CREATING I.D.RESOURCES

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2018
• Higher plant botany has become a very restricted knowledge base.

• When I started identifying plants at the age of 5-6 most primary schools in England had been issued with a copy of MacGregor Skene's 1935 "A Flower Book for the Pocket". It covered 844 flowering plants including 501 rushes and sedges in colour and 24 grasses in B & W and 315 more in the text.

• The first 95 pages had wonderfully simple keys to the genera. This was far in advance of the later "Observers" series produced in the 1960s and was at just the right level to stimulate a primary school child into critical I.D.

• Driving a tractor at the age of 7 and a combine harvester at 11 I was enthralled by the chocolate & yellow Fluellens and purple and yellow Lesser Toadflax I found among the stubble.

• And they were in my flower book.
Notice the succinct but adequate diagnoses for each species. Notice that each illustration and each description had a number and name for quick matching, and an inverted comma to denote the hard inflexion on the previous letter.
KEYS TO THE GENERA

POLYGALACEAE. MILKWORT FAMILY (p. 129)

POLYGALA (Only British genus)

Herbs or shrubs with alternate or opposite, entire leaves, without stipules. Flowers irregular, in racemes. Sepals 5, of which 2 are large and petal-like, free. Petals 3 or 5 free, the lower large, fringed and folded to form a keel enclosing the stamens and ovary. Stamens 8, united in 2 groups. Carpels 2, united, superior; style single; stigma spoon-shaped. Fruit a pod with 2 chambers and 1 seed in each. Greek, polus, many, and gala, milk, from its effect on cows.

FRANKENIACEAE. SEA-HEATH FAMILY (p. 129)

FRANKENIA (Only British genus)

Small shrubs or herbs. Leaves small, simple, narrow, with margins rolled back; opposite, but apparently in tufts since they bear very short, leafy branches in their axils. Flowers regular, solitary. Sepals 4-6, united. Petals 4-6, free. Stamens about 6. Carpels usually 3, united, superior. Fruit a capsule with 1 chamber, 3 rows of seeds on the walls, opening by valves, enclosed in the calyx. Called after the Swedish botanist, Franken.

CARYOPHYLLACEAE. CAMPION FAMILY (p. 129)

Herbs. Leaves entire, opposite at the swollen nodes; stipules usually absent. Flowers regular. Sepals 4-5, free or united. Petals 4-5, free. Stamens 8-10. Carpels 3-5, united and superior. Styles 2-5. Ovary with a single chamber, sometimes partitioned at the base. Fruit a capsule opening by apical teeth, usually with numerous seeds attached to a central column.

A. Stipules absent:
   (a) Sepals united
      1. Styles 2
      2. Styles 3
      3. Styles 4 or 5
      Dianthus, 1
      Silene, 2
      Lychnis, 3
   (b) Sepals free
      1. Petals notched
      2. Petals entire
      Cerasium, 4 or Stellaria, 5
      Sagina, 7 or Arenaria, 6

B. Membranous stipules present:
   (a) Flowers pink
   (b) Flowers white

1. DIANThus (p. 129)

Annual or perennial herbs with narrow leaves. Calyx with 5 teeth and surrounded at the base by 2 or more sepal-like bracts. Petals toothed or fringed. Styles 2. Capsule on a stalk and opening by 4 teeth. Seeds flat. From the Greek dios, divine, and anthos, a flower.

2. SILene (p. 130)

Annual or perennial herbs. Flowers usually in loose, terminal cymes. Calyx inflated, with 5 teeth. Petals with 2 scales at the mouth of the corolla tube. Capsules opening by 6 teeth. Styles 3. Perhaps from the Greek, silene, the moon, the flowers of some opening at night.

3. LYCHNIS (p. 133)

Annual or perennial with the same floral characters as Silene, from which genus it is distinguished by the possession of 5 styles. Greek, luchnos, a torch, from the flower colour.

4. CERASIUM (p. 133)

Small, softly hairy annual or perennial herbs. Sepals usually 5, free. Petals usually 5, notched; sometimes absent. Stamens usually 5 or 10. 5 small nectaries at base of stamens. Capsule nearly cylindrical, often bent and projecting beyond the calyx, opening by short teeth. Greek, keras, a horn, from the shape of the capsule.

5. STELLARIA (p. 134)


6. ARENARIA (p. 137)


7. SAGINA (p. 137)

Small, annual or perennial, often tufted, herbs with oval-shaped leaves. Sepals 4-5, free. Petals 4-5 or absent. Stamens 4 or 10. Styles 4-5. Latin, sagina, flattening, a plant formerly called this having been used as fodder.

8. SPERGULA (p. 138)


9. SPERGULA (p. 138)

Small prostrate herbs. Leaves apparently tufted, with membranous stipules. Flowers pink; sepals and petals 5. Styles 3. Capsules opening by 3 valves; seeds often winged. The name is formed from Spergula.
PHILOSOPHY

• One of the irritating aspects of FSC courses is that headquarters insist on deciding whether a course is for beginners, is intermediate or advanced.

• Advertise a course as one of these and you get perhaps half a dozen takers, cater for all three and you can fill the course with 15.

• So I always try and cater for all three by providing plenty of original handouts that will appeal to all three. For lab work I try and pair up beginners with the more advanced and they enjoy helping each other. And all three categories come back for more!

• These days the beginners are very often at the former primary school level and know virtually nothing about plants.
SURFACE FLOATING WATER PLANTS

Flowering Plants
- Wolffia
- Lemna
- Spirodea

Ferns
- Azolla

Liverworts
- Riccia
- Ricciocarpos

Duckweeds (9)  Water Ferns (2)  Crystalworts (4)
 KNOW YOUR DUCKWEEDS

Spirodela (Lemna) polyrhiza

roots 7-21 in number, veins 7-16, fronds 5-10 mm, orbicular ovate, deep green above edged maroon, and maroon below, reproduction vegetative, flowering rare (recorded once in Somerset in U.K.) produces reniform rootless turions that sink in the autumn to overwinter, slow to recolonize after pond clearance, reliant on spread by birds and amphibians, ponds, canals, streams, often with some eutrophication. Scattered distribution north to Lancs. & Northumberland and central lowlands where July mean >2°C.

Landoltia [Spirodela] punctata [oligorhiza]

roots 1-7(10) in number, veins obscure 3-5(7), fronds 3-5 mm long, oblong ovate, somewhat angled, asymmetric, darker green above than Lemna species, edged maroon, and maroon below, brown pigment cells in epidermis [best seen in chlorotic/dead fronds], 5-10 faint pimplies along mid-line above, turions have been reported, imported with macro-aquatics in garden centres, and found in an outside garden pond in Treborh Botanic Gardens, Gwynedd in 2009.

Lemna minor

single root to 1.5 cm, 1 vein only (often faint), extending no more the 2/3 distance between node and apex. Fronds floating, 0.8-4.0 mm long, 1.0-2.0 x longer than wide, in groups of 1 to 3-4, pale to bright green, obovate, usually some what translucent, tented (doubly concave), does not sink, persists on surface over winter as floating turions - thicker, smaller, rounded and no root or nerve. Withstands lower light levels than Lemna minor. New world taxon introduced c.1970 (well spread by 1978), north to Banff in Scotland. Now commonest Lemna in S. England.

Lemna valdiviana

alien

single root to 1.5 cm, 1 vein only, prominent, extending at least 3/4 distance between node and apex. Fronds submerged at several overlapping levels, 1.0-5.0 mm, thin, flat, 1.3-3.0 x longer than wide, in groups of 1 to 3-4. pale to bright green, transparent, ovate to lanceolate always more elongated than Lemna minor, turions absent. Despite similarity morphologically, DNA fingerprint distinct from Lemna minuta. On the BSBI database it has been reported from Abergavenny, Swansea, Burry Port and from several sites in S.E. Ireland. it over-wintered in Chelsea Physic Garden pond 2009-2010.

Lemna gibba

underside

Lemna trisulca

Wolffia arrhiza

no roots, or veins, <1.5 mm, almost spherical, smallest known higher plant, floating in rafts, reproduction only vegetative in U.K. Can tolerate quite high nutrient levels, restricted to frost free areas, has recovered its former range in recent years, reappeared in London (Camden) in 2011. Main strongholds: Somerset Levels, coastal Monmouthshire, Glamorgan, E. & W. Kent, E. & W. Sussex.
• As an I.D. resource an illustration of a plant carries vastly more morphological information that we can take in very rapidly, compared with a textual description however detailed.

• Unfortunately however in normal life our brain uses pattern recognition to identify something by comparing the OVERALL IMPRESSION of the picture with a plant without necessarily noticing small structural details that clinch the distinction between two similar species.
SUBMERGED WATER PLANT GENERA

Recognition of leaf insertion and dissection patterns.

Lagarosiphon
Elodea/Egeria
Crassula
Ceratophyllum
Myriophyllum
Ranunculus (subgenus: Batrachium)
Utricularia

simple, helical
simple, whorled
simple, opposite-decussate
whorled-dichotomous
whorled–pinnate
pinnate–dichotomous
irregularly pinnate–alternate with water flea-trapping bladders

Waterweeds
5
Pigmy-weeds
2
Hornworts
2
Water-milfoils
4
Water-crowfoots
12
Bladderworts
6
Common Species of Water Crowfoots

Ranunculus peltatus
- all with capillary submerged leaves

Ranunculus aquatiliis
- hybrids
- sterile × fertile

Ranunculus baudotii
- sterile × sterile

Ranunculus circinatus

Ranunculus trichophyllus

Ranunculus hederaceus
- no capillary leaves

> 10mm
- pear-shaped nectary

< 10mm
- circular nectary

< 6mm
- semi-lunate nectary

No floating leaves

- curved sepals
  - not salt tolerant
  - slightly acid ponds

- straight sepals
  - neutral to slightly alkaline
  - neutral ponds some salt tolerance

Receptacle elongates in fruit
- blue tipped sepals
- some salt tolerance
- brackish dykes high salt tolerance

Capillary leaves
- 3-D ‘blob’

Capillary leaves in circular plate

Neutral rivers & ponds with some enrichment
- moderately acid marshy ground with flowing ground water

Other species: R. tripartitus, R. omiophyllus, (both western and southern) R. penicillatus, R. fluitans (both with long submerged capillary leaves in rivers).

N.B. don’t confuse the aquatic umbellifer Apium inundatum with water crowfoots. It has fine capillary leaves but these are pinnate not repeated forked.
Plants with leaves floating on the surface.

White Water-lily

*Nymphaea sp.*

Yellow Water-lily

*Nuphar lutea*

Fringed Water-lily

*Nymphoides peltata*

Frogbit

*Hydrocharis morsus-ranae*

Broad-leaved Pondweed

*Potamogeton natans*

Arrowhead

*Callitriche sp.*

Water-crowfoots

*Ranunculus subgen: Batrachium*

Water-starworts

*Sagittaria sagittifolia*

20 - 30cm

10-20cm

3 - 4cm

3 - 8cm

5 - 10cm

2 - 3cm

5 - 20cm

code: surface leaves
KEY TO BRITISH STARWORTS: Genus *Callitriche*

*Callitriche* flowers do not have perianths, and in taxa with yellow pollen, pollen is thought to be dispersed by floating on the water surface. Those taxa with colourless pollen have been shown using DNA studies to achieve pollination under water, either by cross-pollination or by self-pollination between separate male and female flowers on the same plant.

**C. stagnalis**
- Rosette leaves bluntly rounded at apex.
- Fruits broadly winged, and grey in colour. Due to variation only reliably separated from the next by its uniformly spherical pollen grains. Pollen yellow.
- The only species in non-submerged habitats, (except for *C. palustris*) woodland/heathland ruts, also in ditches and ponds. Less common than the next in deep and fast flowing waters. Throughout U.K.

**C. platycarpa**
- Rosette leaves bluntly triangular at apex.
- Fruits narrowly winged, and pale brown in colour. Due to variation only reliably separated from the above by its mostly triangular pollen grains. Pollen yellow.
- More typical of permanent deeper water bodies than the above, ponds, ditches, streams canals and fast flowing rivers. Throughout U.K.

**C. obtusangula**
- Rosette and submerged leaves rhomboid spatulate. Fruits unique in being both longer than wide plus unwinged, square ended from above, pale brown when ripe.
- Pollen mostly banana shaped, bright yellow.
- Most typical of calcareous lowland waters, less common than the two above, rivers, fens, ditches, ponds and gravel pits. Brackish dykes. North to Lancashire and Northumberland, scattered sites in Central Lowlands. Mostly south of the mean winter 10°C isotherm.

**C. palustris**
- Rosette leaves similar to *C. platycarpa*, submerged leaves ligulate. Pollen more or less spherical and pale yellow. Fruits uniquely longer than wide, and black when ripe, narrowly winged all round or just at the apex.
- Typical of expanses of damp mud in winter wet sites, wet woodland ruts, lakes and ponds drying up in summer. UK distribution unknown, probably an overlooked species. Please send all records with fruit samples to Richard Landsdown. Confirmed Gelway & Dunbartonshire. Now sold by water garden nurseries!
**C. brutia**  
**var. brutia**  
**var. hamulata**  
Rosette leaves similar to *C. platycarpa*, submerged leaves ligulate, usually some apically notched. Pollen more or less spherical, colourless. Fruits more or less as wide as long, narrowly winged, blackish when ripe. Style uniquely reflexed.  
**var. brutia** with apical notch curved inside, and symmetric, peduncles 2 to 12 mm.  
**var. hamulata** with apical notch flat based (spanner shaped), wider than lamina, and typically asymmetric, peduncles less than 2 mm. The subsp. can only be reliably I.D. ed if peduncles present.

**C. truncata**  
**var. occidentalis**  
No rosette leaves, submerged leaves ligulate, truncate to shallowly emarginate, often red tinged, very small c.1 cm long. Pollen spherical, colourless. Fruits unwinged in this subsp., wider than long, dark brown when ripe, cross shaped from above.

**C. hermaphroditica**  
**subsp. hermaphroditica**  
No rosette leaves, submerged leaves ligulate, tending to be wider near base. Pollen grains more or less spherical, colourless. Fruits unique in being sessile, wing as wide as fruit. Ripe fruits when dry > 1.8 mm wide or long in subsp. *macrocarpa* and < 1.7 mm wide in subsp. *hermaphroditica*.

**C. hermaphroditica**  
**subsp. macrocarpa**  

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Based with permission on Water Starworts *Callitriche* of Europe by Richard Landsdown. 2008. BSBI Handbooks No: 11.
• One of the first hurdles that a beginner higher plant botanist faces is that keys and descriptions use unfamiliar terms, and frequent trips to the glossy are needed one at a time to find out what they mean, and many of them never stick. Many people finally trying to do without them and falling back on picture matching pattern recognition.

• What I therefore attempt to do when introducing an unfamiliar group to anyone is to provide a glossary diagram incorporating all the names of the structural features, so they don't have to thumb through a glossary, and in looking at the diagram not only associate the 'bit' with the name but subliminally learn several names at once.

• The next stage is to produce synoptic side by side annotated diagrams of all the species in a genus, so that rather than wading through a cryptic key one dichotomy at a time a quick visual scan with notes under each drawing to guide the user to the critical characters enables a comparison of several species simultaneously.
ANATOMY OF GRASS GROWTH

The apical meristem buds off cells downwards that differentiate alternately into solid segments bearing leaf primordia and hollow internodes, the latter remaining tightly compressed unless triggered into extension growth to form a culm [a flowering stem].

The meristems at the base of the laminas and those at the base of the sheaths enable these organs to be regenerated if the laminas or sheaths are cut off by mowing or grazing.

The CROWN remains at the base of the vegetative tiller and can regenerate it from its apical and lateral buds. Once committed to a culm tiller it is carried aloft and cannot regenerate a culm if cut off.

An intra-vaginal tiller arises from an adventitious bud in the axil of a sheath without puncturing it. An extra-vaginal tiller arises from an adventitious bud that grows out horizontally breaking through one or more existing sheaths.

To an agronomist a ‘tiller’ is a grass plant arising from a crown, hence vegetative and culm tiller. Also in a stricter sense a side shoot arising from a lateral bud, the usage of the term more familiar to a botanist.

[Cereals are rolled after germination with heavy cast-iron rollers to damage the apical cell of the crown, and induce several lateral culm tillers to emerge, each developing a head of grain. Plant breeders are now developing new strains with less apical dominance so the plants now develop 4-5 tillers on their own]
Spikelet Gizz

Species numbers: native (alien)

Poa
Meadow-grasses
12 (3)

Puccinellia
Salt-marsh grasses
4

Glyceria
Sweet-grasses
5 (1)

Anisantha
Bromes
1 (6)

Bromus
Fescues (perennial)
4 (11)

Festuca
Fescues (annual)
10 (3)

Vulpia
Dog's-tails
4 (3)

Cynosurus
1 (1)

Agrostis
Bents
6 (5)

Arrhenatherum
False-oat grass
1

Trisetum
Yellow-oat grass
1

Avena
Oats
(6)

Holcus
Soft-grasses
2

Hordeum
Barleys
3 (7)

Phleum
Cat's-tails
5

Alopecurus
Fox-tails
6

Drawings sketched by Charles Hubbard © & redrawn by Joan Sampson.

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Spikelet Gizz

Species numbers: native (alien)

Agrostis
Arrhenatherum
Trisetum
Avena
Holcus
Hordeum
Phleum
Alopecurus

Bents 6 (5)
False-oat grass 1
Yellow-oat grass 1
Oats (6)
Soft-grasses 2
Barleys 3 (7)
Cat's-tails 5
Fox-tails 6

Drawings sketched by Charles Hubbard © & redrawn by Joan Sampson.
Genera with branched panicles that have morphologically unique spikelets and/or ligules.

[numbers refer to the number of species in each genus in the UK flora.]
**REED-LIKE GRASSES & COMMON REED**

- **Glyceria maxima**
  - Reed Sweet-grass

- **Phalaris arundinacea**
  - Reed Canary-grass

- **Phragmites australis**
  - Common Reed

**Lamina**
- **keeled**
  - Sheath tubular, splitting above, keeled and rough
  - Ligule membranous with central point

- **membranous, ragged**
  - Sheath overlapping from base, not keeled, smooth spiral insertion

**Ligule**
- **not membranous, a ring of hairs instead**

Call code: Aquatic reedy grasses (annoot)
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page(s)</th>
<th>Image</th>
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</thead>
<tbody>
<tr>
<td>30</td>
<td>Spikelets arranged singly, spaced out, inflorescence a spike-like raceme...</td>
<td>p.81 - 91</td>
<td></td>
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<tr>
<td></td>
<td>one common woodland-hedge row and one chalk grassland species (B)</td>
<td></td>
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<tr>
<td></td>
<td>one common and two rare grassland Festuca × Lolium hybrids (s F)</td>
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<tr>
<td>31</td>
<td>Spikelets attached singly to the main axis of the spike or raceme............</td>
<td>p.146 - 147</td>
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<tr>
<td>32</td>
<td>Spikelets attached in clusters of twos or threes to the main axis............</td>
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<td>33</td>
<td>Spikelets one flowered and sunk in hollows in the thickened jointed axis of cylinders spikes...</td>
<td>p.338 - 341</td>
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<tr>
<td></td>
<td>try Parapholis * Surf Grass* or (34)</td>
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<tr>
<td></td>
<td>2 saltmarsh species, 1 common, the other local</td>
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<tr>
<td>34</td>
<td>Spikelets two or more flowered and pressed against the main axis or sticking out but not sunk in hollows........</td>
<td>p.104 - 105</td>
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<tr>
<td>35</td>
<td>Spikelets stalkless, clustered in pairs, alternating on opposite sides of the main axis and 3-6 flowered.........................</td>
<td>p.106 - 113</td>
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<tr>
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<td>try Leymus * Creeping* Lyme Grass or (36)</td>
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<td></td>
<td>local on coastal dunes</td>
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<td>36</td>
<td>Spikelets clustered in threes, outer spikelets (usually) sterile, central spikelet 1 (rarely) 2 flowered;..............................</td>
<td>p.143 - 153</td>
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<tr>
<td></td>
<td>try Hordeum  and Hordeumus Barleys</td>
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<tr>
<td></td>
<td>3 native and several casual species of Hordeum, one native species of Hordeumus (calcareous woodland)</td>
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<tr>
<td>37</td>
<td>Spike with spikelets attached by their narrow edges to the main axis with the upper glume external and the inner glume abutting the main axis or absent.</td>
<td>p.92 - 103</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Spike with spikelets attached by their broad edges on to the main axis........</td>
<td>p.442</td>
<td></td>
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<tr>
<td>39</td>
<td>Inner glumes absent except at apex of spike...... try Lolium Rye Grasses or (40)</td>
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<tr>
<td></td>
<td>1 very common native, 1 common introduced fodder species and 2 rare casuals</td>
<td></td>
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<tr>
<td>40</td>
<td>Inner glumes all present.........................................................................try × Festuclum</td>
<td>p.146 - 147</td>
<td></td>
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<tr>
<td></td>
<td>4 representatives, 1 local and 3 rare</td>
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<tr>
<td>41</td>
<td>Perennials, grain tightly enclosed between lemma and palea;........ try Elymus and Elytrigia Couches and Twitch or (42)</td>
<td>p.208 - 213</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 local woodland species (Elymus), and 3 Elytrigia species, 2 coastal, 1 widespread</td>
<td></td>
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<tr>
<td>42</td>
<td>Annuals, grain free from lemma and palea Triticum (cultivated wheats)</td>
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<tr>
<td>43</td>
<td>Spikelets dumpy, nodding with florets arranged almost horizontally, and glumes hooded......................................................</td>
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<tr>
<td></td>
<td>try Briza * Quaking Grasses* or (44)</td>
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<tr>
<td></td>
<td>one common native on calcareous soils, two aliens</td>
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</tbody>
</table>
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<table>
<thead>
<tr>
<th>83</th>
<th>Leaf blades of both tillers and culms flat, 3 to 8mm or more wide, and with long pointed auricles, apex of ovary/grain without hairs....try <em>Festuca</em> [Fescues Section One = <em>Schedonorus</em>]</th>
<th>2 common grassland species, 1 woodland and shady hedgerows.</th>
<th>p. 140 - 145</th>
</tr>
</thead>
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<tr>
<td>84</td>
<td>Leaf blades of both tillers and culms flat, 4-14mm wide, but without auricles, apex of ovary/grain hairy.............try <em>Festuca altissima</em> Reed or Wood Fescue or (85)</td>
<td>rare damp woods, N W Britain, E. Sussex and S W Ireland.</td>
<td>p. 124 - 125</td>
</tr>
<tr>
<td>85</td>
<td>Perennials with leaf blades of tillers bristle-like, but those of culms flat, apex of ovary/grain hairy ....try <em>Festuca heterophylla</em> Various-leaved Fescue or (86)</td>
<td>thinly scattered introduction, mainly in woodland</td>
<td>p. 132 - 133</td>
</tr>
<tr>
<td>86</td>
<td>Perennials with leaf blades of tillers folded longitudinally and bristle-like (or sometimes flat), culm leaves flat (or sometimes bristle-like), apex of ovary/grain without hairs ....try <em>Festuca</em> [Fescues Sections Two and Three]</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>Young tiller leaves with cylindrical sheaths, edges fused almost to top, new tillers tend to cut horizontally through old sheaths (extravaginal), auricles vestigial <em>Festuca</em> [Fescues Section Two - <em>rubra</em> aggregate] or (88)</td>
<td>1 widely distributed species, 1 on coastal shingle, 9 subspecies between them</td>
<td>p. 134 - 141</td>
</tr>
<tr>
<td>88</td>
<td>Young tiller leaves with spirally inserted sheaths, with edges overlapping, all tillers arising upwards inside existing sheaths without perforating them (intravaginal), auricles small but pointed.... <em>Festuca</em> [Fescues Section Three - <em>ovina</em> aggregate]</td>
<td>2 common species, 4 rare natives, 1 alien</td>
<td>p. 126 - 129</td>
</tr>
</tbody>
</table>

**Hordeum & Hordeymus**

Spikelets in 3's with common attachment to spike axis, outer pair sterile or male only, except in *Hordeymus* where laterals are bisexual. Spikelet trios alternating on opposite sides of the spike axis and falling together at maturity.

- **Glumes** - coloured brown
- **Florets** - coloured green (for clarity)

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**Hordeum secalinum**
- Spikes 2 - 8 x 0.7 - 1.5 cm
- Outer spikelet glumes both bristle like
- Glumes minutely rough
- Common, neutral pasture & meadow grassland east of a line from Cardiff to Scarborough

**Hordeum marinum**
- Spikes 2 - 6 x 1.5 - 3 cm
- Upper glumes of outer spikelets winged
- Coastal, on mineral clay & marine alluvial soils. Inland salted road verges
- Very local, East Anglia, Severn Estuary and South Coast.

**Hordeum murinum**
- Spikes 4 - 12 x 1 - 3 cm
- Inner spikelet largest central sessile
- Glumes edged with stiff hairs
- Common, waste ground.

**Hordeum leporinum**
- Outer spikelets largest central stalked
- Scarce, scattered distribution in shaded woodland on calcareous soils.
- Central, northern & eastern England.

**Hordeymus europaeus**
- Spikes 5 - 10 x 0.7 - 1.2 cm
- All spikelets bisexual, each with 1 - 2 florets.
- Glumes flat and winged.
**The Genus Nitella**
- Main axis single celled.
- No cortex (i.e. no longitudinal striations).
- Branchlets branched (furcate).
- Corona of nucule 2-celled in height.

**Glossary**
- Main axis circular in cross-section.
- No spine cells.
- No stipuloides.
- No bract cells or bracteoles.

**Branchlet Ray Terminology**
- **Main Axis Stem**
  - Single celled
  - Circular in cross-section
  - No longitudinal striations

- **Branch**
  - Two per node

- **Whorl of Branchlets**

- **Dactyl**
  - Last furcation may be 1, 2 or 3-celled

**The Genus Chara**
- **Monoecious Species**
  - Branchlet in section
  - **Abaxial Bract Cells**
  - **Axial Bracteoles**
  - **Node**
  - **Oogonium > Oosporangia**

- **Dioecious Species**
  - **Node**
  - **Corona**
  - **Bracteole**
  - **Bract Cells**

**Branchlet**
- **Node**
- **Internode**
- **Whorl of Branchlets**

**Branch**
- **Node**
- **Primary Ray**
- **Secondary Ray**
- **Tertiary Ray**
- **Quaternary Ray**

**Spine Cells**
- Only on primary cortex rows
- Secondary cortex rows 0, 1 or 2
- Intervening primary rows

**Glossary**
- **Corona**
- One tier
- **Bracteole**
- **Bract Cells**
- **Node**
- **Oogonium > Oosporangia**
- **Globule**
- **Antheridia filament**
- **Stipuloides**
- **Cortex**
- **Main Axis**
- **Ascending & Descending cortical rows**
Key to NITELLA taxa

Including all U.K. taxa except: *N. spaniolema*, *N. confervacea* & *N. hyalina*.

**DACTYLS**

1-CELLED

- Branchlet once furcate (rarely 2x)
- Dactyls (ultimate rays) ONE-celled
- If mucronate micro formed from cell wall
- c. 1.0mm
- Monocious
- Dioecious

**Nitella opaca**

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**Nitella flexilis**

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**Nitella capillaris** extinct?

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**Nitella translucens**

- 3 variants, dactyls can be very large at times
- Dactyls (ultimate rays) 2-celled, usually in 3s & microscopic

**Nitella mucronata**

- 2-3 celled
- Apical cell forming mucro narrower than rounded top of next cell.
- Summer form as large as *N. flexilis* with small mucro.
- Winter form minute & richly branched.
- Oospore membrane pattern RETICULATE.

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**Nitella gracilis**

- 2-3 cells, tapering.
- Delicate plant, yellowish-green, overlaps in dimensions with winter form of *Nitella mucronata*, rare-sporadic.
- Oospore membrane pattern GRANULAR.
- Dactyls never more than 2-celled.
- Branchlets variable in length and in number of divisions in same whorl. Oospore membrane pattern RETICULATE.

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**Nitella tenuissima**

East Anglian fens and Anglesea
CHARA - MORPHOLOGY TERMS

- diplostichous
- trilostichous
- isostichous
- haplostichous
- diplostephanous
- haplostephanous
- heterclamous
- monarthrodactylus
- aulanthus
- tylacanthus
Key to CHARA taxa

Including all U.K. taxa except: C. tomentosa, C. mucosa, C. fragifera, C. braunii

HOW TO USE KEY
Choose spine cell arrangement, then go to matching key on right. If characters do not fit go to alternative number in brackets at end of line.

One species
Spine cells in clusters of 2 to 4, dioecious but only female plants found so far in U.K. Oospores form without fertilization. Scarce, scattered coastal distribution in brackish alkaline water bodies, mainly on sandy substrates. Chara canescens

Eight species
1 Spine cells always solitary, axes to 1.5mm diameter. NO basal bulbils, globules <500μm .... 5(2)
2 Spine cells solitary or occasionally paired, less than 1/2 axis diameter long, on raised cortical rows, axes to 3mm diameter. NO rhizoidal bulbils recorded, fresh plants often tinged pinkish/brownish, encrusted, monoecious, globules <500μm long, rare Norfolk Broads, possibly just a freshwater form of C. baltica .... Chara intermedia (3)
3 Spine cells solitary to rarely 2 to 3 in a cluster, acute and longer than 1/2 axis diameter, axes to 1.5mm diameter, monoecious, multicellular bulbils FREQUENT on rhizoids, globules >500μm long, brackish waters, coastal, formerly widespread, now rare Chara baltica (4)
4 Spine cells in clusters of 2 to 4, monoecious, NO basal bulbils, plants green .......................... 7

Five species
1 Spine cells only rudimentary or papilliform ........ 11(2)
2 Spine cells well developed, dioecious .............. 17
11 Internodes only up to 4x branchlet clusters, branchlet clusters not markedly incurved, coronula more or less parallel sided to spreading, monoecious........ 15(12)
12 Internodes very long, up to 5x branchlet clusters, which spread at an acute angle and are incurved, coronula markedly connivent, dioecious [needs to be fertile for certain I.D.] Rare and sporadic in alkaline brackish waters Chara connivens

5 Ripe oospores BROWN, spine bearing rows sunk so that spines arise in grooves, or rarely, cortical rows equally developed Chara vulgaris forms (6)
6 Ripe oospores BLACK, spine bearing rows either prominent, equal or sunk but prominent in most plants in a population so that spines arise from ridges Chara contraria forms Page 2.
7 Spine bearing rows sunk so that spines arise in grooves Chara hispida forms (8) Page 2.
8 Spine bearing rows raised, so that spines arise on ridges........ 9
9 Spines in clusters of 2 to 4, whole plant `furry', densely spiny & lime encrusted, peaty sites, monoecious Chara pedunculata (10)
10 Spines solitary, (rarely 2 to 3 in a cluster), plant not furry with spines, green, never much encrusted, clusters of multicellular bulbils at rhizoid nodes, monoecious, brackish sites Chara baltica
15 Fairly stout, internodes longer than branchlets, all cortical rows ABOUT SAME WIDTH spine cells and stipuloides minute. Multicellular, irregularly shaped basal bulbils occasional, oospores black, very common in a wide range of non-brackish, still waters Chara globularis (16)
16 Slender, internodes + equal to branchlets in length, the two rows of cortical cells between the spinous rows only HALF THE WIDTH of the spinous rows. At least one set of stipuloides moderately developed, multicellular rhizoidal bulbils common, oospores black, widespread in a range of habitats, frequent particularly in the north, can tolerate acid bog waters Chara virgata
17 Spine cells solitary, or occasionally in clusters of 2 to 3, at least as long as axis diameter. Unicellular, globular rhizoidal bulbils up to 1mm common, ripe oospores black, plants ERECT, axes to 0.5mm prickly but not densely spinous, shallow calcareous fresh to brackish Chara aspera (18)
18 Spine cells in clusters of 3 to 4 (6), plants STRAGGLY, axes to 0.75mm, densely spiny and bristly (rare), calcareous fresh over peat or sand Chara curta

Page One
Chara Key

When grown in culture the so-called varieties *longibracteata, papillata, vulgaris*, and *crassicaulis* end up as *vulgaris*, and *hispidula* ends up as *contraria*. Thus these forms must be ‘ecormorphs’ rather than separate genetically defined varieties. I therefore regard these morphologies as ‘expressions’ in response to as yet unknown environmental factors.

**Chara vulgaris** forms

Spine cells finger-like, abruptly tapered at the ends to give blunt rounded apices ..... **Chara vulgaris** forms

[Key to **vulgaris** ecomorphic expressions: individual plants may express one or more of these traits together.]

- Bracteoles and adaxial bract cells very long, to 6x length of nucule ............. *longibracteata* expression
- Spine cells well developed, deciduous, and recurved so that the tips
  lie in the grooves ................................................................. *papillata* expression
- Spine cells poorly developed, length less than width of 2 cortical rows, bracteoles and
  adaxial bract cells not much longer than nucules.................................... *vulgaris* expression
- Branchlet whorls tightly incurved forming tight bunches against the axis,
  very long internodes ..................................................................... *crassicaulis* expression

**Chara contraria** forms

Spine cells globular, or well developed, if well developed, straight, spreading and longly tapered
to pointed apex. ............ **contraria** forms

[Key to **contraria** ecomorphic expressions]:

- Spine cells globular ........................................................................... *contraria* expression
- Spine cells long tapered, densely clustered ...................................... *hispidula* expression

**Chara hispida** forms

1 Axes up to 3mm diameter, spines erect in clusters of 2 to 4.... **Chara hispida** var. **major**. (2)
   [see also C. intermedia]

2 Axes up to 1.25mm diameter, spines in cluster of 2 to 3, (rarely solitary) **Chara hispida** var. **hispida** (3)

3 Spines in pairs, adpressed one above the other so that they lie
   flat in the grooves .......................................................................... **Chara hispida** var. **rudis**

Drawings original or redrawn based on the BSBI Charophyte Handbook drawings by Margaret Tebbs 1986.
LIFETIME CHANGES IN DRAWING TECHNIQUES

• In the early days I used pencil drawings with a rubber - not being a vision artist but one who drew some lines and if they weren't right - rubbed them out until they were. If this turned out to be messy I would trace the drawing onto a new sheet using a tracing table with a very bright light.

• Discovering polyester drafting film however, got over all my problems. I would rough sketch a plant in pencil and then trace it carefully - filling in the detail - on the transparent polyester film using a 0.1mm Rotring stylus pen and black Rotring ink. If I made an error it was relatively easy to carefully erase areas of the ink with a number 11 scalpel blade in a standard dissecting handle - without taking the surface off the film.

• My biggest project at that stage of my life was to produce the master map for Eric Philp's first edition Atlas of the Kent Flora. It took me a week to get the intensity of the lines just right and to black in the areas for drop-out blue dots on which Eric overlaid many thousands of black crepe dots.

• With the advent of Tipp-ex however I was able to go back to paper with a 0.1mm Rotring pen and produced drawings on ordinary A4 printer paper at 2 to 3x final size.

• With the availability of computer graphics however, everything changed again, and in 1998 I acquired the then state of the art Paintshop Pro version 5. And I have used it without updating it to later versions ever since. It fits on a 3.5" floppy and it still runs OK on Windows 7, which I have stuck with since.
Polyester drafting film, 0.1mm Rotring stylus pen, black Rotring ink, No: 11 scalpel, >>glass photographic plates, ¼ plate camera, >> bromides glued on page with golfball typewritten text >> photographed onto litho plate.

Nowadays the black ink drawings on polyester will scan quite well for reuse.

HEATH
- canina

COMMON
- riviniana

PALE-WOOD
- reichenbachiana

SWEET
- odorata
START OFF ZOOMING SCANNED IMAGE TO 1,000 PIXEL SCREEN TO GET FINE LINES USING EITHER THE LINE DRAW OR ERASE IN REVERSE MODE
BLACK OUT BACKGROUND USING FLOOD FILL TO REMOVE ALL EXTRANEOUS PIXELS
Cryptomeria japonica
Japanese Red Cedar
77) **Fumaria parviflora** Fine-leaved Fumitory, from edge of rape field, west of road Coploe Hill. May 2017. Stacked Photo Ken Adams. [Note the minute sepals].
Used by:
- Professional photographers
- Individual enthusiasts
- Government & industrial research labs
- Universities
- Museums
- Schools
- People like you!

For these subjects:
- Landscapes
- Architecture
- Flowers
- Insects
- Jewelry
- Mineral samples
- Sculptures
- and more!

Works with any digital camera:
- Any brand: Canon™, Nikon™, Sony™, Pentax™, Hasselblad™, Leica™, Olympus™, etc.
- Any size: digital back, full frame or APS-C DSLR, mirrorless, compact point-and-shoot, USB eyepiece, etc.
- Any other source of JPEG or TIFF files
- Does NOT control your camera, but works with other software that does.

Works with any method of focusing:
- Move the camera (focus rail, StackShot™)
- Move the subject (focus stage)
- Turn the lens focus ring by hand
- Turn the fine focus knob of a microscope
- Automatically step the focus motor inside your lens (e.g. ControlMyNikon™, CamRanger™)

Runs on almost all desktop and laptop computers:
Trace in area to remove with FREEHAND tool
Now delete the area with FLOOD FILL
Centaurea x gerstlaureri
KEEP THE FEET OF YOUR MOUSE CLEAN TO REDUCE FRICTION


ESSEX BOTANY KEYS/2 ISSUES/YEAR

- ONE - Five Ficarias/Know Your Pines on Mapmate
- TWO – Know your Reeds/Picture Key to Grass-leaved Pondweeds
- THREE – Sphagnum Glossary/ Know Your Docks
- FOUR – Eleven Alien water plants/Picture Keys to Duckweeds & Water Starworts
- FIVE – Daisies Mayweeds & Chamomiles
- SIX – Picture Key to Horned Pondweeds of Europe/ Picture Keys to Stoneworts
- SEVEN – Heartease & Field Pansy/Grass Glossary. Picture Key to Grass Genera.