good understanding of fruiting structure will help.

The combination of (always) alternate leaves, free perianth segments and (usually) numerous stamens will help to distinguish Rosaceae members from families such as Hypericaceae (many stamens but opposite leaves) and Saxifragaceae (leaves frequently alternate but stamens not more than 10). The introduced *Aruncus* and *Spiraea* can be distinguished from the similar introduced *Astilbe* (Saxifragaceae) by a combination of no stipules; stamens > 10; and a semi-inferior ovary.

Elaeagnaceae species share the perigynous flowers and fleshy hypanthium surrounding the fruit which also characterises many Rosaceae; but they have either **K2 C0 A2** (*Hippophae*) or **K4 C0 A4** (*Elaeagnus*) flowers.

Much caution must be exercised in using presence / absence of stipules as a diagnostic character. Stipules in Rosaceae are often small and transient, and it is not always easy to see stipule scars.

The Cabbage Family: Brassicaceae

After the Rosaceae, it will come as a relief to get back to a family that is rather easily characterised. It appears to be one of the late-evolving strands within the Rosids, with around 3,600 species, and the Brassicales order it belongs to is shared with just one other British family, Resedaceae (there are a few introductions from other families). On paper the distinctions between the two families are not that strong, but in practice you would be unlikely to confuse them, especially as the latter have zygomorphic flowers (a rare and somewhat weak feature in Brassicaceae). The chemistry of the family is interesting and gives rise to both culinary delight and toxic horror.

Brassicaceae characteristics

Trait	Exceptions
Leaves alternate	
Stipules absent	
Flowers ⊕	*Teesdalia, Iberis* (outer flowers in inflorescence Φ)
Ovary superior	
Sepals 4, free	
Petals 4, free	*Capsella*, *Cardamine, Lepidium, Subularia, Conringia* (sometimes petals 0)
Petals alternating with sepals (as seen from above)	
Stamens 6 (typically 2 shorter)	*Arabidopsis, Cardamine* (4, some); *Lepidium* (2-4, some); *Drabella* (4-6)
4 main stamens opposite the sepals	
Fruit a capsule (siliqua or silicula)	

*The fruit of Brassicaceae is known as a **siliqua** when it is at least 3x longer than broad, and a **silicula** when it is less. There is exuberant variation in the shape of these, especially the siliculae, but they mostly follow a common structure. Fruit in cross-section can be rounded or 4-angled or flattened to varying degrees. The ovary has usually two cells (**loculi**) each with 1-many ovules, and these are separated by a membrane (the **septum**). In flattened fruit the septum may go across the broadest dimension of the capsule (a **latiseptate** fruit – think Lunaria, Honesty) or across the narrowest (an **angustiseptate** fruit – think Capsella, Shepherd's-purse).*

*While it certainly isn't the only organ you will need to examine when identifying Brassicaceae, it's worth getting to know the features of the fruit as they are particularly useful. Typically fruit open (**dehisce**) from the base by two valves*

which cover each loculus and fall away to reveal the seeds and behind them the septum. However, sometimes they are indehiscent and sometimes they break into segments across the capsule (like some Fabaceae). Fruit may have a ***stipe*** *(a short stem above where the sepals were) and/or a* ***beak*** *(a non-dehiscent extension at the apex, which may or may not also contain seeds).*

Some special cases of fruit are listed below. Other distinctive features are listed in Floras and field guides (for instance Stace (2010, 2019)).

Trait	**Genera**
Mostly 1-seeded	*Neslia; Cakile; Rapistrum; Crambe; Isatis; Peltaria; Bunias*
Multi-seeded but not septate, divided transversely	*Raphanus*
With stipe	*Lunaria, Diplotaxis, Brassica, Sisymbrium*
Beaked	*Brassica, Sinapis, Hirschfeldia, Coincya*

Cautions

There is little in the British flora which can be mistaken for a Brassicaceae member, if the characteristics listed above are taken into account.

Although we have concentrated here on the fruit, determination down to species level will almost inevitably rely on leaf, sepal, petal and sometimes anther characters in various combinations. Many species have a persistent style at the fruit apex, and the shape of this and its disposition are often important as well as characters already mentioned.

References and Further Study

All of the books and material mentioned in the Module 1 notes are of value here too.

Gonard, A. (2010). *Renonculacées de France*, Société Botanique du Centre-Ouest, Nercillac. There is nothing comparable in English, but if you can read French this gives a lot of information, widens your view beyond our shores and is well-illustrated with photos and drawings.

Rich, T.G.C. (1991). *Crucifers of Great Britain and Ireland,* BSBI, London. An essential handbook for in-depth knowledge of this family.

Stace, C.A. (2010, 2019). *New Flora of the British Isles*, 3rd / 4th editions, Cambridge University Press / C&M Floristics.

Thomas, R., Busti, D. & Maillart, M. (2016). *Petite Flore de France*, Éditions Belin. In French; provides examples of ID matrices (laid out rather differently from the one here).