CREATING I.D.RESOURCES

KEN ADAMS

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.

12. *Ranunculus auri'comus.* **Goldilocks.**

Perennial, 1 ft., not uncommon in shady moist places in England and southern Scotland; I. Flowers yellow, spring. Lower leaves long-stalked, kidney-shaped, with 3 shallow, toothed lobes, glabrous; upper leaves deeply cut. Some of the petals are often small or absent.

13. *Ranunculus a'cris.* **Meadow Buttercup.**

Perennial, 2 ft., common in meadows throughout Britain; I. Flowers golden yellow, summer. Stems tall, erect, branched, from a short stock. Leaves deeply cut into 3–5 lobes which divide into narrow, toothed segments, hairy. Flowers 1 in. across. Sepals spreading. Flower-stalks round. Like the following species of this genus (and no. 11) the nectary at the base of the petals is covered by a small scale; the flowers are visited by small bees, hoverflies, and other insects; slight differences in the time of ripening of stamens and stigmas favour cross-pollination.

14. *Ranunculus re'pens.* **Creeping Crowfoot.**

Perennial, ½–1 ft., common in waste places and as a weed throughout Britain; I. Flowers golden yellow, summer. Leaves with 3 leaflets, each with 3 broad, toothed lobes, stalked, hairy. Flower-stalks furrowed. The short stock gives off runners which root and form new plants, thus multiplying and spreading the weed.

15. *Ranunculus bulbo'sus.* **Bulbous Buttercup.**

Perennial, 1 ft., common in meadows and pastures throughout Britain; I. Flowers golden yellow, early summer. Leaves stalked, hairy, with 3 leaflets, each divided into broad, lobed segments. Flower-stalks furrowed. Sepals bent sharply back. Base of stem swollen into a small corm.

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.

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 — DIANTHUS, **1**
  - 2. Styles 3 — SILENE, **2**
  - 3. Styles 4 or 5 — LYCHNIS, **3**
- (*b*) Sepals free
  - 1. Petals notched — CERASTIUM, **4** or STELLARIA, **5**
  - 2. Petals entire — SAGINA, **7** or ARENARIA, **6**

B. Membranous stipules present:
- (*a*) Flowers pink — SPERGULARIA, **9**
- (*b*) Flowers white — SPERGULA, **8**

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. CERASTIUM (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)

Annual or perennial herbs, usually glabrous. Flowers in loose cymes. Sepals 5, *free. Petals* 5, *deeply notched. Stamens* 10, *sometimes fewer. Styles usually* 3. *Capsule ovoid, opening to half-way down by* 6 *teeth. Latin,* stella, *a star, from the flower shape.*

6. ARENARIA (p. 137)

Small annuals or perennials usually with narrow glabrous leaves. Sepals 5, *free. Petals* 5, *entire. Stamens usually* 10. *Styles usually* 3. *Capsule opening by* 3 *or* 6 *teeth. Latin,* arena, *sand, some species growing in sandy places.*

7. SAGINA (p. 137)

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

8. SPERGULA (p. 138)

Annual herbs with forked branches. Leaves apparently in clusters with small membranous stipules fused in pairs. Flowers white, in leafless cymes. Petals and sepals 5. *Stamens usually* 5. *Styles* 5. *Capsule opening by* 5 *valves. Seeds many, flattened, with a rim. Latin,* spargo, *I spread, referring to the abundant seeds.*

9. SPERGULARIA (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.

code: Floating Plants(2) bmp

SURFACE FLOATING WATER PLANTS

Flowering Plants

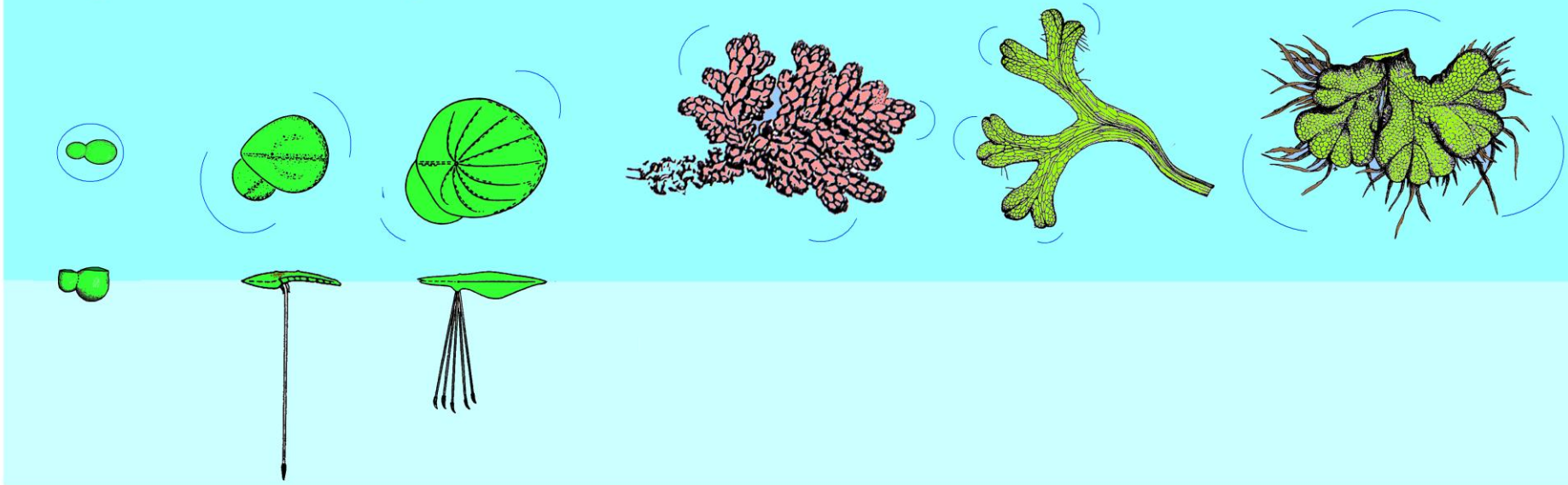
Wolffia *Lemna* *Spirodela*

Ferns

Azolla

Liverworts

Riccia *Ricciocarpos*



Duckweeds (9)

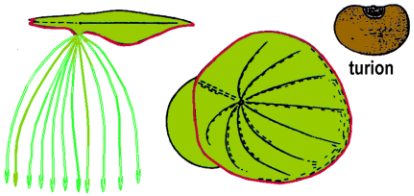
Water Ferns (2)

Crystalworts (4)

KNOW YOUR DUCKWEEDS

[to see nerves in duckweeds use bright back lighting]

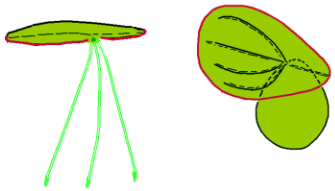
Spirodela (Lemna) polyrhiza



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 eutrification. Scattered distribution north to Lancs. & Northumberland and central lowlands where July mean >21°C.

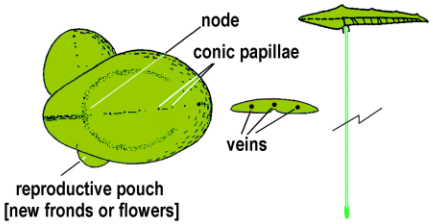
Landoltia [Spirodela] punctata [oligorrhiza]

Alien



roots 1-7(10) in number, veins obscure 3-5(7), fronds 3- 5mm 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 pimples along mid-line above, turions have been reported, imported with macro-aquatics in garden centres, and found in an outside garden pond in Treborth Botanic Gardens, Gwynedd in 2009.

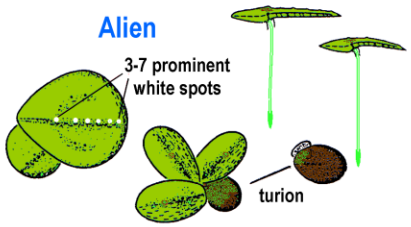
Lemna minor



single root to 15cm, root cap straight, 3 veins widest apart below middle, fronds floating, 1.0- 8.0 mm long, ovate, flat, 1.3 to 2.0x as long as wide, deep green, may become reddish above, convex above, always some rounded fronds, produces very small form that over winters on the surface that can be confused with *L. minuta*, turions absent, but some fronds may sink in autumn, formerly the commonest species [see also *L. turionifera, L. minuta & L. valdiviana].* Can withstand moderate enrichment, weakly acid to weakly basic waters, north to Shetland, but absent from the Scottish Highlands.

Lemna turionifera

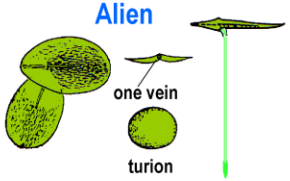
Alien



similar to *L. minor*, but: single root < 15cm, the 3 veins wider apart towards the apex, fronds floating, obovate, flat, 1-4 mm, 1.0-1.5 x longer than wide, olive-green, with red speckling, particularly near the root insertion, giving a 'dirty' appearance, always more red below than above [c.f. *Lemna minor*] produces distinct olive to brown rootless turions that sink in autumn. Has been spreading westwards across Europe. In U.K. from 2007. now in Anglesea, Powys, Monmouthshire, Gloucestershire, Wiltshire, Dorset, Somerset, Lincolnshire and Norfolk.

Lemna minuta [minuscula]

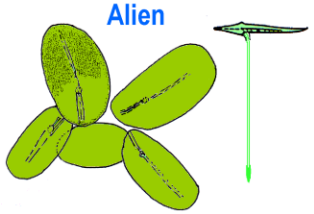
Alien



single root to 1.5 cm, 1 vein only (often faint), extending no more the 2/3 distance between node and apex. Fronds floating, 0.8-4.0mm long, 1.0-2.0 x longer than wide, in groups of 1 to 3-4, pale to light 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.

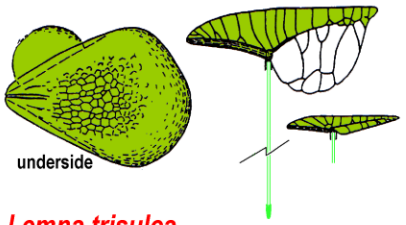
Lemna valdiviana

Alien



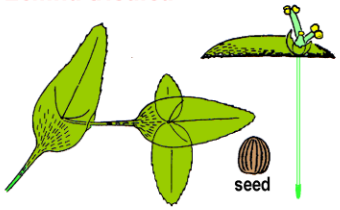
single root to 1.5 cm, 1 vein only, prominant, extending at least 3/4 distance between node and apex. Fronds submerged at several overlapping levels, 1.0-5.0 mm, thin, flat, 1.3-3.0 x longer than wide, in groups of 1 to 3-4. pale to bright green, transparent, ovate to lanceolate, always more elongated 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



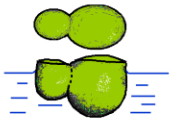
single root to c.5cm, 4-5 veins, fronds floating, 1.0-8.0mm long. rounded/angular. yellowish-green to reddish-purple above and below, flat above with reticulum of air spaces below, if water level drops in hot summers and conditions become eutrophic, becomes convex above, and develops colourless, expanded polystyrene-like swelling below, becoming almost spherical, often forming multi-layered crusts in dried up dykes. Thermophilic, rivers, ditches, brackish dykes, occasionally in ponds. North to Lancs. and Yorks. and central lowlands of Scotland where July mean >21°C.

Lemna trisulca



roots 0-1 to c.1cm, fronds submerged at several overlapping levels in the water column and joined together in chains of up to 50, unless flowering on the surface. Leaf-like with serrated apex and petiole-like stalk, up to 2cm long including stalk, daughter fronds arise at nodes, one prominent and two faint nerves. Restricted to still waters with low nutrient levels, can withstand low light levels, common in shaded ponds but also in slow flowing rivers, ditches, canals and lakes below 300m north to Scottish Lowlands.

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.

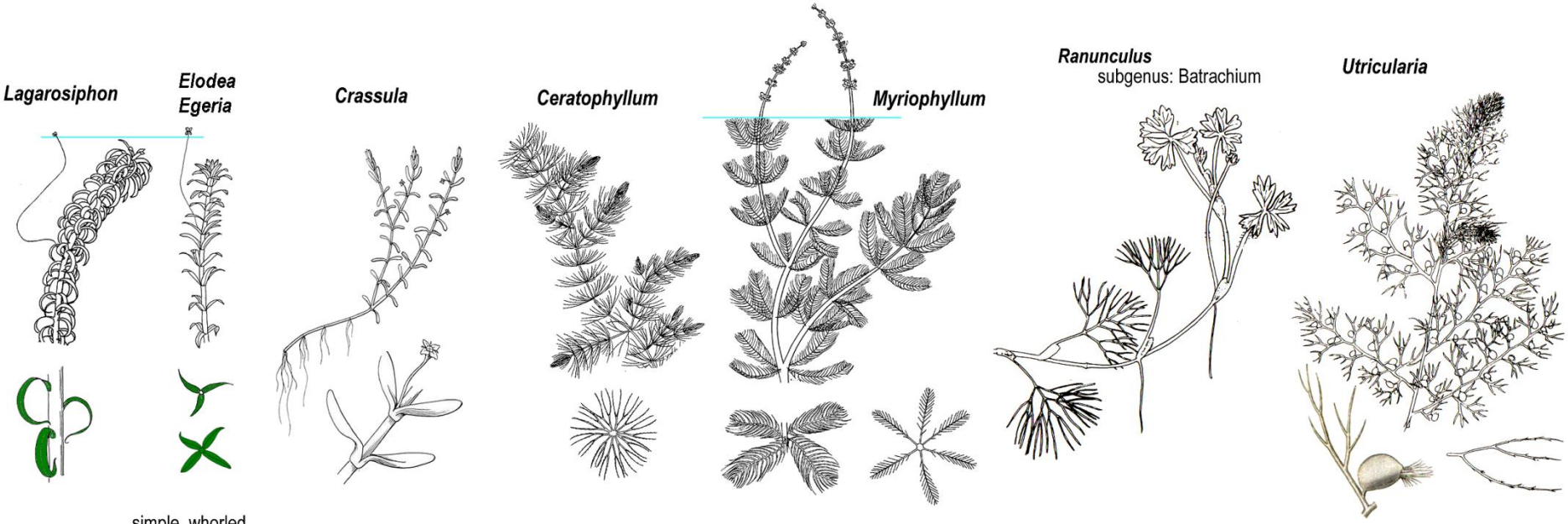
- As an I.D. resource an illustration of a plant carries vastly more morphological information that we can take in very rapidly, compared with a textual description however detailed.

- 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.

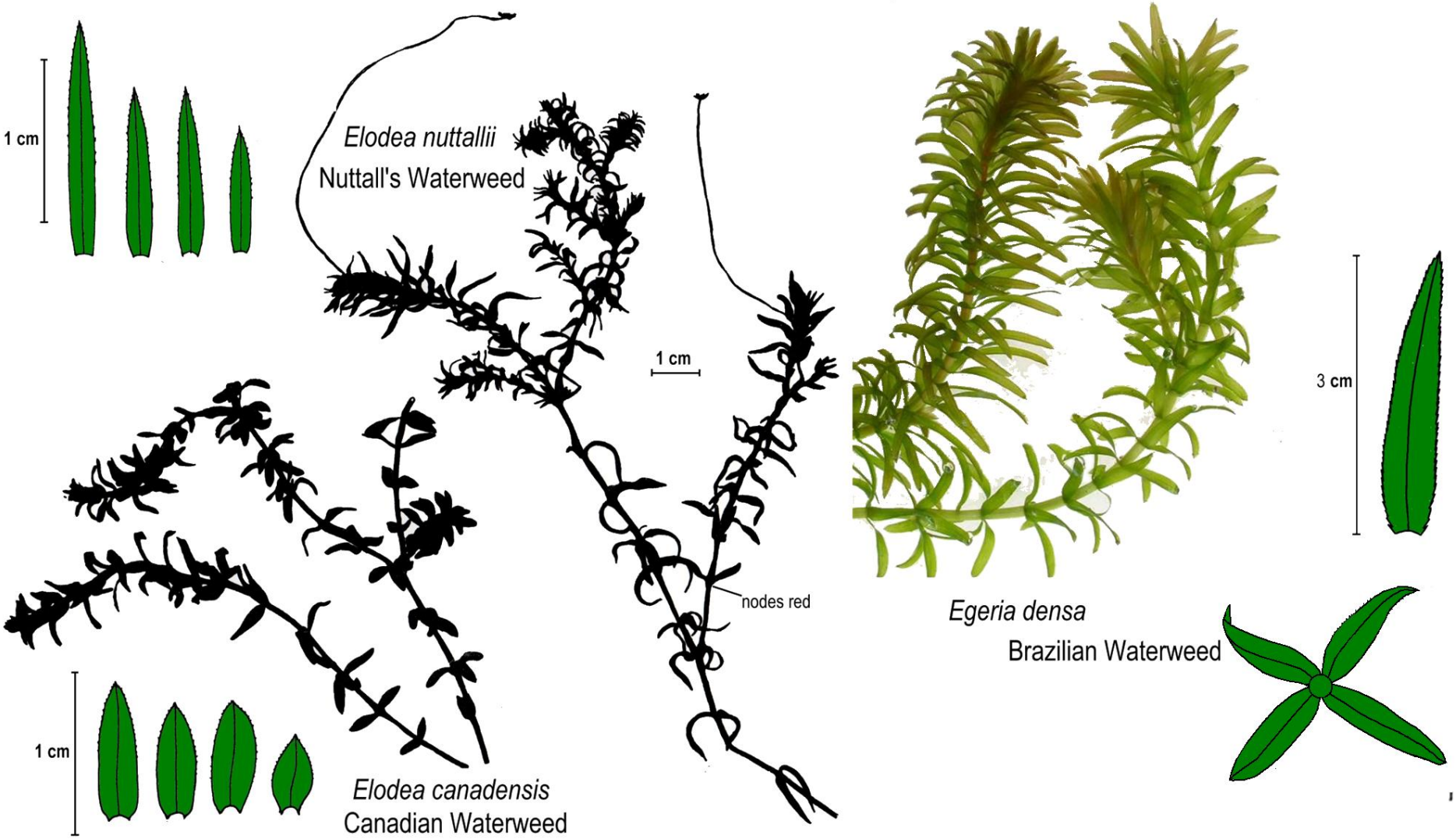
SUBMERGED WATER PLANT GENERA

code: Submerged plants tif

Recognition of leaf insertion and dissection patterns.

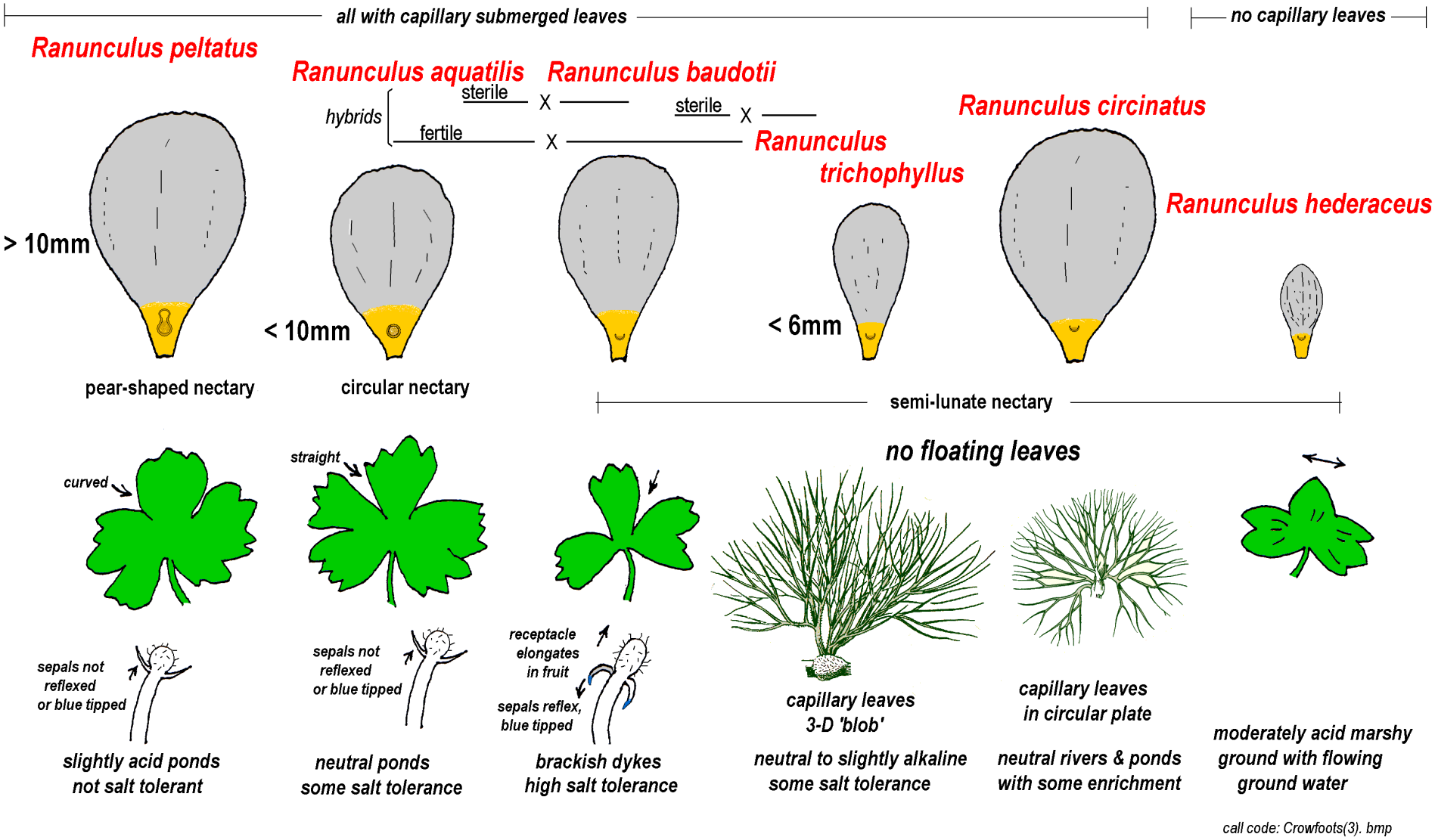


Waterweeds	Pigmy-weeds	Hornworts	Water-milfoils	Water-crowfoots	Bladderworts
5	2	2	4	12	6



call code: Elodea & Egeria. bmp

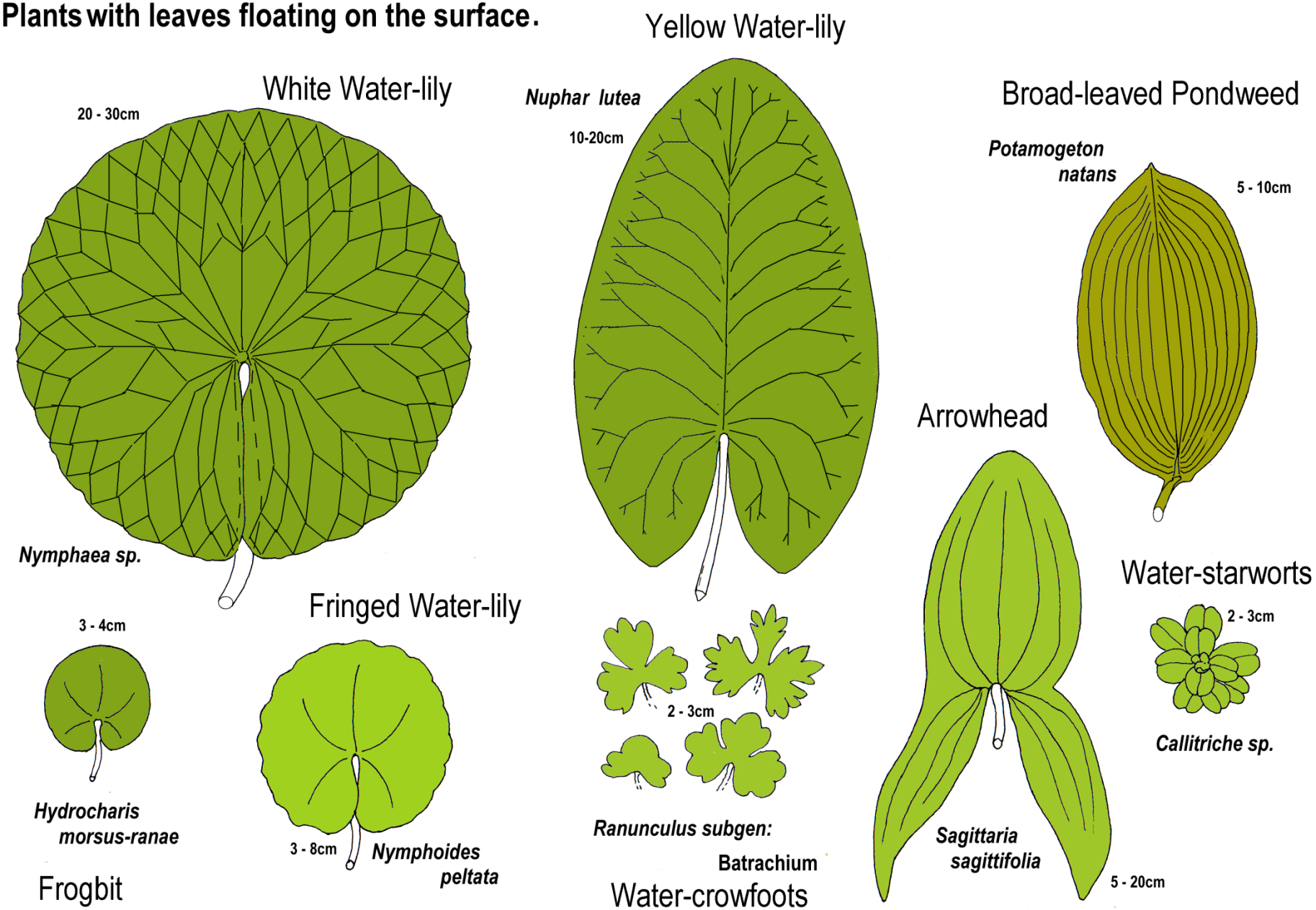
COMMON SPECIES OF WATER CROWFOOTS



Other species: *R. tripartitus, R. omiophyllus,* (both westen 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.

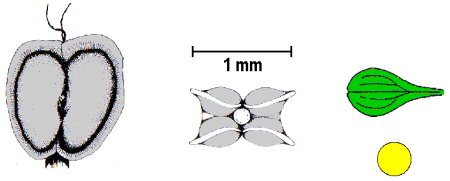


code: surface leaves

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.

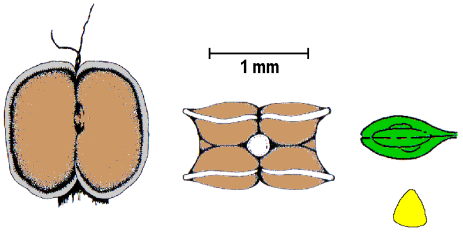
C. stagnalis



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.

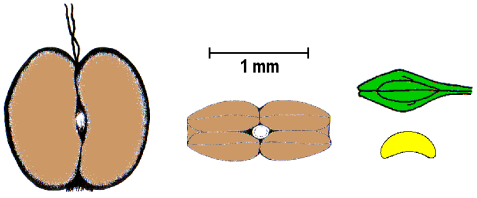
C. platycarpa



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.

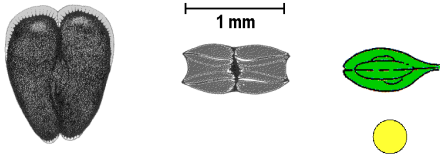
C. obtusangula



Rosette and submerged leaves rhomboid spathulate. 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



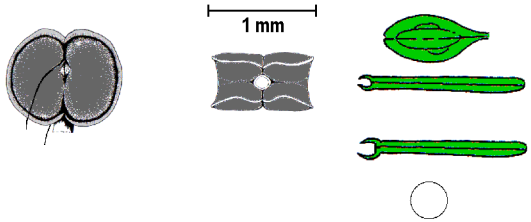
Rosette leaves similar to *C. platycarpa*, submerged leaves ligulate. Pollen more or less spherical and pale yellow. Fruits uniquely longer than wide, and black when ripe, narrowly winged all round or just at the apex.

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 Galway & Dunbartonshire. Now sold by water garden nurseries !

C. brutia

var. **brutia**

var. **hamulata**

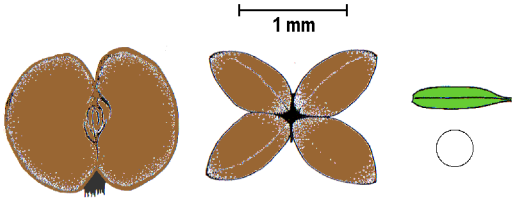


Rosette leaves similar to *C. platycarpa*, submerged leaves ligulate, usually some apically notched. Pollen more or less spherical, colourless. Fruits more or less as wide as long, narrowly winged, blackish when ripe. Style uniquely reflexed.
var. *brutia* with apical notch curved inside, and symmetric, peduncles 2 to12mm.
var. *hamulata* with apical notch flat based (spanner shaped). wider than lamina.and typically asymmetric, peduncles less than 2mm.The subsp. can only be reliably I.D.ed if peduncles present.

var. *brutia* is common in the south, but can only be reliably identified when in ephemeral water bodies as they dry up, it then displays its extra long peduncles.
var. *hamulata* is common in fast-flowing rivers, but also in streams and deep ponds. Throughout U.K.

C. truncata

var. **occidentalis**

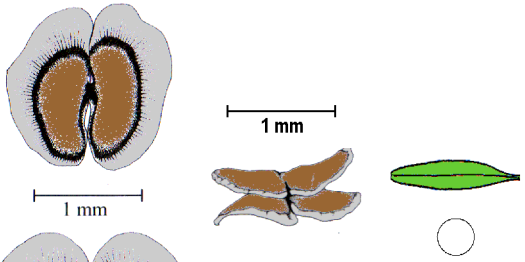


No rosette leaves, submerged leaves ligulate, truncate to shallowly emarginate, often red tinged, very small c.1cm long. Pollen spherical. colourless. Fruits unwinged in this subsp, wider than long, dark brown when ripe, cross shaped from above.

Very local in Britain, in a range of ponds, canals, rivers and coastal habitats. Immediately obvious from its small leaves. Large population between Doncaster & Leicester (c.90 tetrads), Anglesea 10, Somerset & Devon c.30, Essex 11, Dungeness 4. Scattered elsewhere.

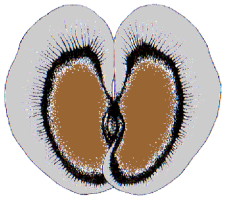
C. hermaphrodictica

subsp. **hermaphrodictica**



C. hermaphrodictica

subsp. **macrocarpa**



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 >1.8mm wide or long in
subsp. *macrocarpa*
and < 1.7mm wide in
subsp. *hermaphroditica*

Northern in Britain. south to the Severn valley. Lakes, gravel pits canals, and slow flowing segments of rivers. Mostly north of the mean summer 15°C isotherm.

Based with permission on Water Starworts *Callitriche* of Europe by Richard Landsdown. 2008 . BSBI Handbooks No: 11.

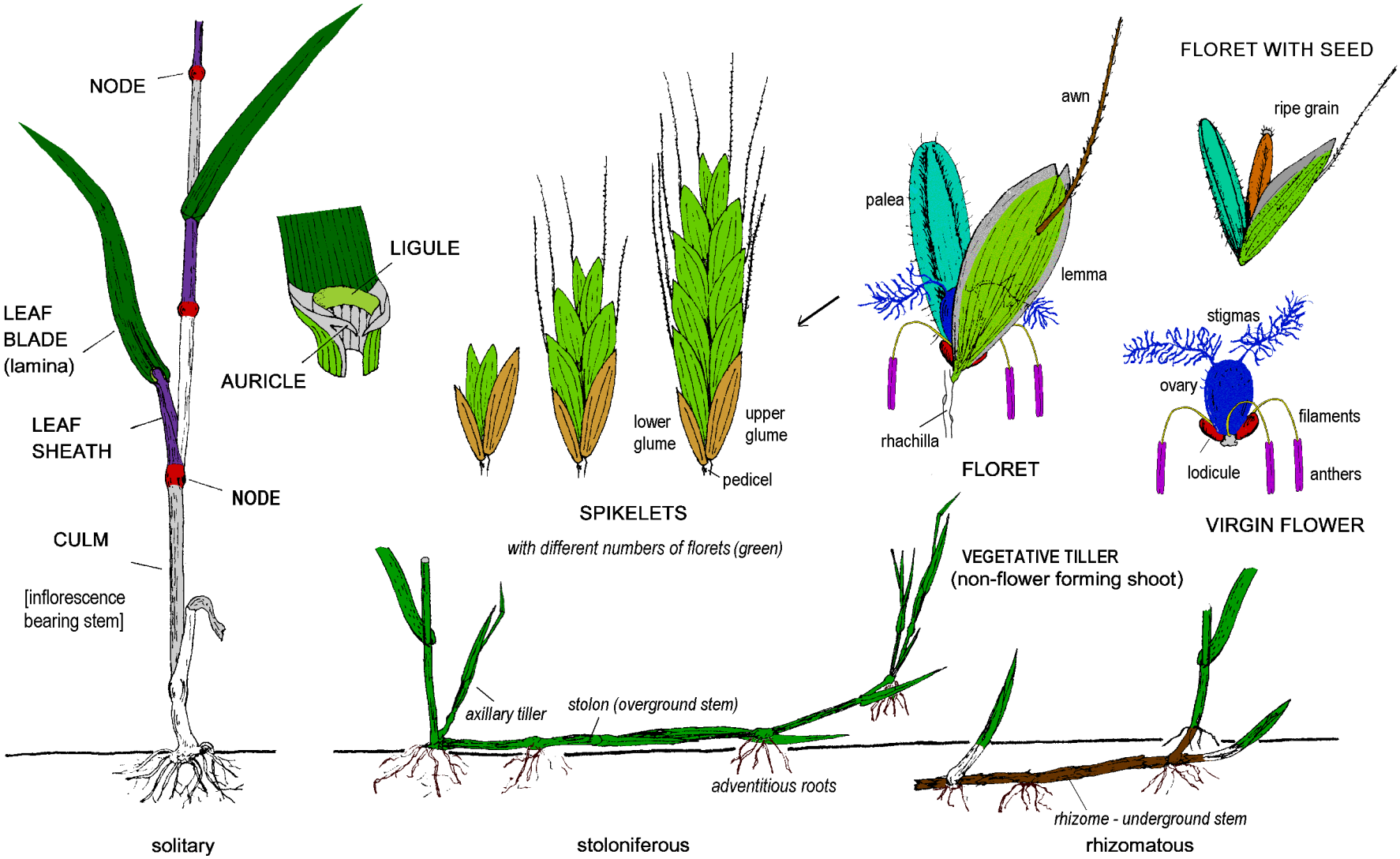
- One of the first hurdles that a beginner higher plant botanist faces is that keys and descriptions use unfamiliar terms, and frequent trips to the glossy are needed one at a time to find out what they mean, and many of them never stick. Many people finally trying to do without them and falling back 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.

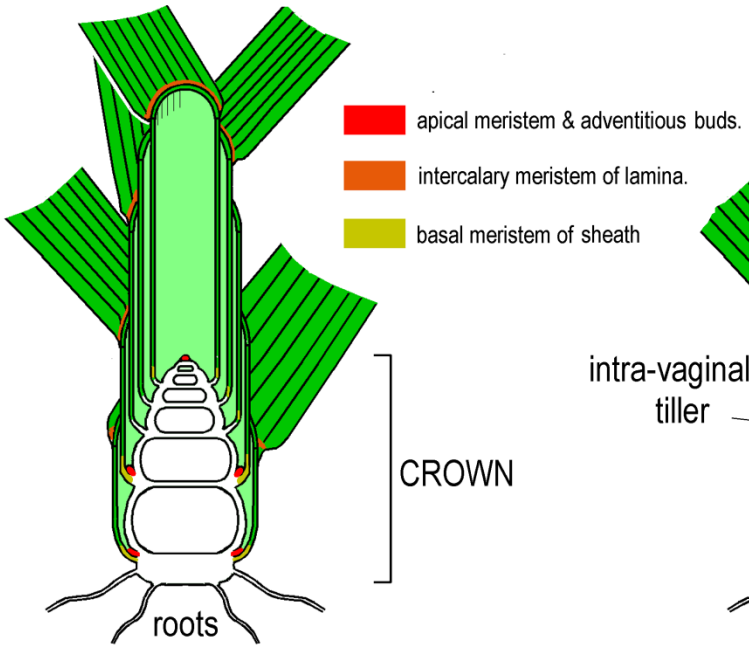
- The next stage is to produce synoptic side by side annotated diagrams of all the species in a genus, so that rather than wading through a cryptic key one dichotomy at a time a quick visual scan with notes under each drawing to guide the user to the critical characters enables a comparison of several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

GRASS STRUCTURE

GLOSSARY



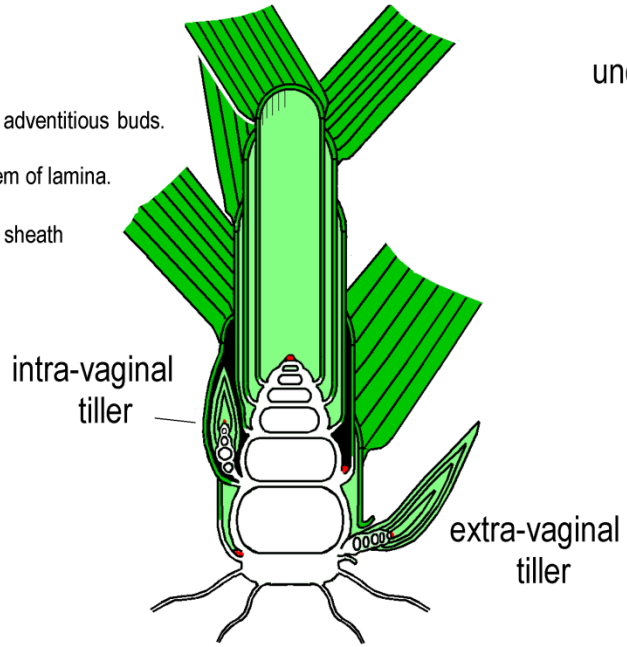
ANATOMY OF GRASS GROWTH



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.

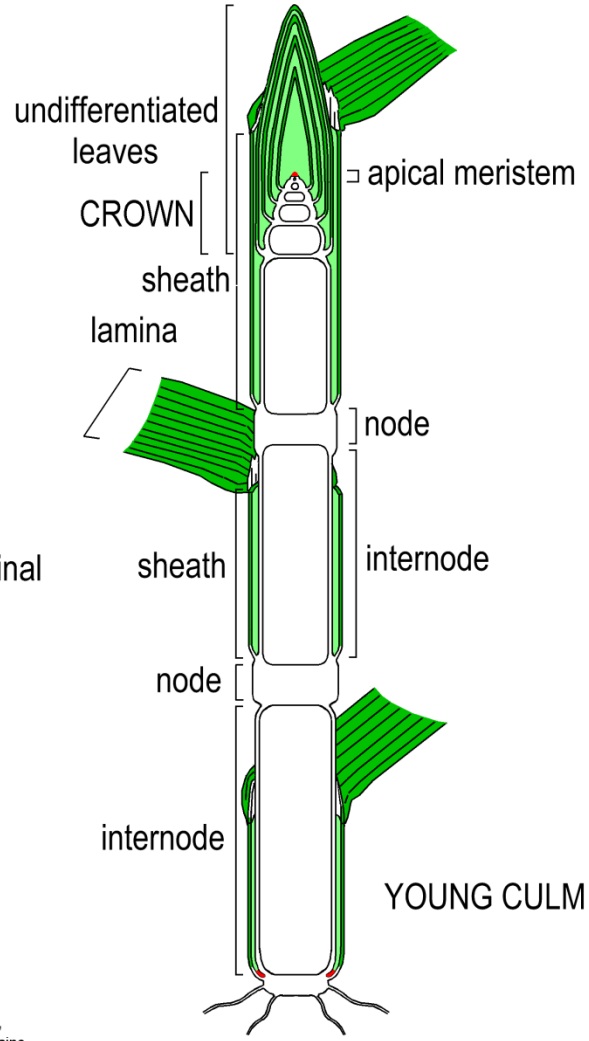


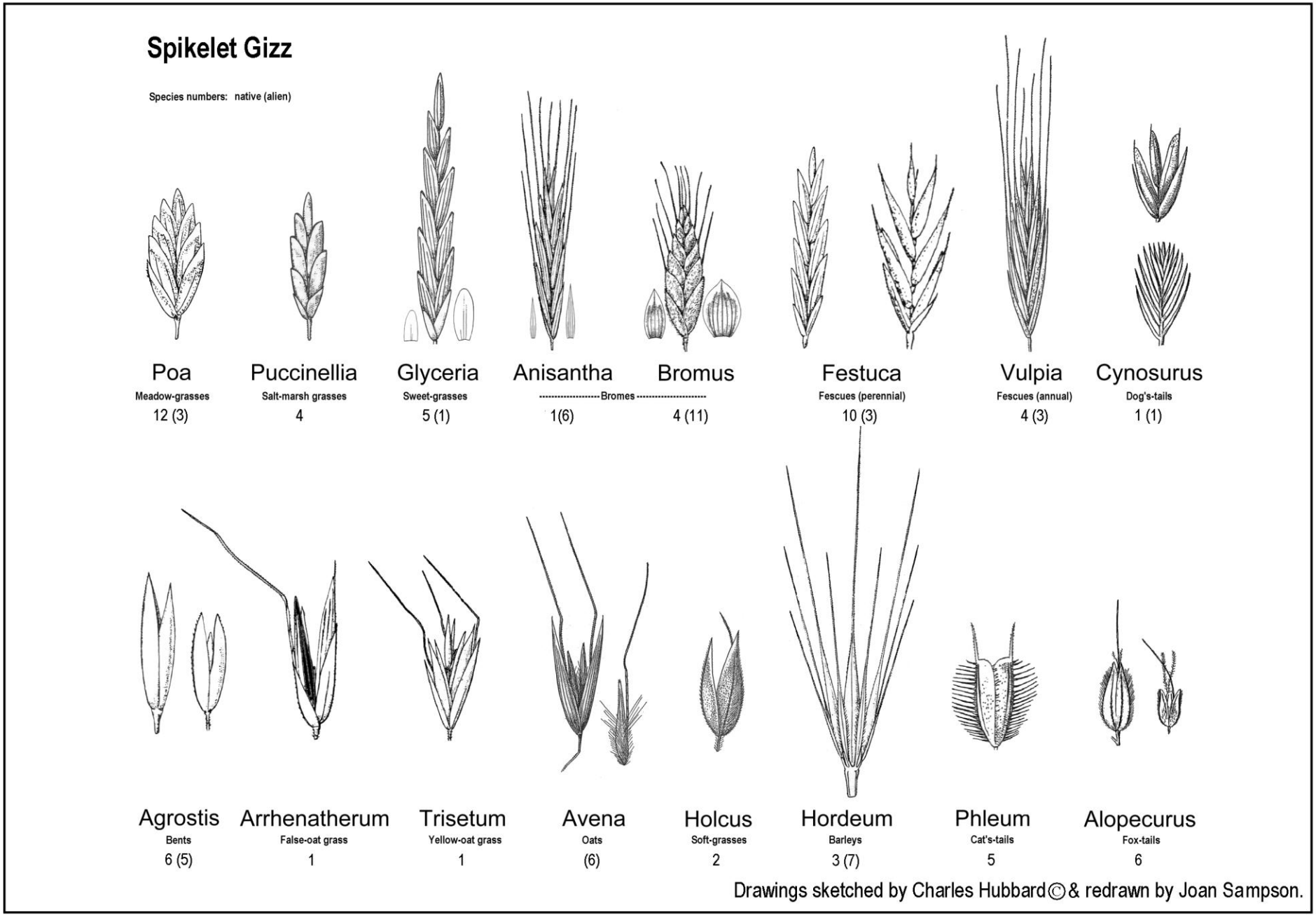
An intra-vaginal tiller arises from an adventitious bud in the axil of a sheath without puncturing it.

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].





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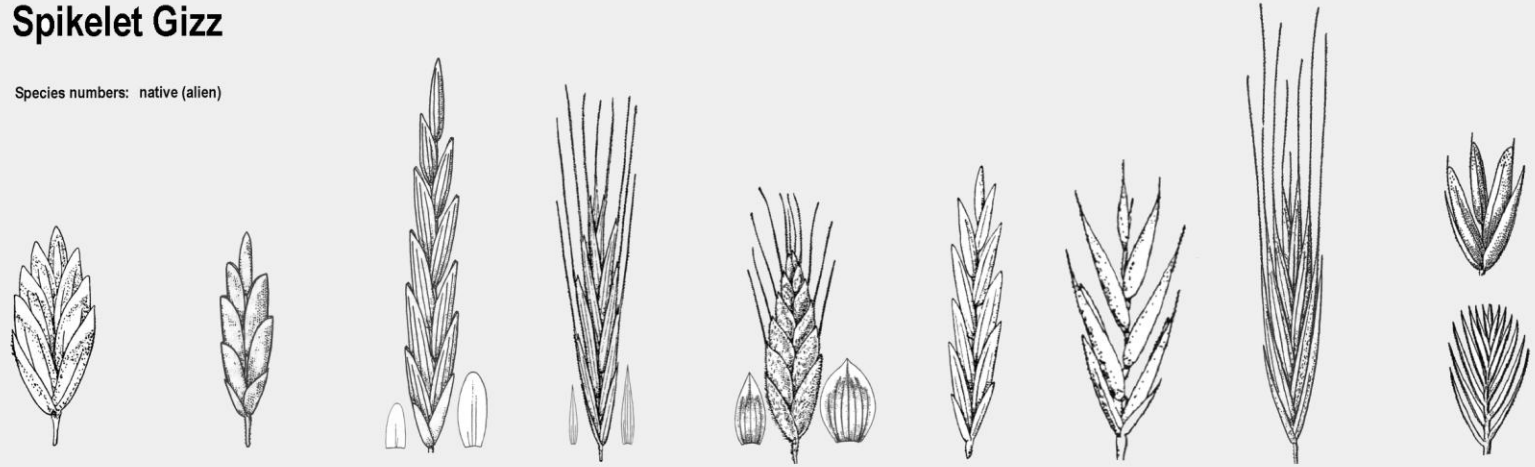
Spikelet Gizz

Species numbers: native (alien)



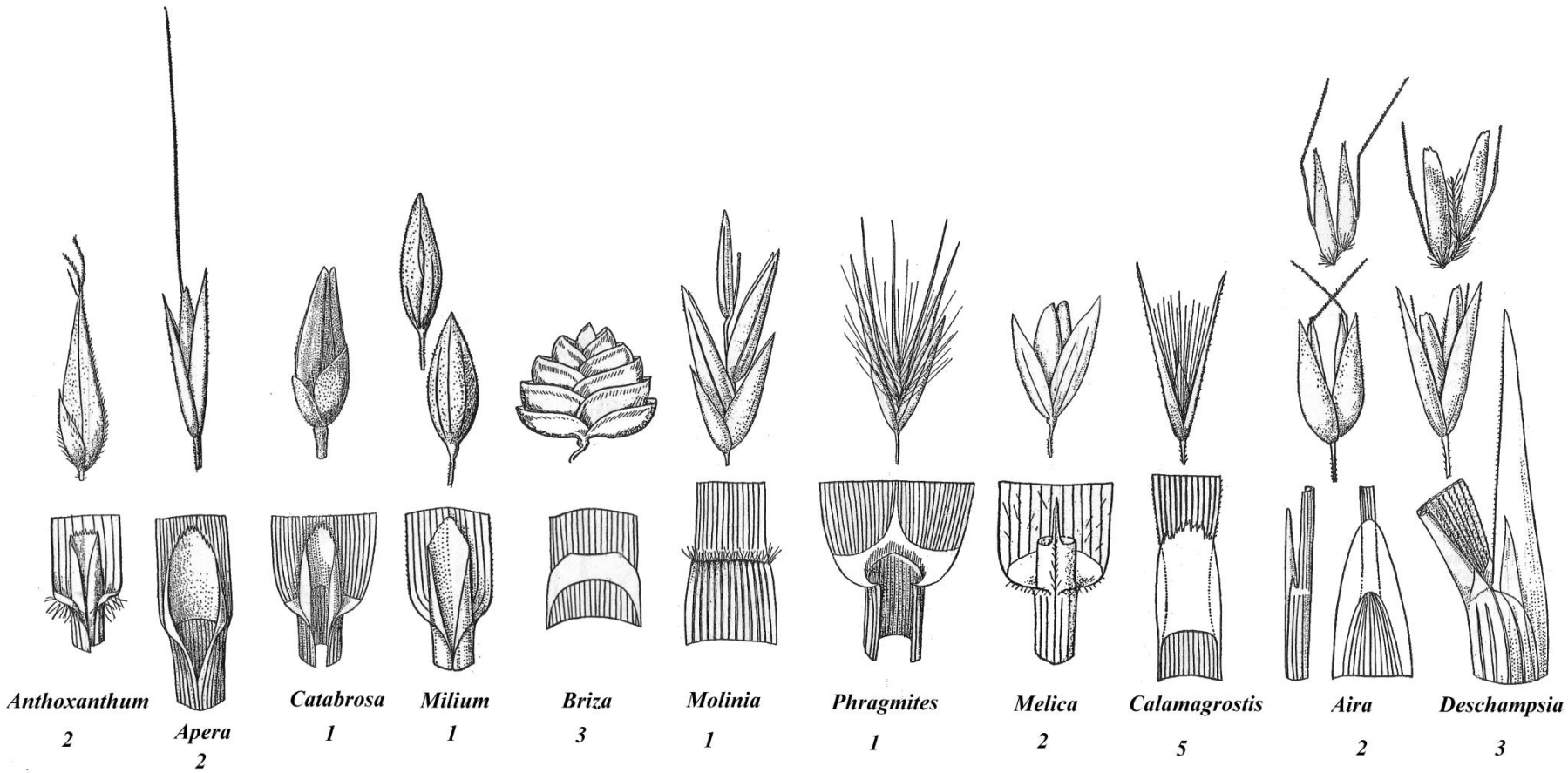
Poa *Puccinellia*

Agrostis	Arrhenatherum	Trisetum	Avena	Holcus	Hordeum	Phleum	Alopecurus
Bents	False-oat grass	Yellow-oat grass	Oats	Soft-grasses	Barleys	Cat's-tails	Fox-tails
6 (5)	1	1	(6)	2	3 (7)	5	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.]



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

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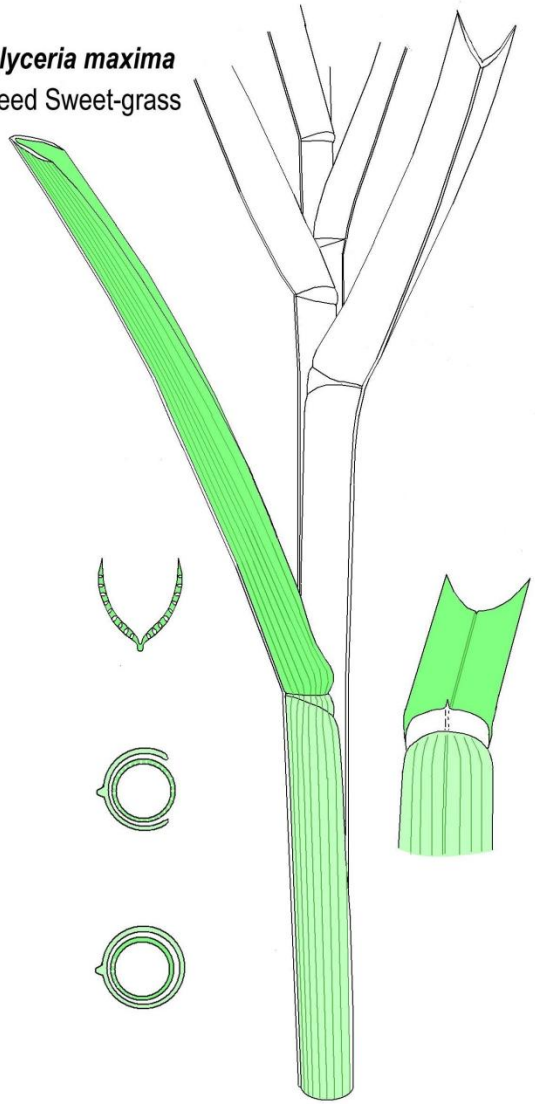
REED-LIKE GRASSES & COMMON REED

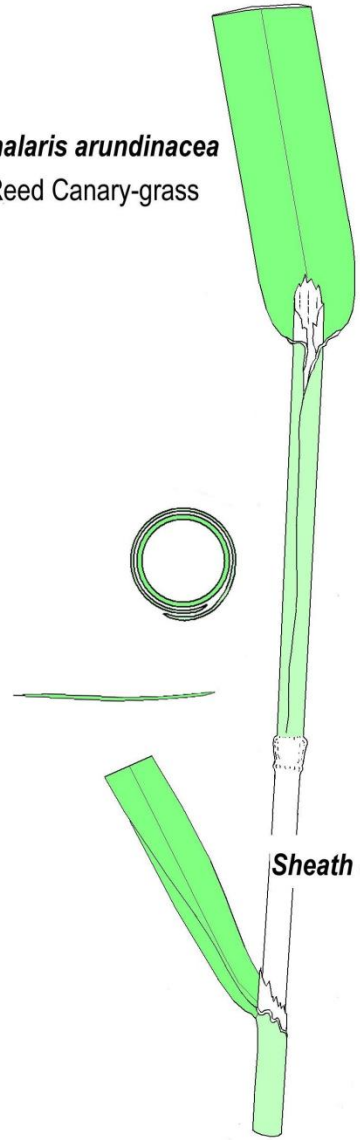
call code: Aquatic reedy grasses (annot)

Glyceria maxima
Reed Sweet-grass



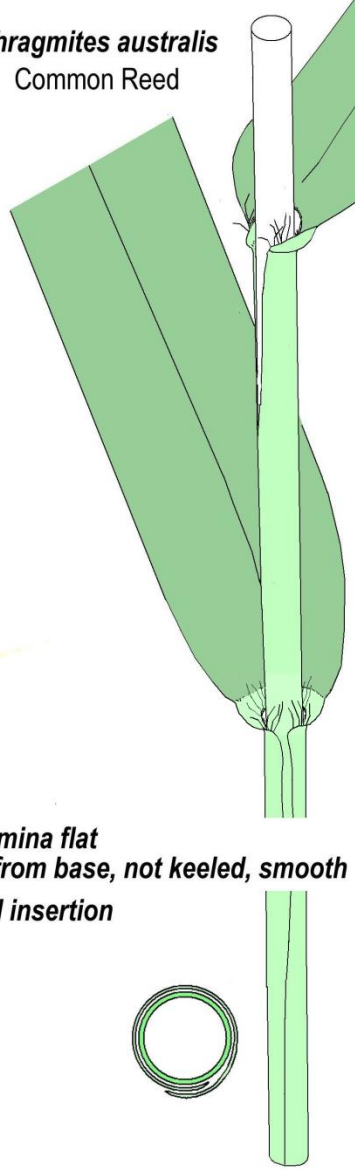
Lamina keeled
Sheath tubular, splitting above, keeled and rough
Ligule membranous with central point

Phalaris arundinacea
Reed Canary-grass



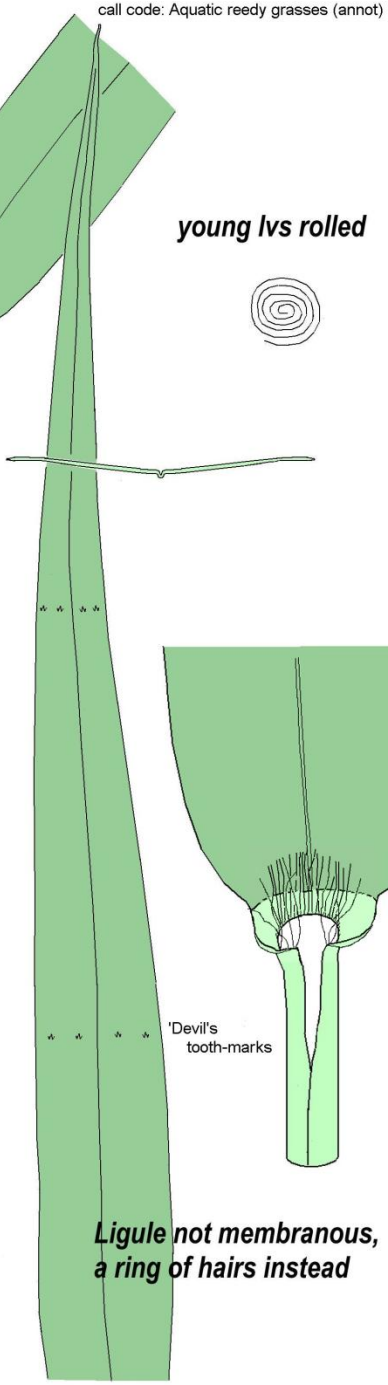
Ligule membranous, ragged

Phragmites australis
Common Reed



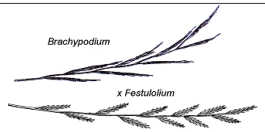
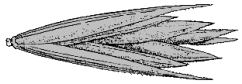
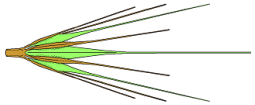
Lamina flat
Sheath overlapping from base, not keeled, smooth
spiral insertion

young lvs rolled



Ligule not membranous,
a ring of hairs instead

With Copyright permission from Penguin.

30 Spikelets arranged singly, spaced out, inflorescence a spike-like raceme…… try *Brachypodium* and x *Festulolium* one common woodland/hedgerow and one chalk grassland species (B) **p.81 - 91** one common and two rarer grassland *Festuca* x *Lolium* hybrids (x F) **p.146 - 147**	
31 Spikelets attached singly to the main axis of the spike or raceme…….....**33 or (32)**	
32 Spikelets attached in clusters of twos or threes to the main axis……..…… **35**	
33 Spikelets one flowered and sunken in hollows in the thickened jointed axis of cylindrical spikes…….try *Parapholis* Sea Hard-grasses **or (34)** 2 saltmarsh species, 1 common, the other local **p.338 - 341**	
34 Spikelets two or more flowered and pressed against the main axis or sticking out but not sunken in hollows…… **37**	
35 Spikelets stalkless, clustered in pairs, alternating on opposite sides of the main axis and 3-6 flowered …… try *Leymus arenarius* Lyme Grass **or (36)** local on coastal dunes **p.104 - 105**	
36 Spikelets clustered in threes, outer spikelets (usually) sterile, central spikelet 1 (rarely 2) flowered……try *Hordeum* and *Hordelymus* Barleys 3 native and several casual species of *Hordeum*, one native species of *Hordelymus* [calcareous woodland] **p.106 - 113**	
37 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. **39 or (38)**	
38 Spike with spikelets attached by their broad edges on to the main axis……..…**41**	
39 Inner glumes absent except at apex of spike…… try *Lolium* Rye Grasses **or (40)** 1 very common native, 1 common introduced fodder species and 2 rare casuals. **p.143 - 153**	
40 Inner glumes all present ……..try x *Festulolium* 4 representatives, 1 local and 3 rare **p.146 - 147**	
41 Perennials, grain tightly enclosed between lemma and palea…….. try *Elymus* and *Elytrigia* Couches and Twitch **or (42)** 1 local woodland species (*Elymus*), and 3 *Elytrigia* species, 2 coastal, 1 widespread **p. 92 - 103**	
42 Annuals, grain free from lemma and palea *Triticum* (cultivated wheats) **p. 442**	
43 Spikelets dumpy, nodding with florets arranged almost horizontally, and glumes hooded…… try *Briza* Quaking Grasses **or (44)** one common native on calcareous soils, two aliens **p.208 - 213**	

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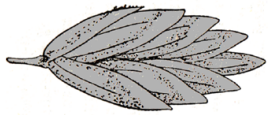
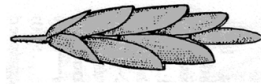
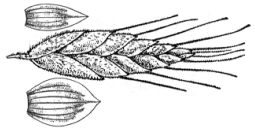
72	Spikelets ovate to oblong in loose whorled panicles, glumes and lemmas unawned, ovate, keeled on the back and shortly pointed, lodicules two.....try *Poa* Meadow-grasses 7 common grassland, waste ground and woodland, and 7 rare species p.164 - 193	
73	Spikelets and panicles similar to *Poa* but spikelets more oblong and glumes plus lemmas rounded on the back (unkeeled), and more rounded apically, lodicules two, leaf sheaths open.....try *Puccinellia* Salt-marsh Grasses or (74) grasses of salt marshes and brackish mud, 5 species p.194 - 203	
74	Spikelets similar *to Puccinellia*, but longer, with more florets, lodicules fused together and leaf sheaths tubular almost to the apex, [though may split open later] glumes ovoid, rounded/shortly pointed at apex .....try *Glyceria* Sweet-grasses or (75) three common species and one hybrid, freshwater streams, rivers, ponds and ditches p.114 - 123	
75	Creeping stoloniferous *Poa*-like perennial with loose panicles of alternating half-whorls each of 3-5 semi-erect branches bearing clusters of 3-5mm, 1-3 flowered spikelets. Glumes rounded, membranous, tinged with green and purple and very short compared with the florets....try *Catabrosa aquatica* Water Whorl-grass or (76) now a rare grass of cattle trampled margins of streams and ponds p. 220 - 221	
76	Spikelets with awned lemmas, annuals to biennials, without sterile shoots, or rhizomes at flowering time, ovary with hairy terminal appendage. Bromes [sections one and two] ..... 78 or (77)	hairy terminal appendage
77	Spikelets with or without awned lemmas, perennials with sterile shoots, and often rhizomes at flowering time, ovary with or without hairy terminal appendage 80	
78	Spikelets long-awned and wedge-shaped, including the awns appearing widest at their tips, glumes subulate to **narrowly** lanceolate, lower with 1-3 veins. Paleas keeled and hairy, ...try *Anisantha* Bromes [section one] or (79) one common native and 5 alien casuals p.60 - 67	
79	Spikelets awned with shortly to narrowly ovoid spikelets, tapering towards the apex, glumes ovate, shortly pointed, lower with 3-7 veins...try *Bromus* Bromes [section two] 3 native grassland, 6 casual aliens of arable and waste ground p.74 - 87	
80	Perennials, with spikelets < 15mm (excluding awns), narrowed to apex, lemmas < 9mm, ovary without hairy terminal appendage, but apex of ovary/grain hairy in a few species.....Fescues [section one] 84 or (81)	
81	Tufted perennials without rhizomes, spikelets similar to *Bromus* but lemmas markedly keeled and flattened, ovary with hairy terminal appendage, spikelets >15mm lemmas >8mm. .....try *Ceratochloa* Bromes [section three] or (82) 5 alien casual/naturalized species p. 71 bottom of page	
82	Perennials with long or short rhizomes, spikelets narrowly oblong, >15mm (excluding awns), some species with, some without awns, glumes lanceolate, lower 1-3 veined, lemmas >8mm ovary with hairy terminal appendage ..try *Bromopsis* Bromes [section four] or (83) 2 natives woodland, 1 native chalk grassland, 1 naturalized species p.68 - 73	

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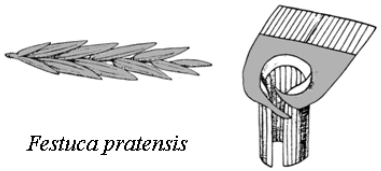
83 Leaf blades of both tillers and culms flat, 3 to 8mm or more wide,
and with long pointed auricles,
apex of ovary/grain without hairs……try *Festuca* [Fescues Section One = *Schedonorus*]

2 common grassland species, 1 woodland and shady hedgerows. p.140 - 145



Festuca pratensis

84 Leaf blades of both tillers and culms flat, 4-14mm wide, but without auricles
apex of ovary/grain hairy……..try *Festuca altissima* Reed or Wood Fescue or (85)

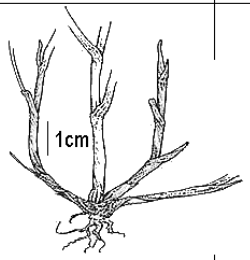
rare damp woods, N W Britain, E. Sussex and S W Ireland. p.124 - 125

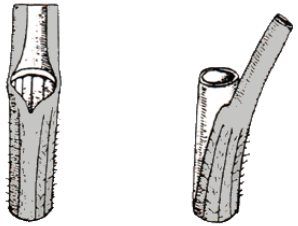
85 Perennials with leaf blades of tillers bristle-like, but those of culms flat
apex of ovary/grain hairy ….try *Festuca heterophylla* Various-leaved Fescue or (86)

thinly scattered introduction, mainly in woodland p.132 - 133

86 Perennials with leaf blades of tillers folded longitudinally and bristle-like (or sometmes flat),
culm leaves flat (or sometimes bristle-like),
apex of ovary/grain without hairs. ….try *Festuca* [Fescues Sections Two and Three] 87

87 Young tiller leaves with cylindrical sheaths, edges fused almost to top,
new tillers tend to cut horizontally through old sheaths (extravaginal),
auricles vestigial *Festuca* [Fescues Section Two - *rubra* aggregate] or (88)



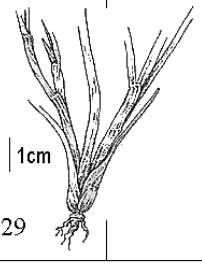


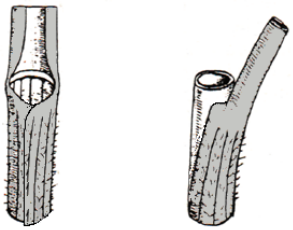
1 widely distributed species, 1 on coastal shingle, 9 subspecies between them

p. 134 - 141

Tiller diagrams, modified from Stace et al, 1992.
Watsonia 19: 107-112. (with permission).

88 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…..*Festuca* [Fescues Section Three - *ovina* aggregate]





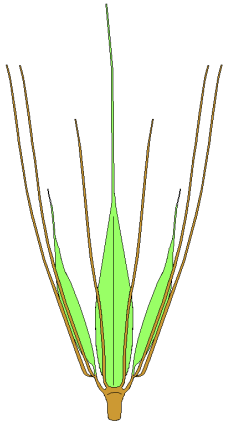
2 common species, 4 rare natives, 1 alien.

p. 126 - 129

Hordeum & Hordelymus

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

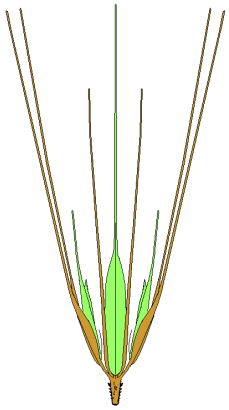
glumes - coloured brown florets - coloured green (for clarity)



Hordeum secalinum

Spikes 2 - 8 x 0.7 -1.5cm
outer spikelet glumes
both bristle like

Common, neutral pasture & meadow grassland east of a line from Cardiff to Scarborough

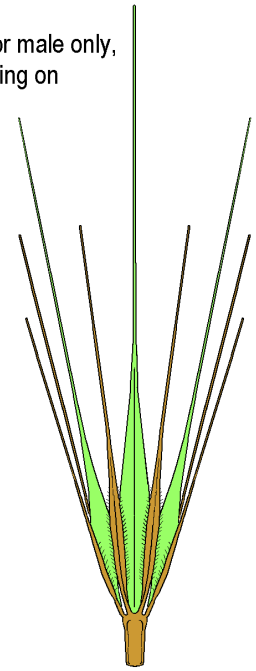


Hordeum marinum

Spikes 2 - 6 x 1.5 - 3cm
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.

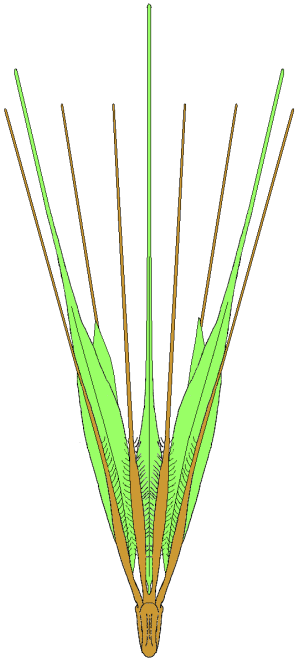
glumes minutely rough



Hordeum murinum

Spikes 4 -12 x 1 - 3cm
inner spikelet largest
central sessile

Common, waste ground.

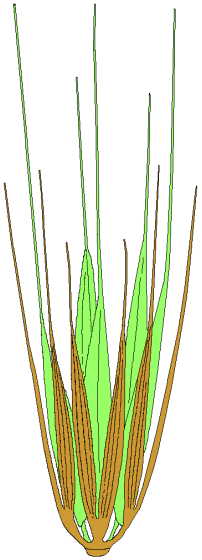


Hordeum leporinum

outer spikelets largest
central stalked

Very rare alien.

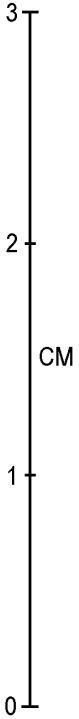
glumes edged with stiff hairs



Hordelymus europaeus

Spikes 5-10 x 0.7-1.2cm
All 3 spikelets bisexual, each with 1-2 florets.
Glumes flat and winged.

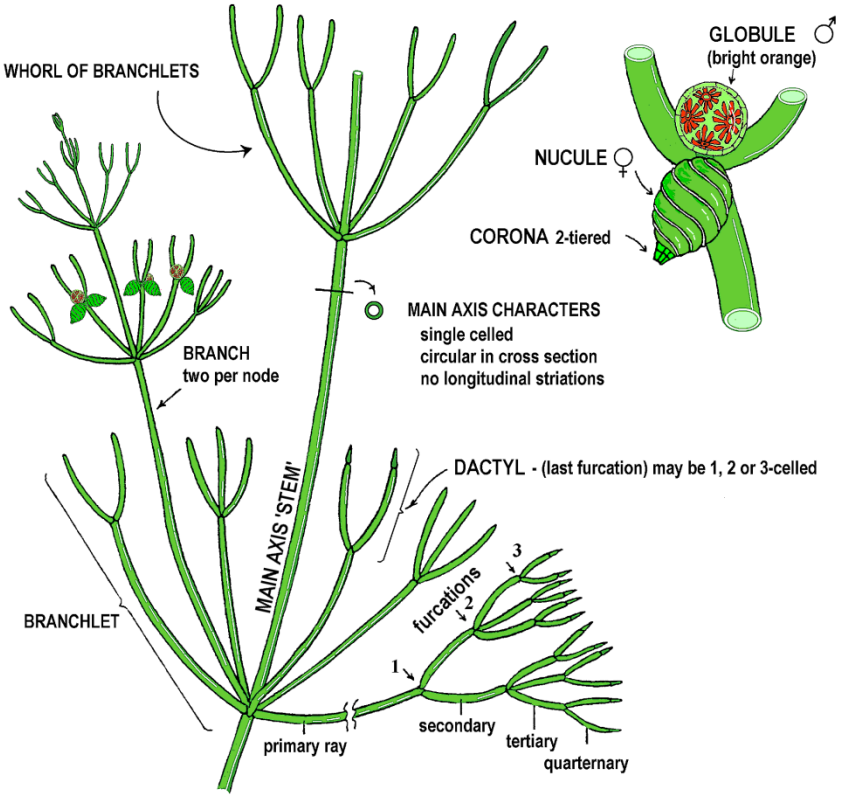
Scarce, scattered distribution in shaded woodland on calcareous soils. Central, northern & eastern England.



The Genus Nitella

GLOSSARY

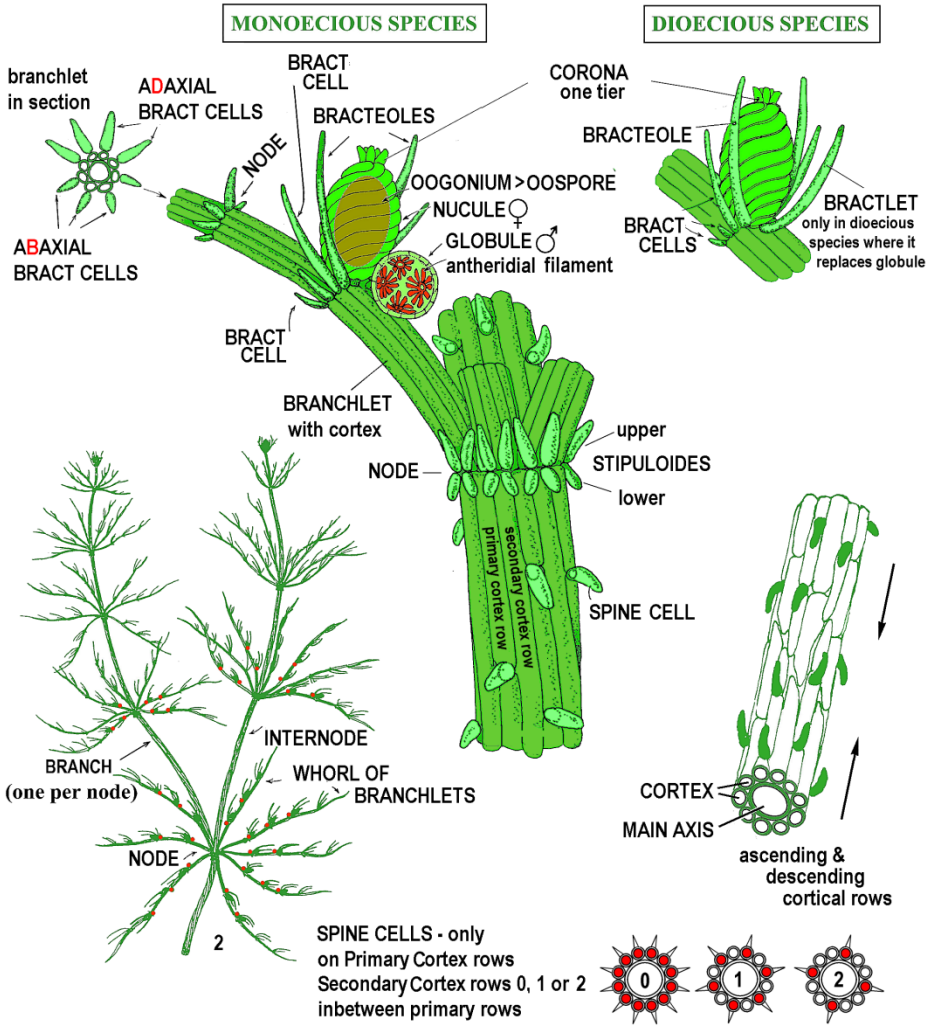
- Main axis single celled.
- No cortex (i.e. no longitudinal striations).
- Branchlets branched (furcate).
- Corona of nucule 2-celled in height.
- Main axis circular in cross-section.
- No spine cells.
- No stipuloides.
- No bract cells or bracteoles.



BRANCHLET RAY TERMINOLOGY

The Genus Chara

GLOSSARY

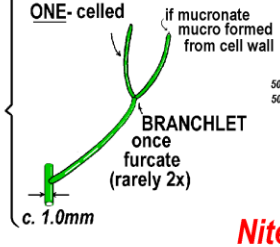


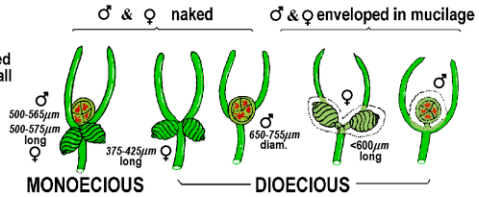
Key to NITELLA taxa

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

DACTYLS 1-CELLED

DACTYLS (ultimate rays)
ONE- celled

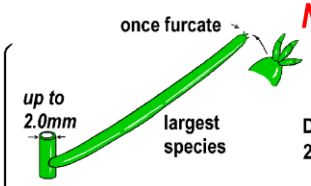




Nitella opaca

Nitella flexilis **Nitella capillaris** *extinct ?*

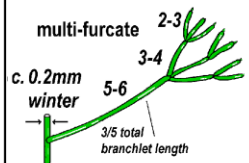
DACTYLS 2-3 CELLED



Nitella translucens

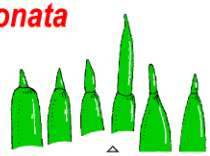
3 variants, dactyls can be very large at times

DACTYLS (ultimate rays)
2-celled, usually in 3s & microscopic



Nitella mucronata

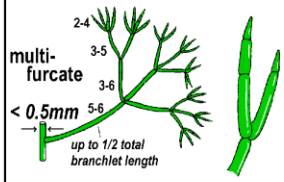
DACTYLS
2-3 celled.
APICAL CELL
forming mucro
narrower than
rounded top of
next cell.



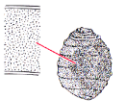
Summer form as large as N. flexilis with small mucro.

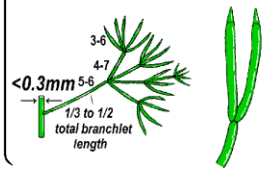
Winter form minute & richly branched.

Oospore membrane pattern RETICULATE .



DACTYLS **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.

APICAL cell tapering smoothly to next cell.

BRANCHLETS variable in length and in number of divisions in same whorl. *Oospore membrane pattern RETICULATE.*

Nitella tenuissima

East Anglian fens and Anglesea

CHARA -MORPHOLOGY TERMS

- diplostichous
- trilostichous
- isostichous
- haplostichous
- diplostephanous
- haplostephanous
- heterclamous
- monarthrodactylus
- aulanthus
- tylacanthus

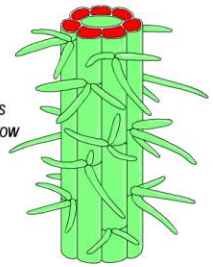
Key to CHARA taxa

Including all U.K. taxa except:

C. tomentosa, C. mucosa, C. fragifera, C. braunii

If plants are encrusted, to observe spine cells and cortical rows, soak plants in cider vinegar for c. 4 hrs to remove calcium carbonate encrustation.
When collecting, look for young bright green unencrusted fertile apices obvious from their bright orange male globules.

Page One



Spine cells on every row

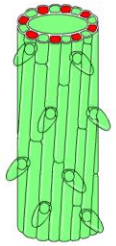
HOW TO USE KEY

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



Spine cells on every other row

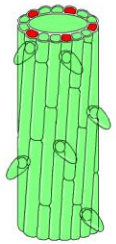
1 Spine cells always solitary, axes to 1.5mm diameter. NO basal bulbils, globules <500µm.... **5(2)**

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 rhizoid, 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



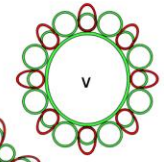
Spine cells on every third row

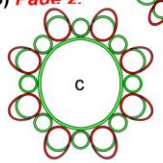
1 Spine cells only rudimentary or papilliform .... **11(2)**

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)** ***Page 2.***

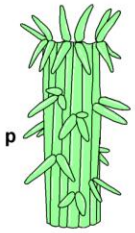
6 Ripe oospores BLACK, spine bearing rows either prominant, equal or sunk but prominant in most plants in a population so that spines arise from ridges ***Chara contraria*** forms ***Page 2.***

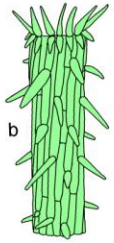
7 Spine bearing rows sunk so that spines arise in grooves ***Chara hispida*** forms **(8)** ***Page 2.***

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***





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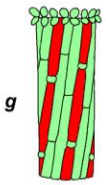
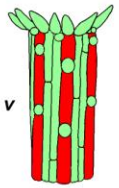
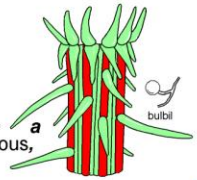
15 Fairly stout, internodes longer than branchlets, all cortical rows ABOUT SAME WIDTH, spine cells and stipuloides minute. Multicellular, irregularly shaped basal bulbils occasional, oospores black, very common in a wide range of non-brackish, still waters ***Chara globularis*** **(16)**



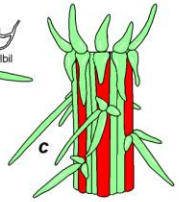


16 Slender, internodes + equal to branchlets in length, the two rows of cortical cells between the spinous rows only HALF THE WIDTH of the spinous rows. At least one set of stipuloides moderately developed. multicellular rhizoidal bulbils common, oospores black, Widespread in a range of habitats, frequent 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 spinous and bristly (rare), calcareous fresh over peat or sand ***Chara curta***



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 'ecomorphs' rather than separate genetically definined 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: individiual 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]:

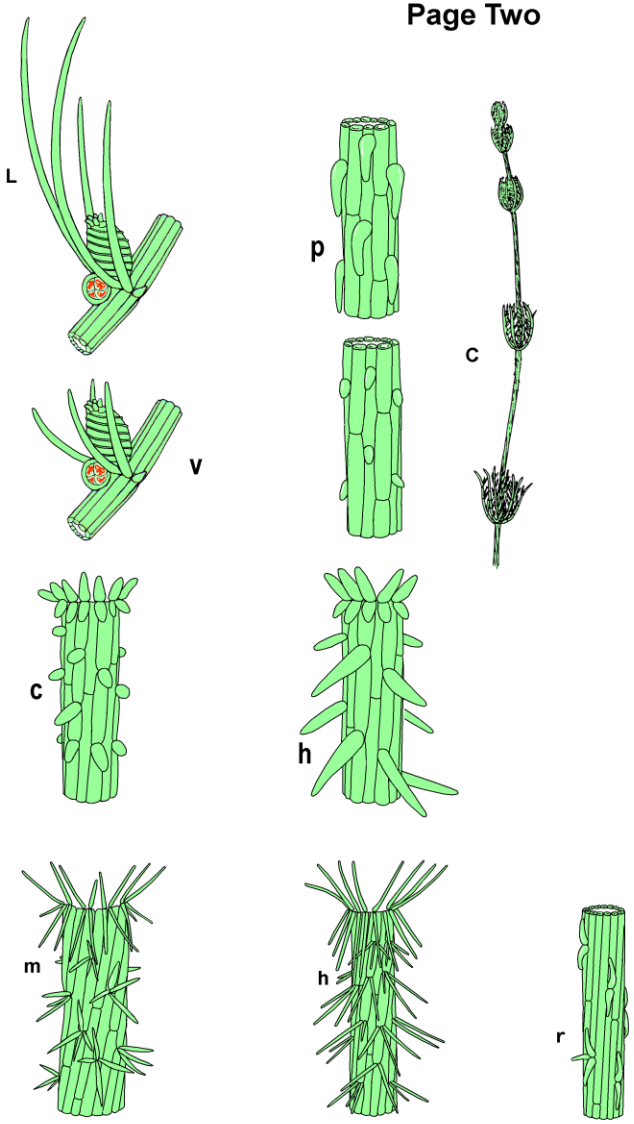
- Spine cells globular ..... ***contraria*** expression
- Spine cells long tapered, densely clustered ..... ***hispidula*** expression

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***]

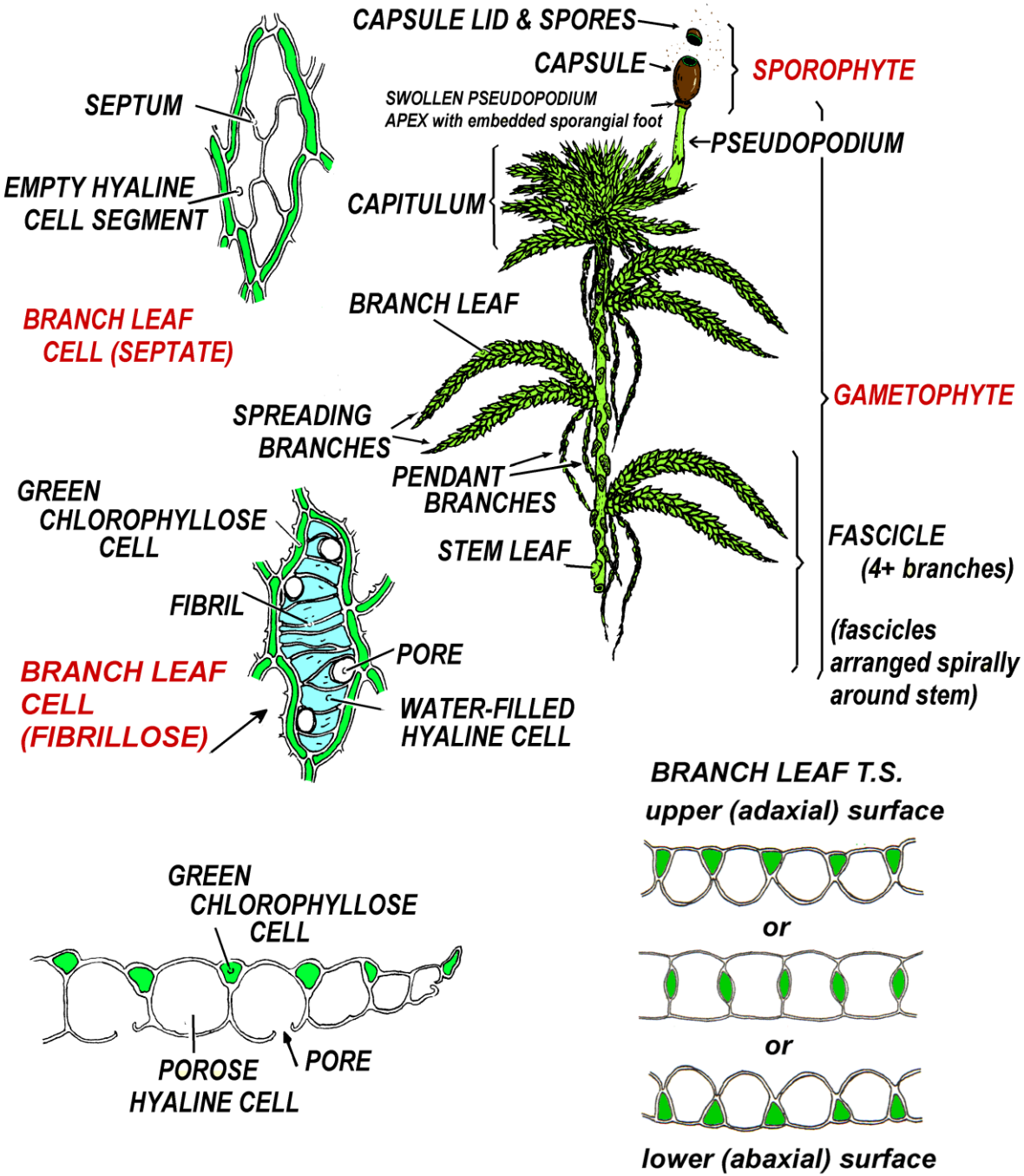
2 Axes up to 1.25mm diameter, spines in cluster of 2 to 3, (rarely solitary) ***Chara hispida*** var. ***hispida*** (3)

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.

SPHAGNUM STRUCTURE

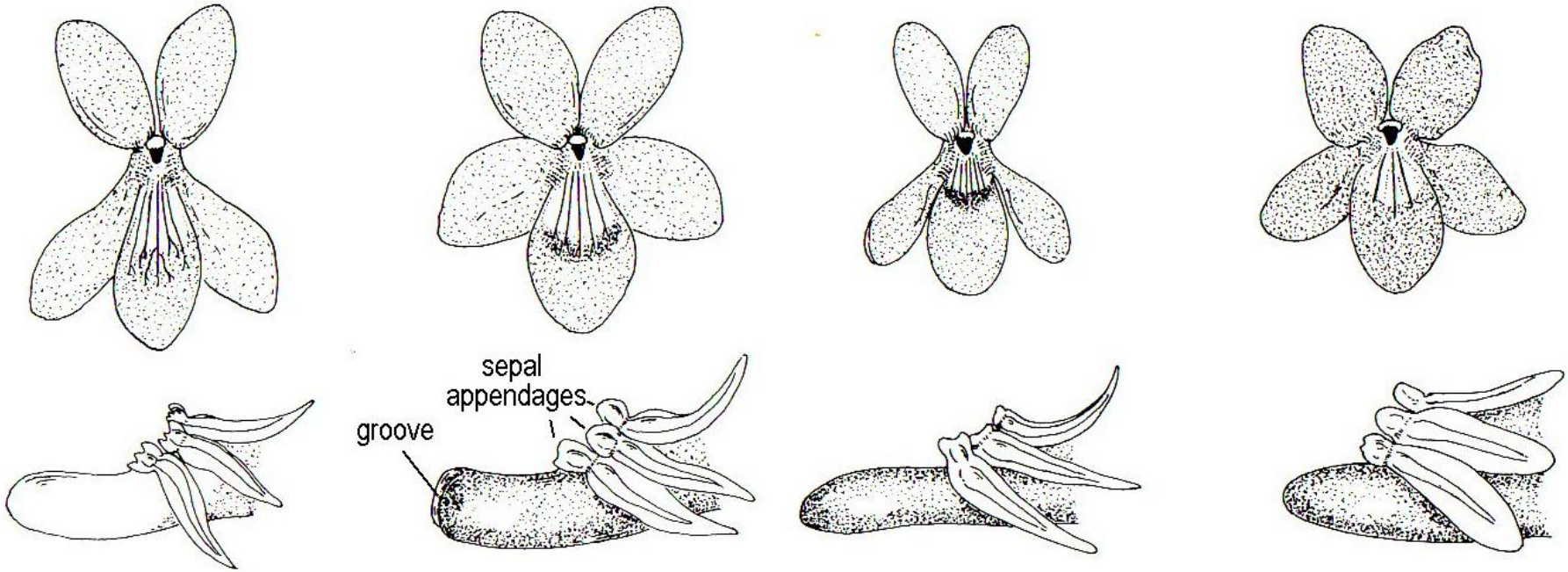


LIFETIME CHANGES IN DRAWING TECHNIQUES

- 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

ZOOM

SELECT FREEHAND

MAGIC WAND

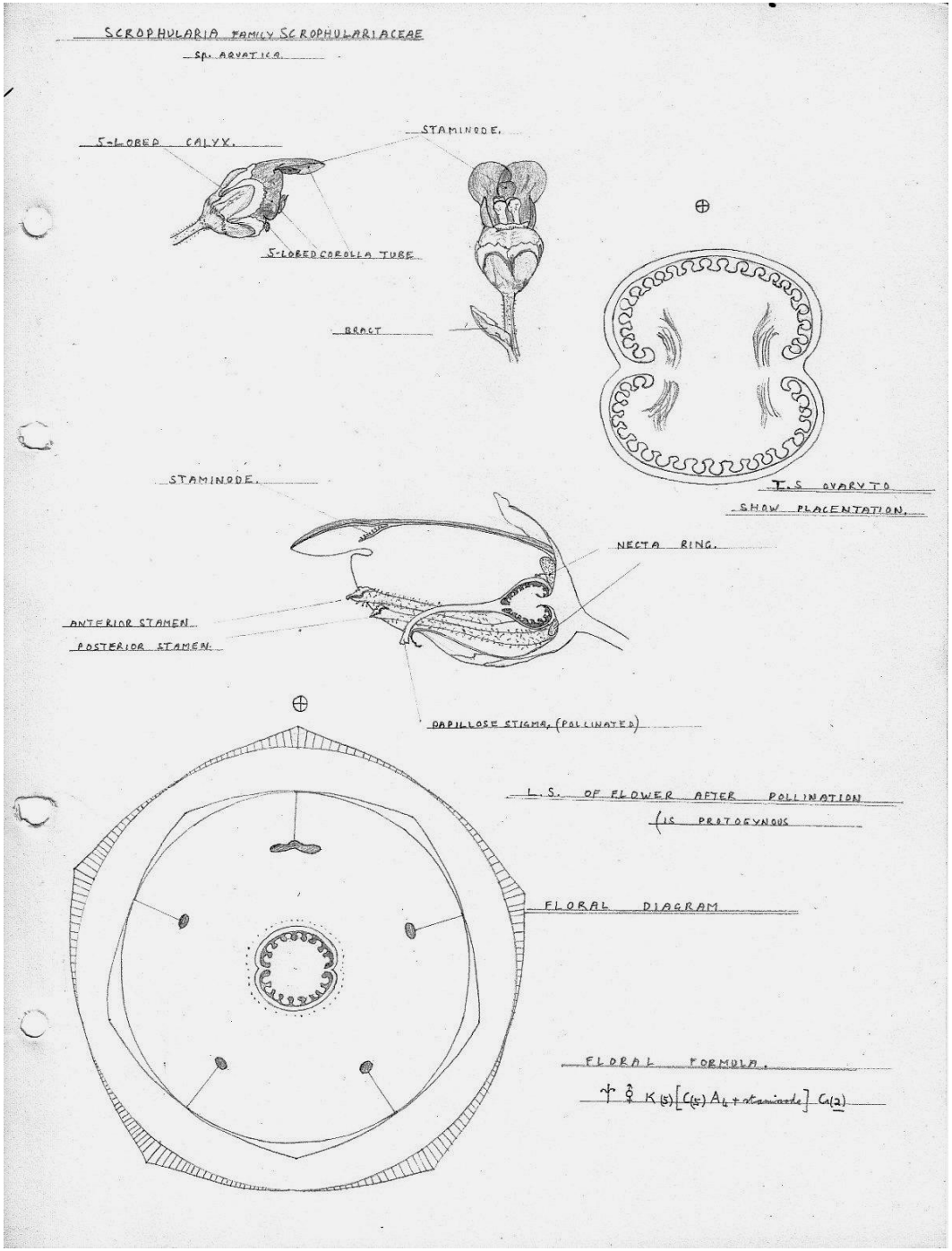
ERASER

AIR BRUSH

FLOOD FILL

LINE

SHAPES



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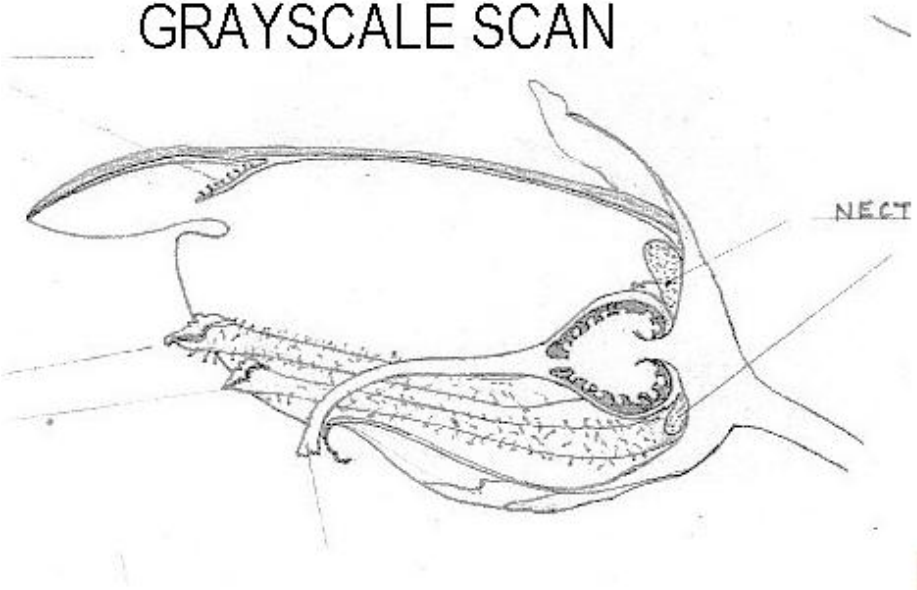
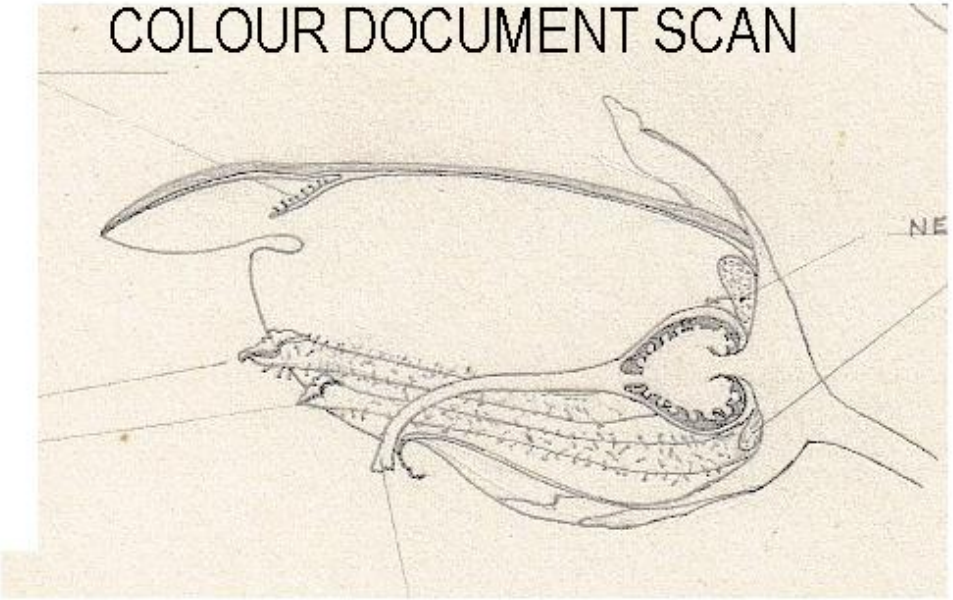


COLOUR DOCUMENT SCAN



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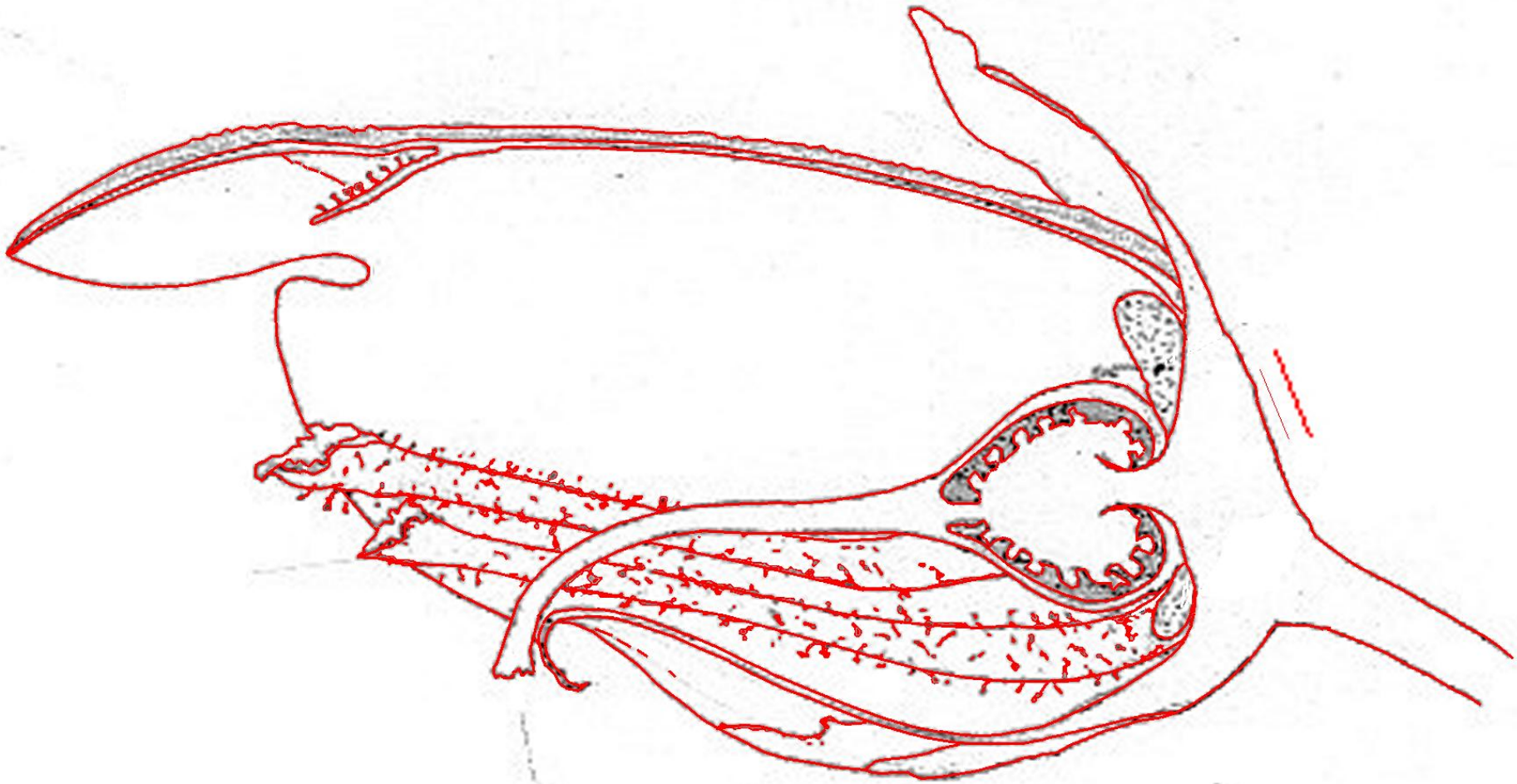
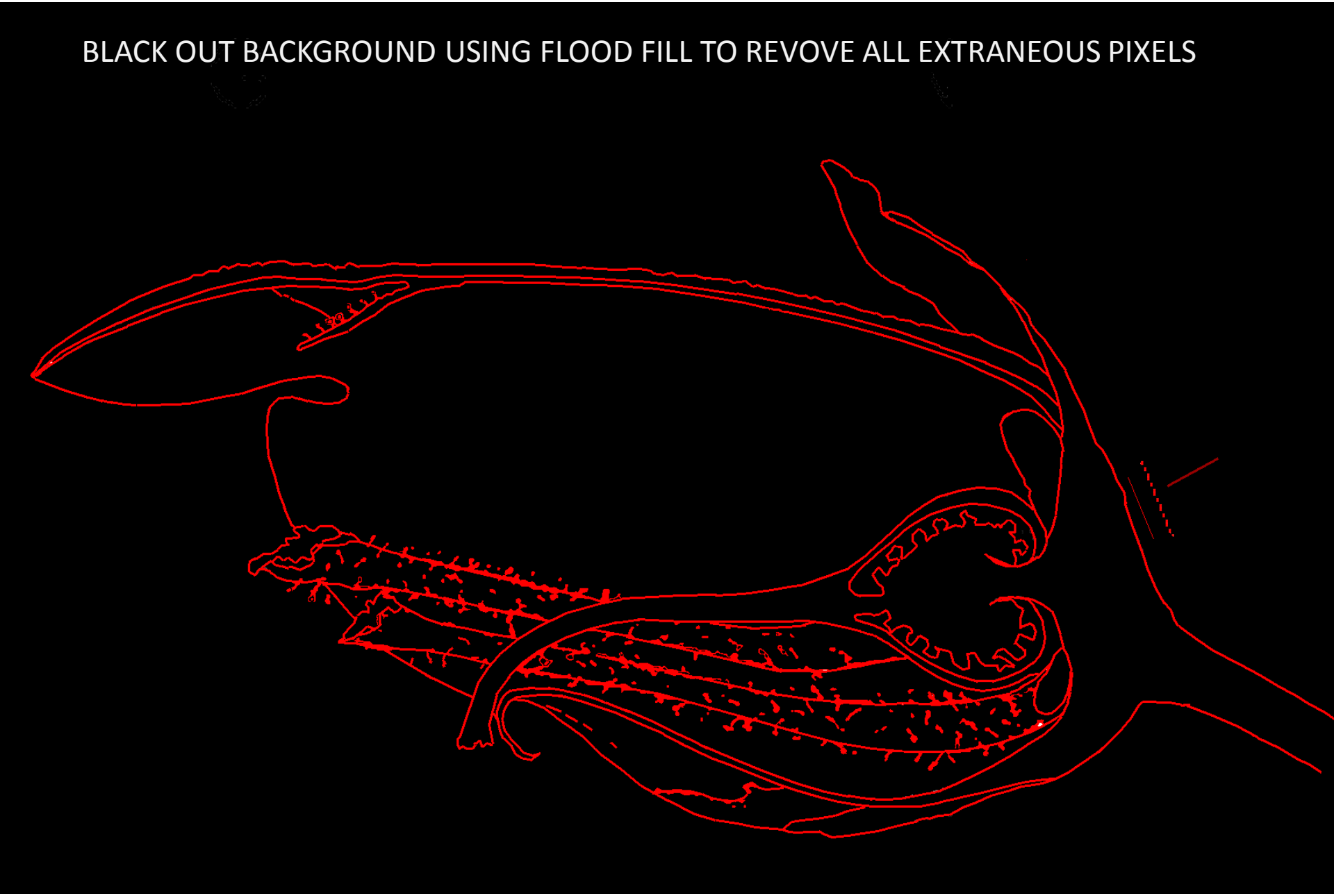
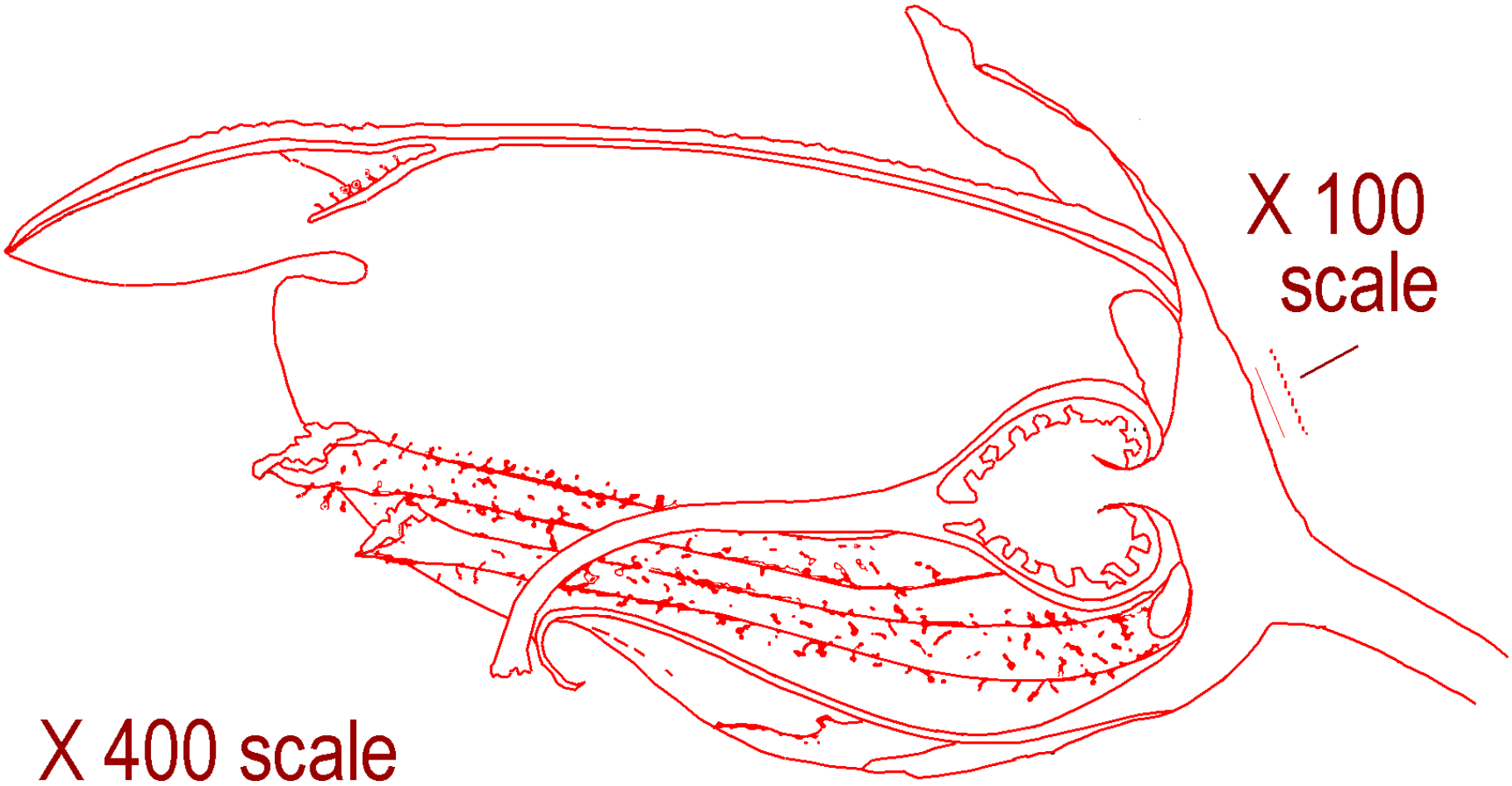


START OFF ZOOMING SCANNED IMAGE TO 1,000 PIXEL SCREEN TO GET FINE LINES USING EITHER THE LINE DRAW OR ERASE IN REVERSE MODE

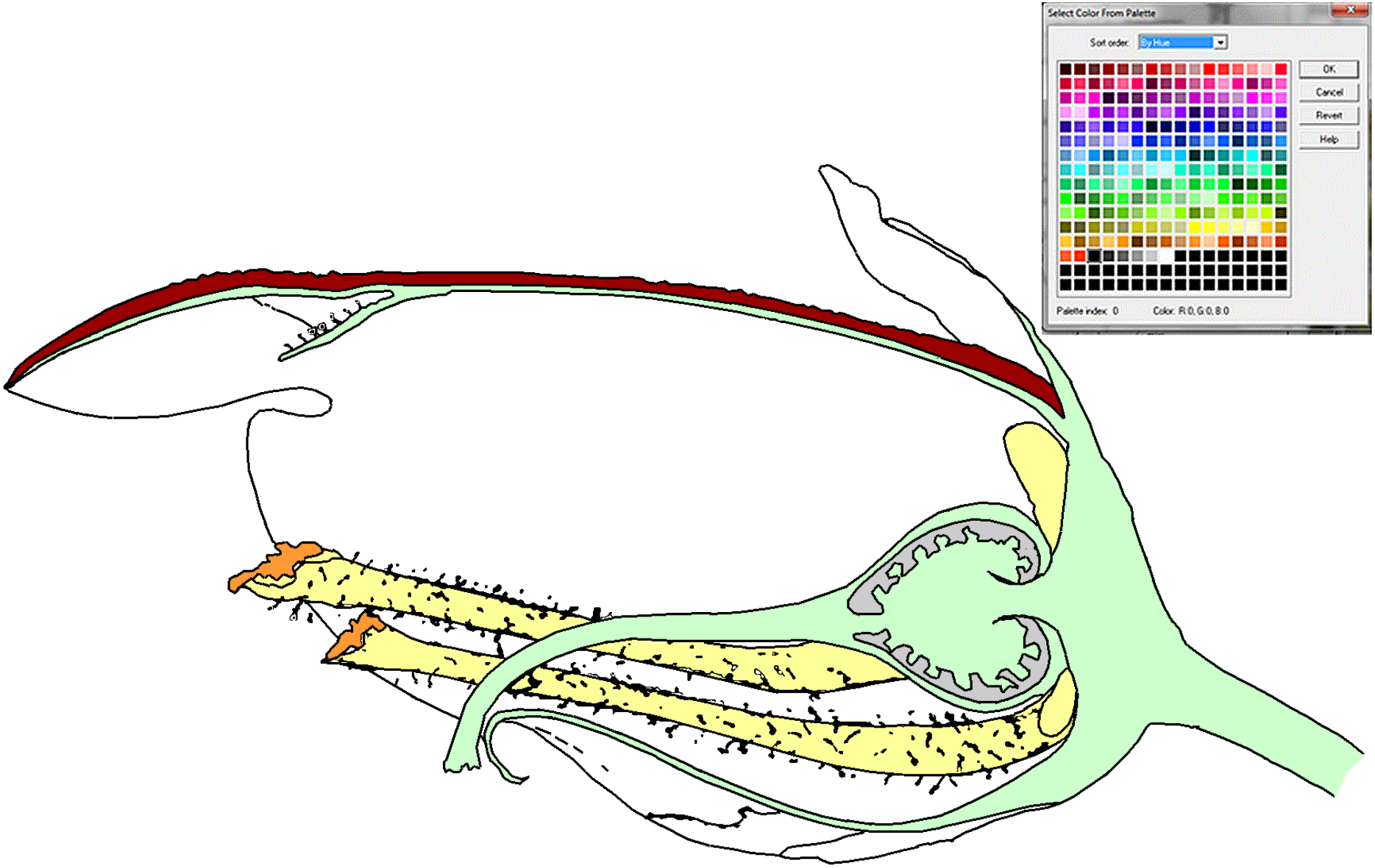
BLACK OUT BACKGROUND USING FLOOD FILL TO REVOVE ALL EXTRANEOUS PIXELS



GRAYSCALE SCAN

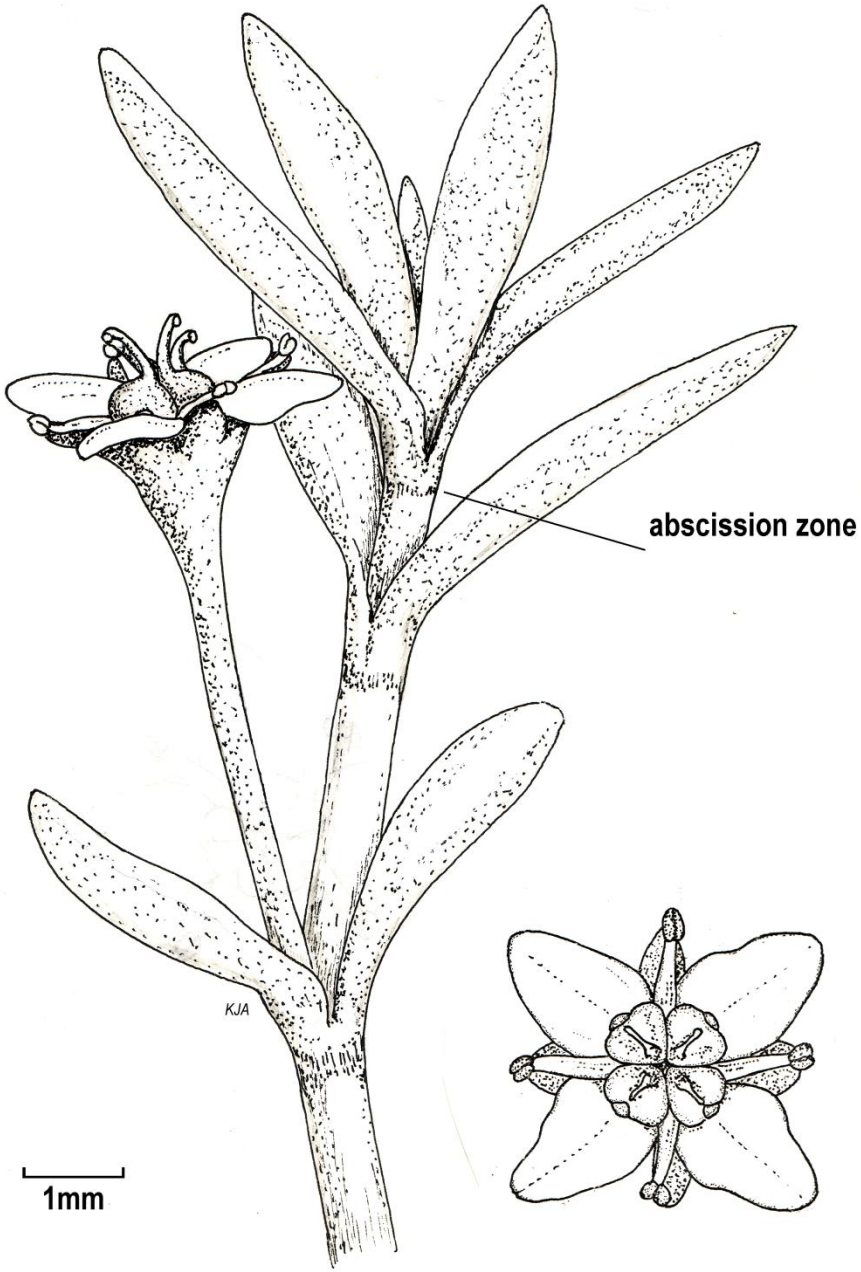


REMOVE BACKGROUND WITH FLOOD FILL


Select Color From Palette
Sort order:
By Hue
OK
Cancel
Revert
Help
Palette index: 0
Color: R:0, G:0, B:0

Cryptomeria japonica

Japanese Red Cedar



Sketches of Swamp Stonecrop (*Crassula helmsii*) traced from closeup photographs taken at Fingringhoe Wick N.R.., Essex in 1976.

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].

Photo credit: David Shield Photography

Photo credit: David Leaser

Zerene Stacker

Focus Stacking For Better DOF

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™)

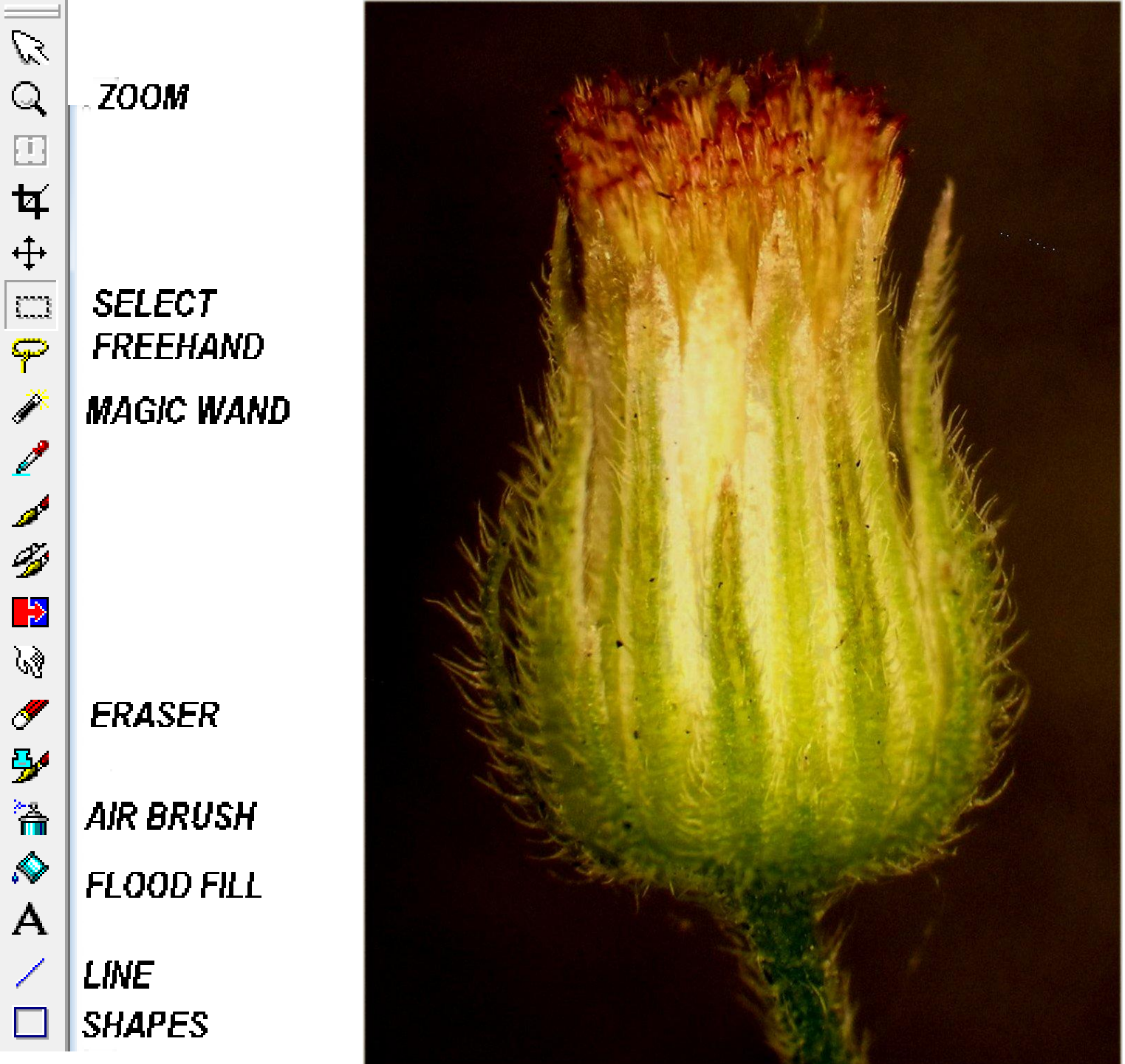
Runs on almost all desktop and laptop computers:

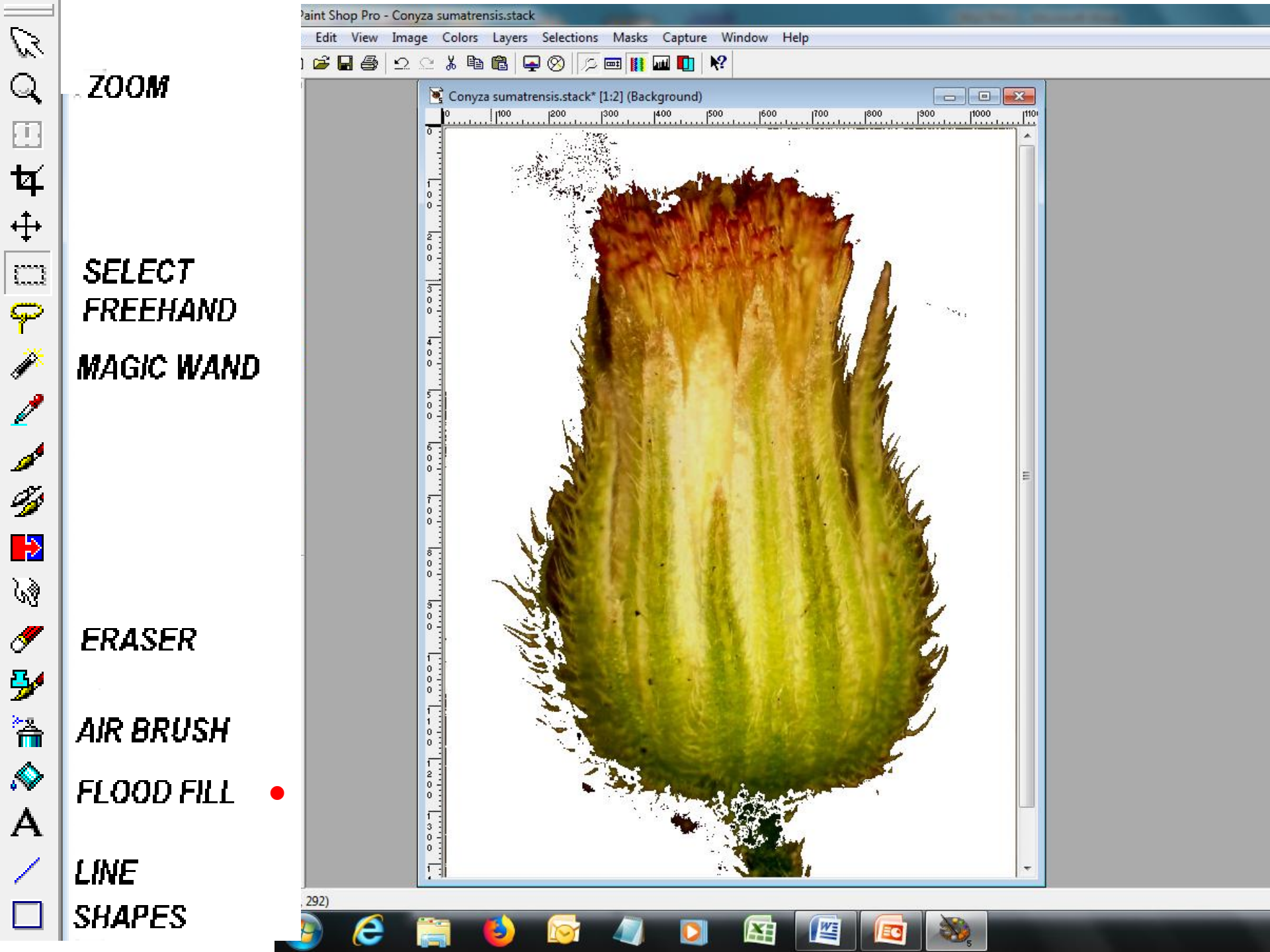
Conyza canadensis

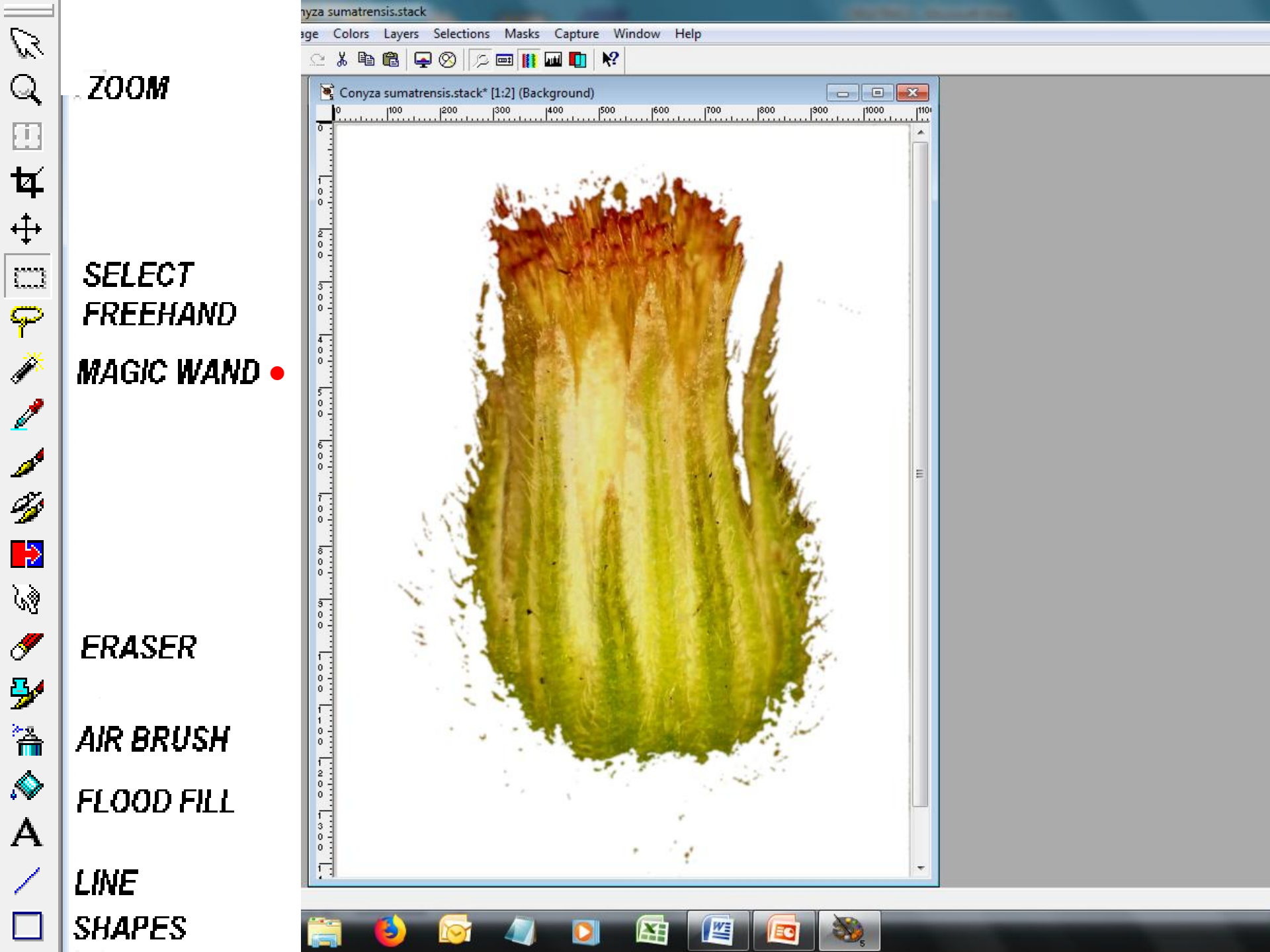
Conyza floribunda

Conyza sumatrensis

Conyza bonariensis


ZOOM
SELECT
FREEHAND
MAGIC WAND
ERASER
AIR BRUSH
FLOOD FILL
LINE
SHAPES


ZOOM
SELECT
FREEHAND
MAGIC WAND
ERASER
AIR BRUSH
FLOOD FILL
LINE
SHAPES
Paint Shop Pro - Conyza sumatrensis.stack
Edit View Image Colors Layers Selections Masks Capture Window Help
Conyza sumatrensis.stack* [1:2] (Background)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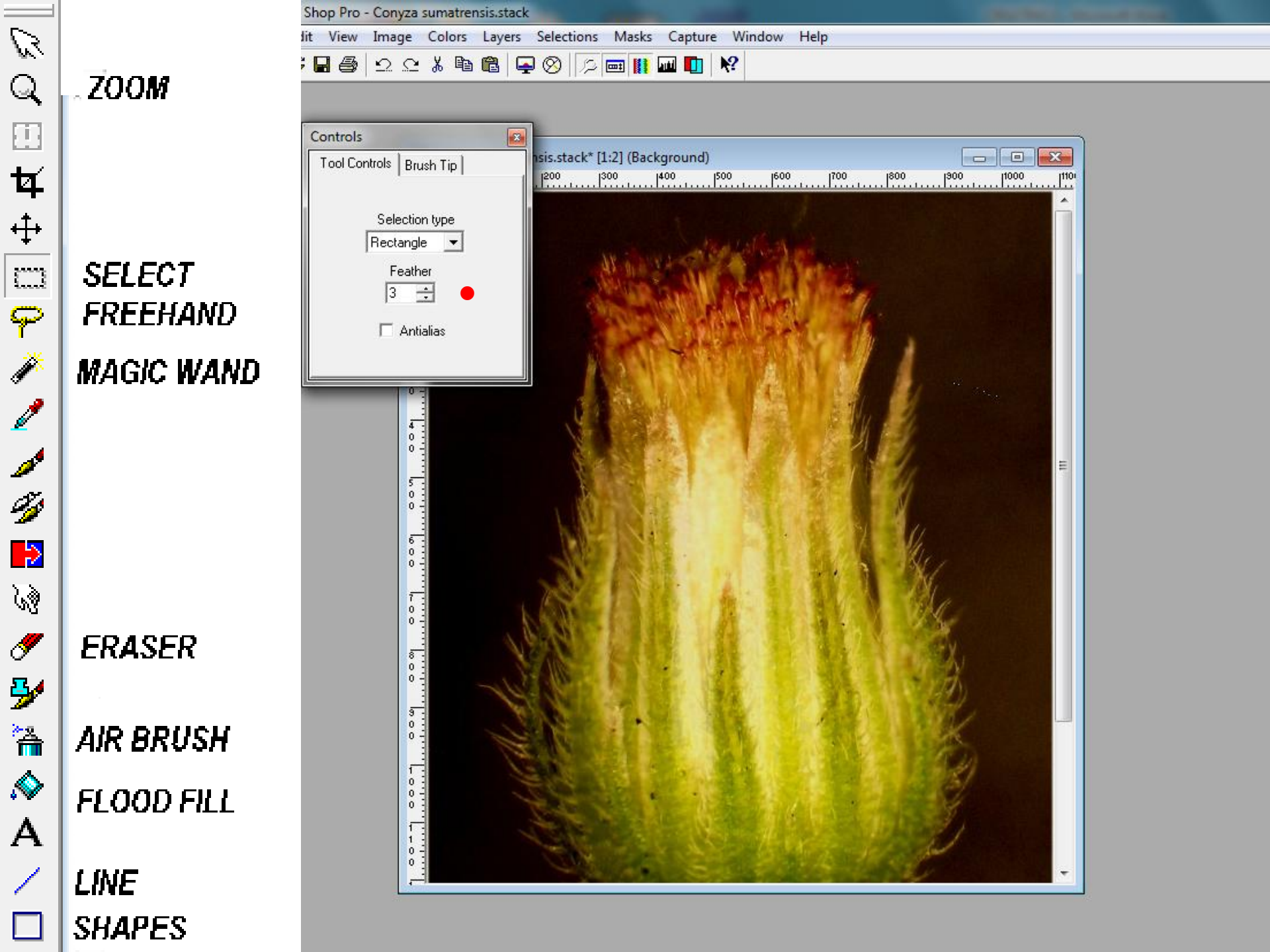
Conyza sumatrensis.stack* [1:2] (Background)


ZOOM
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View Image Colors Layers Selections Masks Capture Window Help
Controls
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Selection type
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sis.stack* [1:2] (Background)

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

Newsletter of the Essex Botanical Society

ESSEX BOTANY

Bryology & Mycology

No: 3. Spring 2016

Sphagnum squarrosum

Progress with BSBI Atlas 2020. Sphagnum Bogs of Essex. Neglected Freshwater Algae: the Desmids. Our vanishing Heathland Lichens. Another New Essex liverwort. Beard-grasses on the move. The First & Second Floras of Essex. Know your Docks. Deciphering latin names.

Newsletter of the Essex Botanical Society

ESSEX BOTANY

Bryology & Mycology

No: 4 Autumn 2016

American Pennywort - Chelmer Canal

3rd Flora of Essex Update. 11 Alien Water Plants in Essex & Counting. American Pennywort & Australian Stonecrop. Heathland Lichens your response. Wild Flower Meadows at Hyde Hall. Essex V.C. Boundaries. New Atlas of Seaweeds. Know your Duckweeds. Key to Starworts.

Newsletter of the Essex Botanical Society

ESSEX BOTANY

Bryology & Mycology

No: 5 Spring 2017

Water Poplar - male Clone 23 - Sewalds Hall Farm

Atlas 2020 Update. Essex Water Poplar & Elm DNA Fingerprinting. Picture Keys to Daisies, Mayweeds & Chamomiles & the Moss Family Plageotheciaceae. More Lichens to look out for. Orange Bark Algae. The liverwort *Nowellia* New to Essex. The Slime Mould *Trichia botrytis*.

Newsletter of the Essex Botanical Society

ESSEX BOTANY

Bryology & Mycology

No: 6 Autumn 2017

Colony of 80 Greater Tongue-orchid, new to Essex

Atlas 2020 Update. Greater Tongue-Orchid in Essex. Extermination of Water-Violet by dogs and horses. Fruticose lichens on Essex trees. Flat-leaved Horned-Pondweed new to the U.K. Horned-Pondweeds of Europe. Essex Watsonian boundary Part 2. Picture key: Stoneworts.

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.

Zannichellia pedunculata

Zannichellia obtusifolia

600 μm