



Training the Botanical Trainers handbook 2017

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Contents

The Background to the Training the Botanical Trainers	4
What are we hoping to achieve?	4
Some basic introductory ideas	5
Learners? Students? Participants? Clients?Botanists!	5
Identifying or recognizing? Jizz botanist or field taxonomist?.....	5
How to eat an elephant?.....	5
The Botanical Skills Pyramid.....	6
Learning your way up the pyramid.....	6
Pedagogical stuff.....	7
Structuring a Course.....	7
What teaching technique do I use?	7
Knowing when to let go.....	8
Learning outcomes, and aims and objectives – working your way through the teaching- speak	8
Field outings	9
Day Schools.....	9
Residential courses	9
Assessing learning	10
Planning your course	10
Differentiation Case Study.....	13
Bloom’s (modified) Taxonomy	14
The top ten plant families.....	16
Dicot families.....	16
Monocot families	18
Health and Safety and Risk Assessment	19
Example of Field Meeting Information letter	20
Useful bits and pieces.....	22
An Ecological Toolkit.....	22
Using Floral Formulae	23
How to construct a floral formula.....	23

FF Exercises.....	24
What is a difficult higher plant group?	25
Ideas on the issues around the identification, confirmation and recording of plant groups considered difficult.	27
Conclusion	28
Solutions	29
Conclusion	29
Resources for identification	30
Handouts	30
Useful sources.....	31
Other useful resources:	31
My course outline checklist ✓	32
Designing a course – a summary	33
The Botanical Training Skills Pyramid	34
Some useful identification guides and other reading	35

The Background to the Training the Botanical Trainers

The Botanical Society of Britain and Ireland is for everyone who is interested in the flora of Britain and Ireland. The society traces its origins back to 1836, when it was founded as the Botanical Society of London. From its earliest days it has welcomed both professional and amateur members and it remains the biggest and most active organisation devoted to the study of botany in Britain and Ireland.

The BSBI produces national Atlases and county Floras of the distribution of plants. It publishes the New Journal of Botany and holds conferences and field meetings. Members are kept informed by a newsletter three times a year and are invited to make use of our system of county recorders and national referees who can help with the identification of plants.

An education programme supported by the society aims brings high quality botanical training within the reach of all, from A Level students to professional development and postgraduate courses and qualifications. Scientific research on British botany is supported through grants awarded by the Science & Research Committee and through the work of the Plant Unit.

The Botanical Society of Britain and Ireland's Training and Education Committee started running Training the Botanical Trainers workshops in 2006 and they have been a more or less biennial event since then.

There are plenty of people out there who want to learn plant ID – there is a shortage of tutors. The Botanical Society of Britain and Ireland (BSBI) is very kindly funding this workshop, thanks to a generous legacy left to the BSBI by Alan Hamerschlag, a great believer in botanical education. The BSBI hopes to run a series of workshops for new and improving tutors in botany and related fields so that botanical skills can be passed on to a new generation of botanists.

What are we hoping to achieve?

1. Provide a framework for designing a botany course (from an informal field-based training meeting to a residential assessed course) including differentiation and listening to your learners.
2. Offer advice on practical issues such as health and safety considerations and risk assessment.
3. Provide a brief taxonomic and ecological workshop on how to give learners a 'handle' on plants.

Some basic introductory ideas

Learners? Students? Participants? Clients?Botanists!

Different sectors use different terms for the people attending courses or field outings. Does it matter?

Identifying or recognizing? Jizz botanist or field taxonomist?

What is 'jizz'? It is usually defined as the general impression of a plant (or bird, more commonly), based on a first glance rather than an exhaustive examination of diagnostic features. It is primarily a birding term but is applied to most taxonomic groups identified in the field.

We all use jizz to some extent when we identify plants or other organisms, but if we teach the process of identification, using diagnostic features, this provides a scientific evidence-based approach to field taxonomy or ID. Jizz is certainly a powerful aid to field work but learners should be encouraged to learn how to identify plants using a taxonomic approach. – jizz can be developed later if appropriate.

How to eat an elephant?...

There are just over 400 vascular plant families worldwide, and there are over 4,800 species of vascular plant described in Britain as being native or naturalised (Stace 2010). In addition to these are the 'big three' critical taxa (of which more later), consisting of 334 *Rubus*, 411 *Hieracium* and 232 *Taraxacum*, giving a total of over 5,700 species. Although as an island we have a relatively impoverished flora, this is still a huge number of species to learn if you want to be a competent field botanist. Therefore, we could say that the entire British flora is a 'difficult group'. However good your memory, it is virtually impossible to 'remember' over 5,000 species. To make learning easier, we can divide these 5,000 up into 'bite-sized pieces'. Learning 'how to eat an elephant' is useful for learning and teaching plant ID.

...one bite at a time.

Break taxonomic groups, or habitat groups into small, digestible pieces and offer these one piece at a time. This is why successful courses usually cover a small taxonomic or habitat group. For example:

- An introduction to plant families
- Identifying the Apiaceae
- Aquatic Plant identification
- Limestone Flora
- Grasses, Sedges and Rushes for Phase 1 survey

The Botanical Skills Pyramid

In So You Want to Know Your Plants is the Botanical Skills Pyramid. There are seven levels, with Level 1 representing a botanical beginner, and Level 7 the top taxonomists or field botanists.

- Where are you on the pyramid?
- Where do you want to be?
- What level are your students at?
- At what level do you want to pitch your course or field outing?

Learning your way up the pyramid

- Informal field outings
- Day schools on plant families or habitats
- Short courses
- A residential course aimed at beginners or improvers
- A part-time award programme
- More detailed residential courses
- Taxonomic workshops
- FISCs

All of the above are cumulative – informal field courses are an important part of learning at every level.

Pedagogical stuff

Structuring a Course

Whatever level your participants are at, they will need a basic 'toolkit' of techniques and terms to accomplish the aims and objectives of the course. You will need to judge what this toolkit is, by assessing the level of your course, the level of your participants and what the main outcomes should be.

A basic toolkit can include the following:

- Naming of parts
- Using a key
- Resource list
- Taxonomic scope (what families, genera etc are covered?)
- Ecological scope (what habitats, geographical area or communities are covered?)

What teaching technique do I use?

One of the biggest temptations when leading either a lab-based or field-based course is to 'show' learners a specimen, especially if it is something exciting.

An example of this might be:

A. Tutor: Now this is the very rare purple coltsfoot...

Students: Nice. What's next?

No learning experience for the students in being shown.

B. Tutor: Now this is an interesting plant – shall I key it out for you? Look, it keys out to purple coltsfoot.

Students: That's great – what's next?

Some learning experience in demonstration.

C. Tutor: Now this is an interesting plant – why don't you have a go at keying it out yourselves?

Students: Er, how, what key do we use?

Potential for learning, but needs direction and support.

D. Tutor: Now this is an interesting plant – why don't you have a go at keying it out yourselves, using the Interesting Plant Key? You'll find the first couplet a bit tricky unless you've got a x20 lens to check for hairs.

Maximum learning impact as the plant is identified by practice rather than by being shown or demonstrated. You can build up to this, by first of all telling, then demonstrating then letting them practice.

After the students have keyed out, this process can then be supplemented by the tutor providing information on, for example, its conservation status, distribution, ecology, and most importantly in the context of identification, **what it is similar to, and the diagnostic features required for separating it out from these similar plants.**

Knowing when to let go...

One of the most important skills in identification is to know when you cannot make an accurate identification from an inappropriate amount of material, and it is important to pass this on to learners. You will be asked to identify fragments or poorly prepared specimens and there will be no loss of face to say 'there is not enough diagnostic material there for identification'.

To summarize:

Inform, demonstrate, then let them do it themselves = maximum learning experience!

Learning outcomes, and aims and objectives – working your way through the teaching-speak

If you are asked to run a course for an Adult Education group, or a university Continuing Education department, you may be asked to outline the aims and objectives for your course (even if it is just for a day school).

So what do educators mean by aims and objectives?

The aims and objectives are for the learner or student and should be written from their point of view, eg, at the end of this course the student should be able to.....

A learner **aims** to gain an understanding of the taxonomy and identification of the family Asteraceae. Their **objectives** would be to describe the diagnostic features of the family and to be able to use an Asteraceae key. The learning outcomes are usually expressed as:

At the end of the course the student should be able to:

1. Demonstrate an awareness of the key features of the family Asteraceae.
2. Use a key confidently to identify to genera members of the Asteraceae.
3. Recognize and identify ten common species of Asteraceae.
4. Provide diagnostic features to separate out any two species.

This process seems very formal and inappropriate for one day field outings or day schools; however, before designing **any** training, stop to consider:

1. What do I want the learners/students/clients to get out of it?
2. Have I made this clear in the publicity?
3. What species do I want them to see?
4. What do I want them to be able to do at the end of the course?

...and if I can make this clear to the participants and to myself, we're both aiming for the same thing.

Field outings

If your field outing is billed as a training session, are there specific sites or species or habitats or communities that you want to show the participants?

- Will you use keys in the field?
- Have you told participants to bring any necessary equipment (lenses, ID guides, wellingtons etc)?
- Have you stated that it is a beginner's session, or intermediate or improvers?
- Are handouts appropriate in the field?
- Can you demonstrate key points in the field by drawing (eg Show Me Board)?

Day Schools

- Will you be in the field, classroom or both?
- Do you need handouts?
- Will you use a whiteboard?
- PowerPoint (and if so, do you give out PowerPoint handouts?)?
- Do you need a timetable?

Residential courses

- What workroom facilities are available?
- Have you provided handouts?
- Do you have a timetable so participants know roughly where they are supposed to be and when they have free time?

Assessing learning

For day schools, field outings and some residential courses, assessing learning in a formal context is not always required. If you teach on a university module or on a course that can lead up to a qualification, then assessment may be an important part of your course. Don't forget, assessment can also be used informally to consolidate the learning process; short informal tests or quizzes can be used in this way.

For formal learning, make sure before the course starts that you are aware of any students with Personal Learning Plans that may for example cover dyslexia or any learning difficulties and that the handouts and assessment time is varied accordingly.

To summarize:

- Have you drawn up assessments of the appropriate number and length ?
- Have you given clear written guidelines to your students?
- Have you given submission dates and locations?
- Do they know how many specimens are required for keys or vouchers?
- Do you know in what form feedback to students is required?
- Do mark using percentages, letters or other grades?
- Do you know the pass mark?
- How quickly do you need to give students their marks?
- Are you clear on the **level** required? How good do your students have to be? Should they be able to distinguish sedge hybrids, or just to be able to tell a sedge from a rush or grass?

Planning your course

You may wish to carry this out in your own time – this is part of a course planning workshop we carried out in previous years and the example given is for running a field-based 'naming of parts' session for Grasses, Sedges and Rushes.

Introduction to grass, sedge and rush families

Time available: 45 mins in the field

Aim:

- to introduce the 3 similar-looking grass, sedge and rush families and how to distinguish them

Learning outcomes x 3:

- Compare and contrast characters of the grass, sedge and rush families
- Practice distinguishing specimens of each family
- Evaluate the value of using general characters to identify plant families

	Tutor activity	Student activity	Differentiation	Assessment	Resources
Introduction 5 mins	<p>Present session learning objectives</p> <p>Assess prior knowledge by 'fishing' questions e.g.</p> <p>Who knows 3 or 4 species already of each family? Who is a complete beginner?</p> <p>How do we know if we have a grass, sedge or rush and not some other plant?</p>	<p>Allow pairing up at similar levels to boost confidence</p> <p>Brainstorm – discuss in pairs & reply in turn to tutor</p>	<p><i>By process:</i> buddy-up learners enables peer support and tutoring</p>	<p>Question & Answer (Q&A) responses</p>	<p>Handout with learning outcomes & outline of table (to be completed by students)</p>
Content I 10 mins	<p>Present 'compare & contrast' table of GSR families on portable whiteboard</p> <p>Illustrate with specimens to show examples of ligule in a grass and ligule in a sedge</p>	<p>Copy table</p> <p>Pass round specimens</p>	<p><i>By learning styles:</i> utilises visual and aural presentation presented to the whole class as a group</p> <p><i>By process:</i> graduate from simple to complex differences between the families</p> <p><i>By ability:</i> extra differences and exceptions for more experienced members one to one</p> <p><i>By task:</i> written</p> <p><i>By outcome:</i> table provides a template for completing the compare and contrast task, but learners can add more characters to it if they know any more; includes a space to record example species for each family found at the site</p>	<p>Check everyone has copied table; Q&A responses</p>	<p>Portable whiteboard</p> <p>Handout with outline table (as above)</p> <p>Specimens</p>

<p>Content II 20 mins</p>	<p>In groups (pairs or 3s) find, discuss and agree as many examples of each family as you can on the site</p> <p>During one-to-one review ask each group to consider: Are there any plants not sure of which family? Why? How useful are the general characters in deciding the plant family? Are there exceptions?</p>	<p>In pairs sort out specimens into the families</p>	<p><i>By process:</i> use of group work to encourage peer support, and promote group and individual learning</p> <p><i>By learning styles:</i> in contrast to earlier part of session, this is a practical session</p> <p><i>By outcome & ability:</i> Extension activity: for more experienced, can they find all the sedge family plants at the site? Remedial activity: revise table by placing example specimens next to each family section on table</p> <p><i>By task:</i> open-ended task used with verbal discussion of differences & collection of examples specimens of each family</p>	<p>One to one review going around groups checking specimens correctly placed into different families</p>	<p>Grass, sedge and rush specimens</p> <p>Field guides</p>
<p>Consolidation 8 mins</p>	<p>Review answers to evaluation questions posed previously to each group</p> <p>Summarise the exceptions</p> <p>Any questions?</p>	<p>Group discussion</p>		<p>Discussion responses</p>	
<p>Conclusion 2 mins</p>	<p>Review learning objectives</p>				

Differentiation Case Study

By Clare Coleman

This is an exercise that we have run in previous workshops when teaching and differentiation has been the key theme – we thought it useful to leave this in as an exercise you may wish to do in your own time.

Instructions

Take 15 minutes to:

- Read the case study scenario and the 3 student profiles (below)
- Look again at the handout entitled ‘ways to differentiate’
- In your groups, discuss what Herbert could do differently to help ensure Fred, Lucy and Joe all get the most out of his course

Take 5 minutes to:

- List 2 things on the flip chart paper that Herbert could do during a field session to provide differentiated learning
- Nominate a group spokesperson

Scenario

Herbert Smith is leading his first Field Studies Council weekend identification skills course. The course was advertised for beginners, but he has already noticed that several of the group seem to know quite a lot. He has planned to show the students lots of really interesting sites, including some rare species. On Saturday, he takes the group out in the field all day, visiting 3 sites. He leads the group around each site, carefully describing each species to the group as a whole. However, it worries him a bit that some students are not taking any notes. By 3pm it has started raining, but Herbert wants to fit in the last site scheduled for that day, as it has a few specialist species, so he carries on. The group gets back to the FSC centre at 550pm, and Herbert is pleased because there is time for a swift pint before dinner at 6!

Student profiles

Fred is a graduate ecologist. He knows that learning identification skills is important, but has little awareness of what is involved. After the first day of the course he feels anxious and swamped with too much new information.

Lucy is a volunteer for her local Wildlife Trust. She enjoys hunting for new wild flowers on her holidays and thinks that she is quite an experienced botanist, although she has never keyed anything out. She is a bit bored because she already knew most of the species the group looked at today.

Joe is a self-employed gardener. He feels intimidated by the graduates on the course, as he doesn't have an academic background. He really loves plants and wants to learn more about wild British species. He has a lot of knowledge about why certain species (both wild and garden) are placed their respective genera and families.

Bloom's (modified) Taxonomy

Educational psychology can be useful, whatever level you are teaching or training at. Bloom's taxonomy of learning has been revised many times, and this simplified revision is from Manchester Metropolitan University's teaching and learning resources for academics.

Table 1 - Taxonomies of learning (Cognitive Domain). Anderson and Krathwohl's revision of Bloom's

Level	Cognitive Domain	Expectation	Applicable Action Verbs
1	Remembering	Retrieving, recalling, or recognizing knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.	Define, describe, identify, label, list, match, name, outline, reproduce, select, state, recall, record, recognise, repeat, draw on, or recount.
2	Understanding	The student shows understanding of something; showing they have grasped the meaning. Students could show understanding by translating what they learned in a book into actual practice or by interpreting what is known in one context when used in another context.	Convert, defend, distinguish, estimate, explain, extend, generalise, give examples, infer, paraphrase, predict, rewrite, summarise, clarify, restate, locate, recognise, express, review, or discuss, locate, report, express, identify, describe how, infer, illustrate, interpret, draw, represent, differentiate.
3	Applying	Carrying out or using a procedure through executing, or implementing. Applying related and refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply, change, compute, calculate, demonstrate, discover, manipulate, modify, operate, predict, prepare, produce, relate, show, solve, use, schedule, employ, sketch, intervene, practise, or illustrate.
4	Analyzing	Breaking material or concepts into parts, determining how the parts relate or interrelate to one another or to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyse, break down, make a diagram, classify, contrast, categorise, differentiate, discriminate, distinguish, appraise, test, inspect, illustrate, infer, outline, relate, select, survey, investigate, make an inventory, calculate, question, contrast, debate, compare, or criticise.

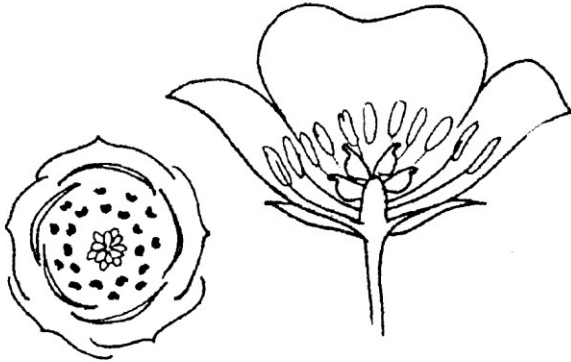
5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. In the newer taxonomy evaluation comes before creating as it is often a necessary part of the precursory behavior before creating something.	Appraise, assess, argue, compare, conclude, contrast, criticise, discriminate, judge, evaluate, choose, rate, revise, select, estimate, measure, justify, interpret, relate, value, measure the extent, validate, summarise.
6	Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way or synthesize parts into something new and different a new form or product. This process is the most difficult mental function in the new taxonomy.	Compose, design, plan, assemble, prepare, construct, propose, formulate, set up, predict, deriver, elaborate, invent, develop, devise, rearrange, summarise, tell, revise, rewrite, write, modify, organise, produce, or synthesise.

The top ten plant families

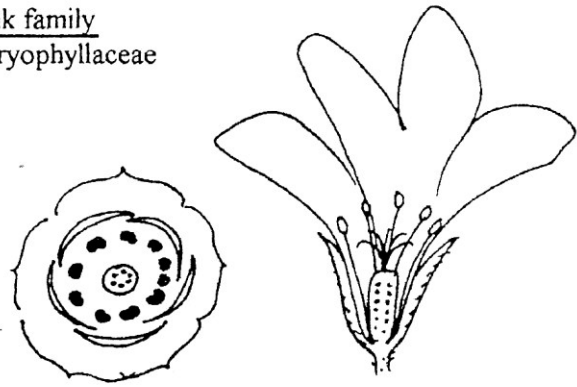
By Brenda Harold

Dicot families

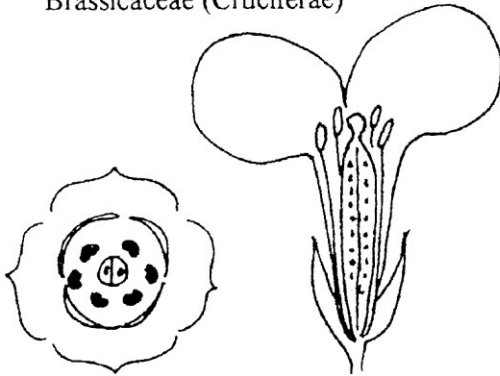
Buttercup family
Ranunculaceae



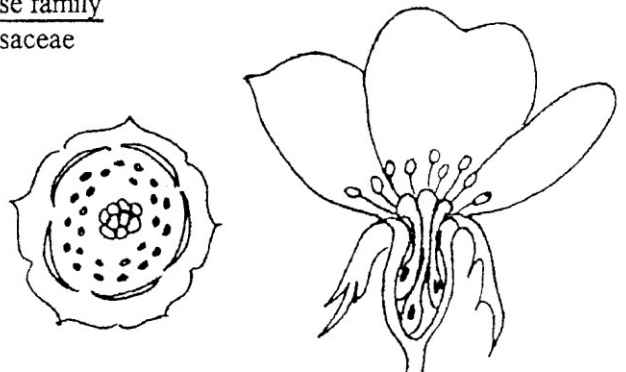
Pink family
Caryophyllaceae



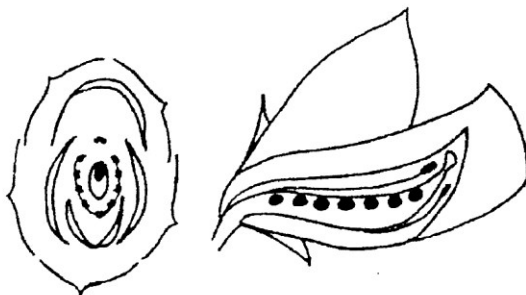
Cabbage family
Brassicaceae (Cruciferae)



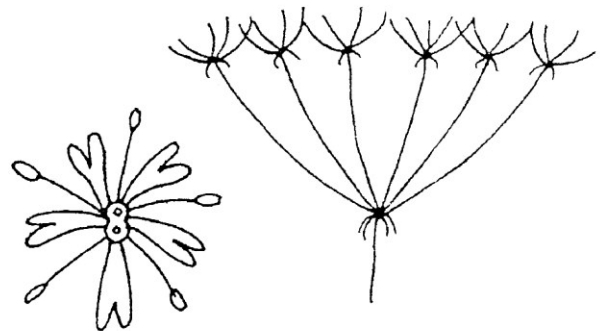
Rose family
Rosaceae



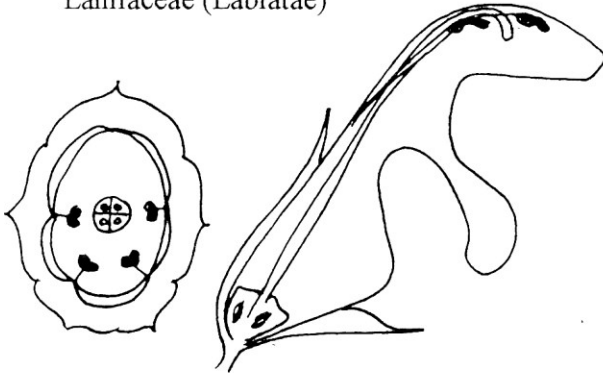
Pea family
Fabaceae (Leguminosae)



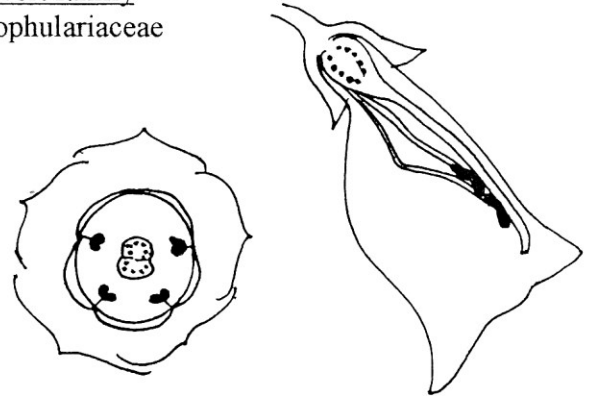
Carrot family
Apiaceae (Umbelliferae)



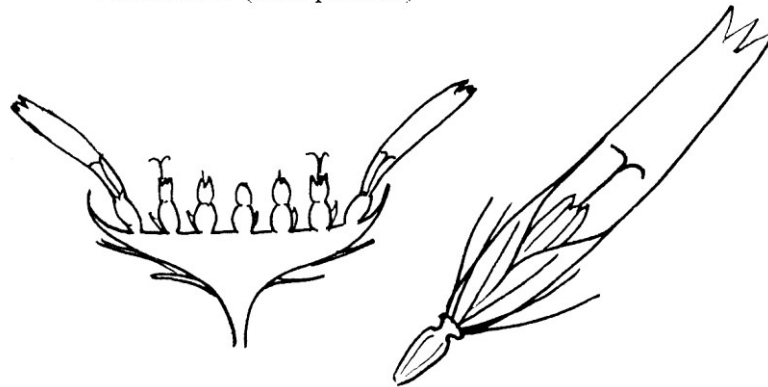
Deadnettle family
Lamiaceae (Labiatae)



Figwort family
Scrophulariaceae



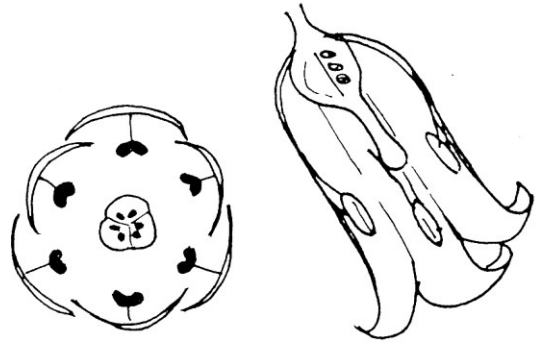
Daisy family
Asteraceae (Compositae)



Monocot families

There are three very large and important monocot families, the lilies (Liliaceae), the grasses (Poaceae) and the orchids (Orchidaceae). Only the Liliaceae family is likely to be studied in a short introductory course because the other two are so complex that they demand more specialized courses.

Lily family Liliaceae



Note: The Scrophulariaceae and Liliaceae have been split into a number of smaller families in Stace's New Flora of the British Isles, 3rd edition 2010.

Brenda Harold, 2011

Health and Safety and Risk Assessment

Without causing alarm or raising the amount of paperwork

Ensure you know your classroom – outdoors or indoors - and your group.

The BSBI Committee have produced extensive guidelines on all parts of leading groups in the field. It is available as a free download from the BSBI web pages Meetings section.

Extract Most of the requirements for organising a successful meeting are common sense. In the event of any problems however, insurance and the law require that this can be demonstrated with evidence. It is therefore worthwhile being familiar with the issues discussed in this guidance, particularly those relating to health and safety and the need for risk assessment. For the BSBI a report of the meeting will make interesting reading for other members when published in the Year Book, and perhaps encourage others to lead or attend a meeting.

The chapter headings are:

Organising Feedback
Bookings Risk-Assessment
Enjoyment Safety
Botany
Timing
Advertising Dogs
Concluding Teaching
Leading

The document includes many hints and tips and is designed to be dipped into, rather than being read from start to finish. It is not intended to be prescriptive. Each field meeting will be different and will have different requirements, but every organiser needs to be familiar with health & safety. The key thing is to show that you have followed common sense, and for most meetings this can be simply done by reviewing and completing a generic risk assessment.

There are a series of useful appendices; in particular:

Example of Field Meeting Information letter

Health & Safety Guidance for BSBI Field Meetings

Generic Risk Assessment Form (included as a handout)

Full risk assessment form (included as a handout)

Field Meeting Risk Review (included as a handout)

Field Meeting Feedback Form

Field Meeting Summary Report Form

For you and your teaching...most of this can be boiled down to Identify basic hazards and carry out a risk assessment – HSE recommend 5 basic steps.....

- | | |
|--------|---|
| Step 1 | Look for the Hazard
eg uneven ground, barbed wire, quarry, |
| Step 2 | Decide who might be harmed
You and the course members
Consider any special needs of your course members |
| Step 3 | Evaluate the risks and decide on management
Consider the likelihood and the severity of potential harm |
| Step 4 | Record your findings
Use a simple table |
| Step 5 | Review your assessment and revise if necessary
Give space to revise your assessment |

Health, Safety and Wellbeing – the three Ls

Location	There are generic risks and specific risks
Lunch	Is there a spot – what do we need; handwash, shelter etc
Loos	Hedge ticket or 10p public WC? - directions

Listening to your learners

Teaching or leading can be stressful – but so can learning. It is good practice to check on your learners at regular intervals to make sure that the physical conditions and the pace of the course is appropriate. Is there anything they would like to do that you haven't covered? Always be prepared to think on your feet if you offer this question!

Be aware of a range of conditions for your learners:

- Are they tired?
- Hot?
- Cold?
- In need of a break?
- Are you going too fast ...or too slow?
- Are there enough handouts, or equipment?
- Where are the loos?
- When is or what's for lunch?

Useful bits and pieces

An Ecological Toolkit

By Sarah Whild

Context is always useful in identification – it helps to ‘anchor’ snippets of learning.

- Know the status of your plants – is it Nationally Rare (Red Data Book), Nationally Scarce, Locally Rare (county red data book), national Biodiversity Action Plan Priority Species?
- Is it an indicator of a particular habitat (limestone, ancient woodland, acid grassland, unimproved grassland)?
- Is it an indicator species (community constant) for a National Vegetation Classification community, especially one of conservation significance?
- What is an Ellenberg Value? What Ellenberg values does it have?
- Is there anything interesting about its life cycle or reproduction?
- Is it on the edge of its range?
- What is its distribution?
- Are there any significant associated species?
- Is it a host or a food plant?
- Does the species appear on Schedule 8 or 9 of the Wildlife and Countryside Act?
- Does this affect your recording or identification of the plant?
- Can you compare and contrast your species with similar taxa from either the same or different habitats? Are there similar unrelated species?
- Are there other techniques that can be taught as an adjunct, for example, how to make a record, how to prepare a voucher specimen?

Using Floral Formulae

Ros Bennett (Nov 2010)

It is my view that mastering floral formulae is beneficial for beginners as well as those who are more advanced and I therefore ensure that FF are at the core of the curriculum of all my courses in plant ID. I fully recognise that many highly successful courses are run without any reference at all to FF. So whether or not you choose to feature the subject is, of course, entirely up to you.

Here are some of the reasons why a familiarity with FF can be beneficial:

Constructing FF provides a secure discipline. It helps the beginner to focus on the parts of the flower important for ID purposes when using a scientific key. And completing a FF ensures that neither beginners nor the experienced overlook anything.

FF provide a universal short-hand summary which is useful when note-taking in the field (when no book is at hand) and also when conveying basic details to another (absent) party

FF pinpoint certain family and generic characteristics – a kind of barcode analogous to the genome but not so unique (and during the process of identification the FF helps eliminate many visually similar but actually impossible contenders)

When teaching a course of mixed ability (or previous knowledge) FF offer a satisfying challenge even to those who already know it all!

How to construct a floral formula

Start with a symbol for the symmetry of the flower – essentially either radial symmetry * (actinomorphic/polysymmetry) and bilateral symmetry † (zygomorphic).

Then proceeding from the outside of the flower, working inwards, each successive whorl is given a different letter K = calyx, C = corolla, (or P = perianth especially when K and C are indistinguishable), A = stamens (androecium), G = carpels (gynaecium), each followed by the number of individual members in that whorl. E.g.

Cerastium (Mouse-ear): * K5 C5 A5+5 G(5)

N.B. Here the gynaecium is made up of 5 carpels that are fused together, so the number 5 is bracketed to indicate this. Brackets can be used elsewhere in the formula to indicate fusion. E.g. in the same family, campion flowers have fused sepals, so

Silene (Campion): * K(5) C5 A5+5 G(5)

In some families the stamens are attached to the petals (not independently to the receptacle) so a different sort of bracket is used to indicate this. E.g.

Symphytum (Comfrey): * K(5) [C(5) A5] G(2)

The line under G in all these examples denotes that the ovary is in a superior position with respect to the point of attachment of the rest of the flower parts. If the ovary is inferior this is indicated with a circumflex. E.g.

Epilobium (Willowherb): * K4 C4 A8 \hat{G} (4)

When there are more than twice as many stamens as sepals, the symbol for infinity is used ∞ . There are a number of additional symbols and refinements available (see Table 1 in Prenner). Some students will eagerly adopt all of them, but I think it is important not to overload beginners.

FF Exercises

It can be an illuminating exercise to use FF to highlight differences or similarities between taxa. It encourages the focus on significant taxonomic features. For example:

1. Many near beginners have often learnt that members of the Brassicaceae can be easily recognised on account of their 4 petals. But with more experience they become disillusioned as they find that it is not a unique characteristic. Species of *Epilobium*, *Chelidonium*, *Galium* and *Potentilla erecta* also have only 4 petals and some of them even appear (initially) to have the same overall jizz as other Brassicaceae. If FF are constructed, it quickly becomes apparent that there are many ways that their floral formulae do not match – number of parts, fusion of parts, position of ovary etc. The most useful unique feature for the Brassicaceae is the combination of C4 A6. Not simply 4 petals, C4. This exercise that focuses on important floral features, rather than petal colour or indefinable jizz, can give the student confidence and empower him/her with appropriate clues to solve a problem of ID and eliminate false possibilities.
2. The FF of many Monocots are identical until you apply additional features (see Table 1 in Prenner). Try *Hyacinthoides* (Bluebell), *Luzula* (woodrush) and one could add *Rumex* (not a Monocot of course).
3. Use FF to highlight the differences between the different genera within a family - try Caryophyllaceae.

Important: A floral formula does not replace the need for noting other observations such as vegetative. It simply summarises and helps us focus on a most important and taxonomic ID feature of a flowering plant.

Prenner *et al*, Floral formulae in taxonomic descriptions. TAXON 59 (1) February 2010: 241–250. Table 1 is on page 243

What is a difficult higher plant group?

There are just over 400 vascular plant families world-wide, and there are over 4,800 species of vascular plant described in Britain as being native or naturalised (Stace 2010). In addition to these are the ‘big three’ critical taxa (of which more later), consisting of 334 *Rubus*, 411 *Hieracium* and 232 *Taraxacum*, giving a total of over 5,700 species. Although as an island we have a relatively impoverished flora, this is still a huge number of species to learn if you want to be a competent field botanist. Therefore, we could say that the entire British flora is a ‘difficult group’. However good your memory, it is virtually impossible to ‘remember’ over 5,000 species. To make learning easier, we can divide these 5,000 up into ‘bite-sized pieces’.

- Taxonomic groups
- Habitat based groups
- Taxonomic groups within a particular habitat
- Taxonomic groups in a particular region
- Habitat groups in a particular region

Within these, there are the more ‘popular’ groups such as orchids and gentians, which have large, colourful flowers, and therefore tend to appeal to the beginner botanist (and to some experienced botanists, too). As a general rule, it is perceived that grasses, sedges, rushes and ferns are ‘difficult’, because they do either not have flowers, or the flowers are insignificant and not brightly coloured.

We see colour differences more easily than we see textural differences so in physical terms the differences between species of grass, sedge or rush are more difficult for us to see. This, combined with the fact that the flower parts for the latter three groups are very tiny and best seen with magnification, really does make them difficult groups to identify.

In addition to these traditionally difficult groups there are several groups of critical taxa. These are mostly species that reproduce **apomictically** (producing fertile seed without any exchange of genetic material – called **apogamy** in ferns). This produces large groups of ‘**microspecies**’ that appear very similar, but are essentially clonal. Generally, these groups are tackled by groups of experts, usually taxonomists, or working groups of experienced enthusiasts, and individual specimens are identified by these working groups and referees. Such groups include:

- Hawkweeds (*Hieracium*)
- Dandelions (*Taraxacum*)
- Brambles (*Rubus*)
- Whitebeams (*Sorbus*)
- Eyebrights (*Euphrasia*)
- Sea-lavenders (*Limonium*)
- Scaly Male-ferns (*Dryopteris affinis* agg.)

In addition to these, are those generally regarded as difficult groups:

- Grasses (flowering parts small, all 'look the same')
- Sedges (flowering parts small, all 'look the same')
- Rushes (flowering parts small, all 'look the same')
- Ferns (no flowers, all 'look the same')
- Yellow composites (colourful, obvious flowers, but still all look the same)
- Willows and poplars (insignificant flowers, ID using leaves, all 'look the same')
- Docks, knotweeds, goosefoots, oraches (insignificant flowers, look the same)
- Water plants (difficult to get to get to, all 'look the same' even though not related)
- Spotted orchids (massive amount of variation)

In addition to these, is the issue of hybrids. Plant hybrids are far more common than animal hybrids; indeed, plant hybridization often gives rise to new species through polyploidy.

Hybrids are generally intermediate between one parent and the other, but first, we need to recognize the range of variation within the parents. Stace (1975) and Preston (2004) discuss many of the issues of hybridization.

Further Reading:

Preston C.D. 2004. Should conservationists continue to ignore plant hybrids? *British Wildlife*. 15:6 pp 411-415.

Stace C.A. 1975. *Hybridization and the Flora of the British Isles*. Academic Press

Stace C.A. 1991. *Plant taxonomy and biosystematics*. Cambridge University Press

Stace C.A. 2010 *New Flora of the British Isles* Cambridge University Press

Ideas on the issues around the identification, confirmation and recording of plant groups considered difficult.

The list was generated from asking 40 botanists at a BSBI Training the Trainers Workshop in October 2014. The ideas generated – mostly from BSBI members – might inform BSBI Council through committees how this organisation might further support members in developing their plant skills.

Positives

(Why we should as botanists bother – what are the good things about getting to grips with difficult plants)

- For science!
- Meeting fellow nerds
- Gaining knowledge and experience
- Furthering botanical knowledge and records
- Good to increase knowledge of spread and distribution
- Feeling of satisfaction in contributing to knowledge base
- Intrinsically fascinating species
- Challenge is exciting
- Unravelling the problem and a sense of achievement
- Interesting and beautiful
- Dislike of recording ‘agg’ – achieving a sense of completion
- Satisfaction in understanding the terms
- Mapping distributions where there were no records before
- Filling in gaps in knowledge
- A chance of finding new vc records or species
- Understanding the richness of the area
- Exploring difficult terrain
- Nice places to visit to see them
- Feedback from referees as motivation
- Role models
- Good enthusiastic teaching
- Good books
- Research and discovery
- Interesting ecology
- Beautiful features at many levels
- Respect from peers
- Doing a thorough and complete job
- Becoming an ‘official’ botanist
- ‘Badges’
- Interest knowledge and skills
- More records produced for more difficult species
- Increased respect
- Better placed to teach and help others
- All around us (to start learning a difficult group)

Conclusion

There seems to be a groundswell of support for tackling these groups and helping others to become more proficient.

Negatives

(What stops botanists doing this and gets the way of trying to identify difficult plants?)

- Lack of resources
- Terminology
- Techniques – eg stomata/pappus hairs
- Costs – visits – resources – time
- The ‘Guru’ effect – need to know why
- The latin barrier
- Developing obsessive behaviours and botanical obsessions
- Cost of specialist books/microscopes
- Not feeling knowledgeable enough
- Daunting
- Too many – too complex
- Difficulty in keys
- Lack of visual material in books/websites
- Lack of opportunity eg courses/ training events and workshops
- Few experts to help
- Botanists can hide behind ‘it’s difficult’
- Taxonomic black hole eg *Hieracium* with no referee
- Not much incentive to learn
- Experts not agreeing
- Incompatible taxonomy in publications
- Lack of critical mass of interest in a particular group
- Perception of difficulties
- Slow/lack of response from referees
- No clear answers some of the time
- Laborious procedures for drying specimens
- Lack of time
- Lack of support or encouragement
- Lack of GOOD literature
- Difficult to know who to ask for help

Conclusion

Many of the as yet un categorised points above emphasis the need for support through resources including people (referees and trainers) good resources (clear guides including lateral keys and visual descriptors) up to date an consistent taxonomic guidance and support for those currently helping – coupled with a concern that there may not be enough trainers/referees etc. The gist of some of both the positives and negates listed above came out in the final section on solutions.

Solutions

(Ideas for overcoming barriers and encouraging more botanists to tackle difficult groups?)

- Teaching with lateral keys which tease out the key characteristics
- Remember that varieties are part of the ‘difficult plant’ challenge
- Break into bite sized pieces
- Encouragement support and reward
- Confidences increases with understanding – tackle difficult plants - tackle anything!
- BSBI workshops
- Mentoring
- ‘tiered systems’ for minimising pressure on ‘top mentors’
- Tim Rich styled handbooks with pictures and clear diagrams
- Better regional coverage for meetings
- More field meetings in ‘common areas’
- Make a ‘game app’ to help people learn – for Latin generally as well as difficult groups
- Increase verification of records to stop county recorders wasting time
- Create support groups within the BSBI that spread the load to help the real experts
- Collating known information and images – eg from BSBI news
- Each one of us needs to ‘have a go’
- Support groups
- Difficult plants project – perhaps after the threatened plants project
- Extend the refer system to have study groups eg sorbus/hieracium
- Reprint out of print literature
- More funding for research and training
- Funding for equipment and resources
- Recorders conference open to all
- More multi access keys commissioned by BSBI
- Set aside time to learn
- Knowledgeable experts need to make the time to teach, help and pass on knowledge
- Take satisfaction from learning a few – don’t expect to learn everything
- More guidance to WHICH resources are available
- T -shirts and badges to popularise and reward:
 - I’m enthusiastic about *Euphrasia*
 - Euphrasias* don’t phase me
 - It’s just a *Euphrasia* I’m going through
 - I’m keen on *Chenopodiaceae*
 - Not all *Salicaceae* are poplar with me
 - Taraxacum* doesn’t tax me
 - Atriplex*? Not complex!
 - There’s nothing higher than *Hieracium*

Conclusion

There seems to be some common ground for ensuring botanists are supported in learning how to identify and record plants perceived as difficult. Without any formal BSBI discussion at this stage – it was felt important to document these members thoughts to help input into the strategic plan

Resources for identification

However scientific our approach, it is always easier to start with a simple guide that can teach identification in small, bite-sized pieces, building up to use more complex handbooks that rely less on pictures and more on keys as we move up the Skills Pyramid.

For example – Fern Identification.

Level 1 – FSC fold out guide to Ferns

Level 3 – FSC AIDGAP Guide to Ferns and their Allies

Level 4 – Jermy and Camus (sadly out of print but an excellent intermediate guide)

Level 5 upwards – Page – the current definitive taxonomic guide for pteridophytes in the UK, or Stace.

There is not this range of guides for all groups, but it is always worth reviewing a range of guides at the start of your course.

Handouts

Handouts are usually appreciated and one of the most common pieces of feedback is ‘insufficient handouts’. However, how can you ensure your handouts are useful and add to the delivery and content of your course? There are some guidelines below.

- Don’t duplicate what is easily available in text books.
- Producing your own handouts rather than using other people’s makes you appear more authoritative (and also helps your learning process!).
- Well-labelled diagrams for ‘naming of parts’ are useful.
- If you have produced your own dichotomous or lateral keys (even to common species) these can be appreciated as a gentler way in (rather than launching straight into Stace!).
- Do your handouts link into particular sessions? If so, then use them during those sessions – don’t prepare redundant handouts.

- If you are setting assessments, do provide a title for the assignment(s) and some brief guidelines on, for example, how long the students have, any deadlines, where to submit it, numbers of specimens etc.
- Lists of references, websites or further reading can make useful handouts.
- Keep your handouts brief and not too dense with small text (point 11 or larger).
- If there are students with dyslexia, they may require handouts on coloured paper using particular fonts – do check their requirements with them.

Useful sources

- The standard floras such as Stace – note there is a third edition produced in 2010.
- Poland and Clements Vegetative Key
- Picture guides such as the Wild Flower Key.
- Fold out guides from the FSC
- Shire Guides (Willows, Umbellifers etc)
- AIDGAP Guides
- BSBI Handbooks
- The Plant Crib
- The Online Crib (free downloads from www.bsbi.org.uk)
- Botanical Keys – an online key accessible through the BSBI website www.bsbi.org.uk
- Stella Ross-Craig illustrations

Other useful resources:

- Hectad and tetrad maps on the BSBI website – the most up to date hectad and tetrad maps of vascular plants
- TEP-barium – print-off colour grass cards to use in the field as a quick check for (especially) Phase 1 survey – available on the BSBI website
- PLANTATT (available on line as a PDF).

My course outline checklist



- Course title
- Field or class-based?
- Residential?
- Have I identified learning outcomes and aims and objectives?
- What level is my course aimed at?
- What level am I at with respect to this subject?
- Will I be setting an assessment (formal or informal)?
- Have I considered health and safety issues?
- Do I know what equipment, learning resources and handouts I need?
- What 'toolkit' do my learners need in order to meet the aims and objectives (ie, naming of parts, resource list, taxonomic or ecological scope)?
- What taxonomic or ecological tools can I use (floral diagrams, NVC, constructing keys, indicator species)?
- What is in my course outline that will make it fun for the learners and for me?
- How can I review my course?

Designing a course – a summary

1. Is there a demand?
2. What is the course/meeting title?
3. Who is the target audience?
4. What are their skill levels?
5. What outcomes have you identified for the session?
6. Is there assessment?
7. How many participants are appropriate?
8. How long does the course need to be?
9. What will it cost to run?
10. Do you need to charge?
11. What equipment do you require?
12. What will you do if it pours with rain, snow, hail and you're in the field?
13. What will you do if your projector doesn't work?
14. Do you have enough specimens to go around?
15. How will you ensure the health, safety and wellbeing of the group
16. How will you get feedback?

Blue = ideal minimum professional level – skills are cumulative up the pyramid

The Botanical Training Skills Pyramid

Can lead a national taxonomic workshop. Is likely to be a national referee and is likely to be an acknowledged national expert

Probably can teach a Master class or lead a regional or national workshop on a taxonomic or habitat group.

Leads a residential course on a taxonomic group, appropriate for improvers and professional consultants. Professionally qualified. Teaches on award programmes. Leads BSBI field outings.

Leads a residential course on a taxonomic or habitat group for beginners or improvers. May or may not be professionally qualified. May lead BSBI field outings.

Can lead a day school or short course for Adult or Continuing Education college, aimed at beginners and leisure learners

Leads field outings or day schools for beginners or improvers, possibly for wildlife trust volunteers.

Can lead a basic field outing to show some common plants or perhaps tree identification for interested members of the public.

General populace with no current engagement in teaching field botany

Sarah Whild and Sue Townsend, MMU, 2017

Some useful identification guides and other reading

- Blamey M. Fitter A. Fitter R. 2003. **Wild Flowers of Britain and Ireland**. Collins
- Bridson D & Forman L. (ed.). 1999. **The Herbarium Handbook**. Royal Botanic Gardens, Kew
- Dudman A.A. & Richards A.J. 1997. **Dandelions of Great Britain and Ireland**. BSBI
- Goldsmith F.B. 1991. Vegetation Monitoring. In Goldsmith F.B. (ed) 1991. **Monitoring for Conservation and Ecology**. Chapman and Hall
- Graham G.G. & Primavesi A.L. 1993. **Roses of Great Britain and Northern Ireland**. BSBI.
- Jermy A.C., Chater A.O. & David R.W. 1982. **Sedges of the British Isles**. BSBI
- Lousley J.E. & Kent D.H. 1981. **Docks and Knotweeds of the British Isles**. BSBI.
- Meikle R.D. 1984. **Willows and Poplars of Great Britain and Ireland**. BSBI.
- Perring F. & Walters M. 1991. **Atlas of the British Flora**. BSBI.
- Poland J. 2009. **The Vegetative Key to the British Flora**. BSBI
- Preston C.D. 1995. **Pondweeds of Great Britain and Ireland**. BSBI.
- Preston, C.D. Pearman D. A. and Dines T. 2002. **New Atlas of the British and Irish Flora**. OUP.
- Price D. 2016. **A Field Guide to Grasses, Sedges and Rushes** Species Recovery Trust
- Rich T & Jermy A.C. 1998. **Plant Crib 1998**. Botanical Society of the British Isles (BSBI)
- Rich T.C.G. 1991. **Crucifers of Great Britain and Ireland**. BSBI.
- Rose F. & O' Reilly. 2006. **A Wildflower Key**. Warne
- Sell P. & Murrell G. 1997- 2008. **Flora of Great Britain and Ireland** Volumes 5, 4 and 3. CUP.
- Stace C.A. 1975. **Hybridization and the Flora of the British Isles**. Academic Press
- Stace C.A. 1991. **Plant taxonomy and biosystematics**. Cambridge University Press
- Stace C.A. 1997. **New Flora of the British Isles** (2nd edition). Cambridge University Press
- Stace C.A. 1999. **Field Flora of the British Isles**. CUP
- Stace C.A. 2010. **New Flora of the British Isles** (3rd edition). Cambridge University Press
- Stewart A., Pearman D.A. and Preston C.D. 1994. **Scarce Plants in Britain**. JNCC
- Streeter, D. HART-Davies, C., Hardcastle A., Cole F., and Harper L. 2016. **Collins Wild Flower Guide**. Collins
- Tutin T.G. 1980. **Umbellifers of the British Isles**. BSBI.