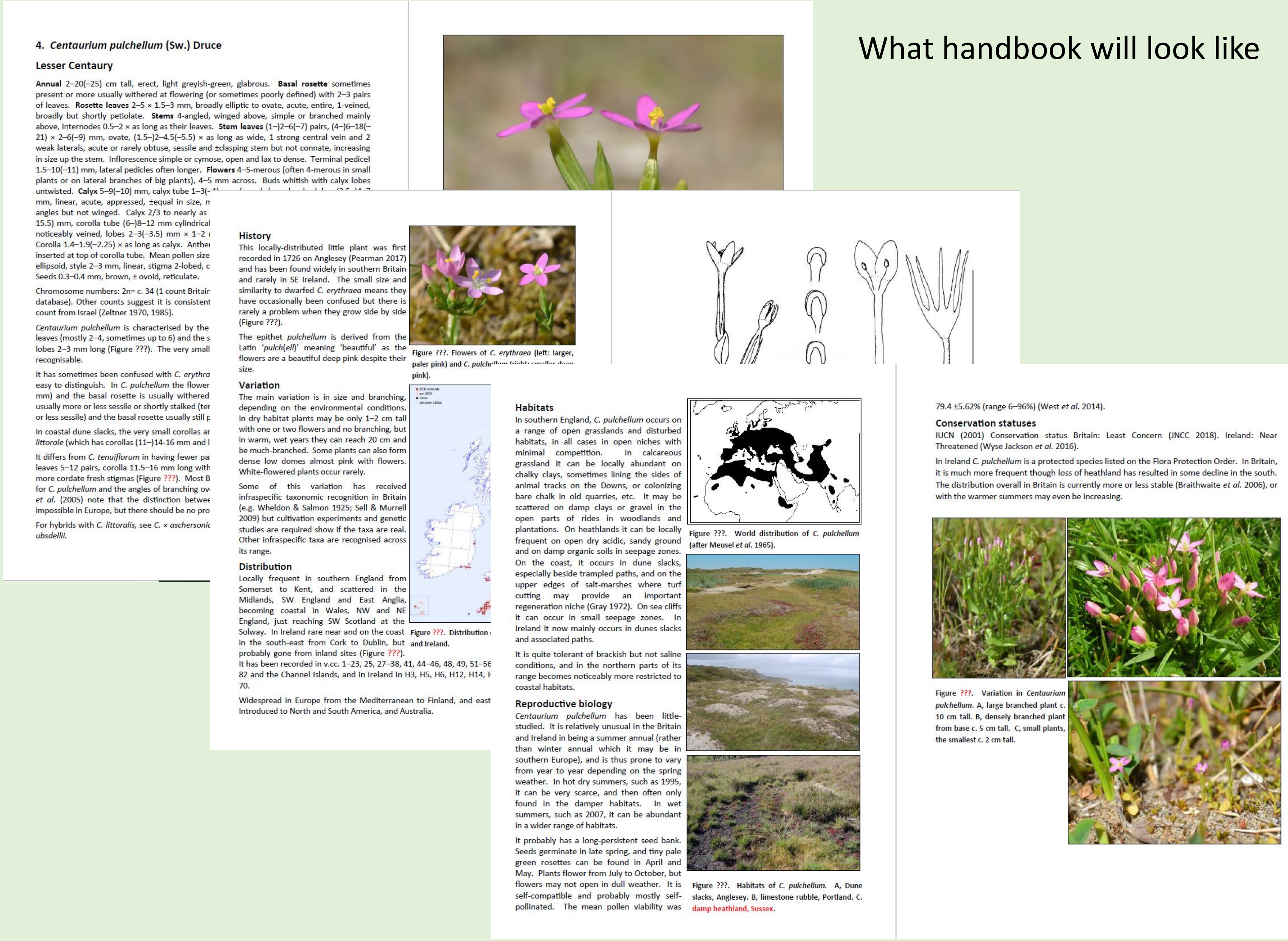

Some new gentian taxa
Tim Rich and Andy McVeigh

BSBI Handbook in prep.

- 2 new taxa
- 2 at different ranks
- 1 taxon accepted
- 1 taxon lost
- 1 new name
- New names for hybrids

So perhaps not so many new taxa, but certainly some change

What handbook will look like



4. *Centaurium pulchellum* (Sw.) Druce

Lesser Centaury

Annual 2–20(–25) cm tall, erect, light greyish-green, glabrous. **Basal rosette** sometimes present or more usually withered at flowering (or sometimes poorly defined) with 2–3 pairs of leaves. **Rosette leaves** 2–5 × 1.5–3 mm, broadly elliptic to ovate, acute, entire, 1-veined, broadly but shortly petiolate. **Stems** 4-angled, winged above, simple or branched mainly above, internodes 0.5–2 × as long as their leaves. **Stem leaves** (1–)2–6(–7) pairs, (4–)6–18(–21) × 2–6(–9) mm, ovate, (1.5–)2–4.5(–5.5) × as long as wide, 1 strong central vein and 2 weak laterals, acute or rarely obtuse, sessile and ±clasping stem but not connate, increasing in size up the stem. Inflorescence simple or cymose, open and lax to dense. Terminal pedicel 1.5–10(–11) mm, lateral pedicles often longer. **Flowers** 4–5-merous (often 4-merous in small plants or on lateral branches of big plants), 4–5 mm across. Buds whitish with calyx lobes untwisted. **Calyx** 5–9(–10) mm, calyx tube 1–3(–...

mm, linear, acute, appressed, ±equal in size, ...
angles but not winged. Calyx 2/3 to nearly as ...
15.5) mm, corolla tube (6–)8–12 mm cylindrical ...
noticeably veined, lobes 2–3(–3.5) mm × 1–2 ...
Corolla 1.4–1.9(–2.25) × as long as calyx. Anther...
inserted at top of corolla tube. Mean pollen size ...
ellipsoid, style 2–3 mm, linear, stigma 2-lobed, ...
Seeds 0.3–0.4 mm, brown, ± ovoid, reticulate.

Chromosome numbers: 2n= c. 34 (1 count Britain ...
database). Other counts suggest it is consistent ...
count from Israel (Zeltner 1970, 1985).

Centaurium pulchellum is characterised by the ...
leaves (mostly 2–4, sometimes up to 6) and the s...
lobes 2–3 mm long (Figure ???). The very small ...
recognisable.

It has sometimes been confused with *C. erythra*...
easy to distinguish. In *C. pulchellum* the flower...
mm) and the basal rosette is usually withered ...
usually more or less sessile or shortly stalked (ter...
or less sessile) and the basal rosette usually still p...

In coastal dune slacks, the very small corollas ar...
littorale (which has corollas (11–)14-16 mm and l...

It differs from *C. tenuiflorum* in having fewer pai...
leaves 5–12 pairs, corolla 11.5–16 mm long with ...
more cordate fresh stigmas (Figure ???). Most B...
for *C. pulchellum* and the angles of branching ov...
et al. (2005) note that the distinction betwee...
impossible in Europe, but there should be no pro...

For hybrids with *C. littoralis*, see *C. × aschersonic*...
ubsdellii.

History

This locally-distributed little plant was first recorded in 1726 on Anglesey (Pearman 2017) and has been found widely in southern Britain and rarely in SE Ireland. The small size and similarity to dwarfed *C. erythraea* means they have occasionally been confused but there is rarely a problem when they grow side by side (Figure ???).

The epithet *pulchellum* is derived from the Latin *'pulch(ell)'* meaning 'beautiful' as the flowers are a beautiful deep pink despite their size.

Figure ???. Flowers of *C. erythraea* (left: larger, paler pink) and *C. pulch*... pink).

Variation

The main variation is in size and branching, depending on the environmental conditions. In dry habitat plants may be only 1–2 cm tall with one or two flowers and no branching, but in warm, wet years they can reach 20 cm and be much-branched. Some plants can also form dense low domes almost pink with flowers. White-flowered plants occur rarely.

Some of this variation has received infraspecific taxonomic recognition in Britain (e.g. Wheldon & Salmon 1925; Sell & Murrell 2009) but cultivation experiments and genetic studies are required show if the taxa are real. Other infraspecific taxa are recognised across its range.

Distribution

Locally frequent in southern England from Somerset to Kent, and scattered in the Midlands, SW England and East Anglia, becoming coastal in Wales, NW and NE England, just reaching SW Scotland at the Solway. In Ireland rare near and on the coast in the south-east from Cork to Dublin, but probably gone from inland sites (Figure ???).

It has been recorded in v.cc. 1–23, 25, 27–38, 41, 44–46, 48, 49, 51–5... 82 and the Channel Islands, and in Ireland in H3, H5, H6, H12, H14, H... 70.

Widespread in Europe from the Mediterranean to Finland, and east... Introduced to North and South America, and Australia.

Figure ???. Distribution ... and Ireland.

Habitats

In southern England, *C. pulchellum* occurs on a range of open grasslands and disturbed habitats, in all cases in open niches with minimal competition. In calcareous grassland it can be locally abundant on chalky clays, sometimes lining the sides of animal tracks on the Downs, or colonizing bare chalk in old quarries, etc. It may be scattered on damp clays or gravel in the open parts of rides in woodlands and plantations. On heathlands it can be locally frequent on open dry acidic, sandy ground and on damp organic soils in seepage zones. On the coast, it occurs in dune slacks, especially beside trampled paths, and on the upper edges of salt-marshes where turf cutting may provide an important regeneration niche (Gray 1972). On sea cliffs it can occur in small seepage zones. In Ireland it now mainly occurs in dunes slacks and associated paths.

It is quite tolerant of brackish but not saline conditions, and in the northern parts of its range becomes noticeably more restricted to coastal habitats.

Figure ???. World distribution of *C. pulchellum* (after Meusel *et al.* 1965).

Reproductive biology

Centaurium pulchellum has been little-studied. It is relatively unusual in the Britain and Ireland in being a summer annual (rather than winter annual which it may be in southern Europe), and is thus prone to vary from year to year depending on the spring weather. In hot dry summers, such as 1995, it can be very scarce, and then often only found in the damper habitats. In wet summers, such as 2007, it can be abundant in a wider range of habitats.

It probably has a long-persistent seed bank. Seeds germinate in late spring, and tiny pale green rosettes can be found in April and May. Plants flower from July to October, but flowers may not open in dull weather. It is self-compatible and probably mostly self-pollinated. The mean pollen viability was 79.4 ±5.62% (range 6–96%) (West *et al.* 2014).

Figure ???. Habitats of *C. pulchellum*. A, Dune slacks, Anglesey. B, limestone rubble, Portland. C. damp heathland, Sussex.

Conservation statuses

IUCN (2001) Conservation status Britain: Least Concern (JNCC 2018). Ireland: Near Threatened (Wyse Jackson *et al.* 2016).

In Ireland *C. pulchellum* is a protected species listed on the Flora Protection Order. In Britain, it is much more frequent though loss of heathland has resulted in some decline in the south. The distribution overall in Britain is currently more or less stable (Braithwaite *et al.* 2006), or with the warmer summers may even be increasing.

Figure ???. Variation in *Centaurium pulchellum*. A, large branched plant c. 10 cm tall. B, densely branched plant from base c. 5 cm tall. C, small plants, the smallest c. 2 cm tall.

Why are Gentianaceae difficult taxonomically?

- Some taxa are defined by quantitative differences between sets of partially overlapping morphological characters
  - partly related to their origin by allopoidy or autoploidy (Mansion *et al.* 2005).
- Some taxa are of relatively recent origin and closely related, such as the *Gentianella amarella* subspecies
  - genetically adapted to local environment
- Marked differences in growth form due to local environmental conditions
- Marked population fluctuations of annuals and biennials, making comparison between years difficult on the same site.
- After some work on population dynamics, we are less sure that some populations may have both annuals and biennials (c.f. Pritchard 1959)
- Hybridisation and introgression occur in some taxa
  - Most hybrids fertile, few are sterile
- Very difficult to cultivate plants

- Also long-standing problem of floras being compiled from herbaria, which give different character ranges to those in field due to selection of material and drying

Table 6. Comparison of measurements collected in the field and herbaria for *Gentianella germanica*.

	Field			Herbarium			P (t-test)
Character	n	mean ± s.e.	(1–)10–90(–100) percentile range	n	mean ± s.e.	(1–)10–90(–100) percentile range	
Internodes	321	10.4 ± 0.12	(5–)8–13(–16)	627	9.3 ± 0.08	(4–)7–12(–16)	<0.001
Leaf length [mm]	321	24.2 ± 0.40	(6–)14–32(–43)	578	16.7 ± 0.20	(6–)11–24(–42)	<0.001
Leaf width [mm]	321	12.2 ± 0.20	(3–)7–16.5(–22)	578	7.6 ± 0.10	(3–)5–11(–17)	<0.001
Leaf length / leaf width ratio	321	2.02 ± 0.02	(1–)1.6–2.40(–3.8)	578	2.3 ± 0.02	(1.3–)1.7–2.9(–4.3)	<0.001
Corolla length [mm]	321	28.6 ± 0.20	(12–)25–32(–37)	796	26.2 ± 0.10	(15–)22–30(–35)	<0.001
Calyx length [mm]	321	15.8 ± 0.20	(5–)12–20(–24)	796	11.6 ± 0.07	(5–)9–14(–18)	<0.001
Corolla length / calyx length ratio	321	1.86 ± 0.02	(1–2–)1.5–2.2(–3.2)	796	2.3 ± 0.01	(1.5–)1.9–2.7(–5.1)	<0.001

Data of A. McVeigh.

Parnell, J., Rich, T., McVeigh, A., Lim, A., Quigley, S., Morris, D. & Wong, Z. (2013). The effect of preservation methods on plant morphology. *Taxon* **62**: 1259–1265.

The case of *Centaurium tenuiflorum*

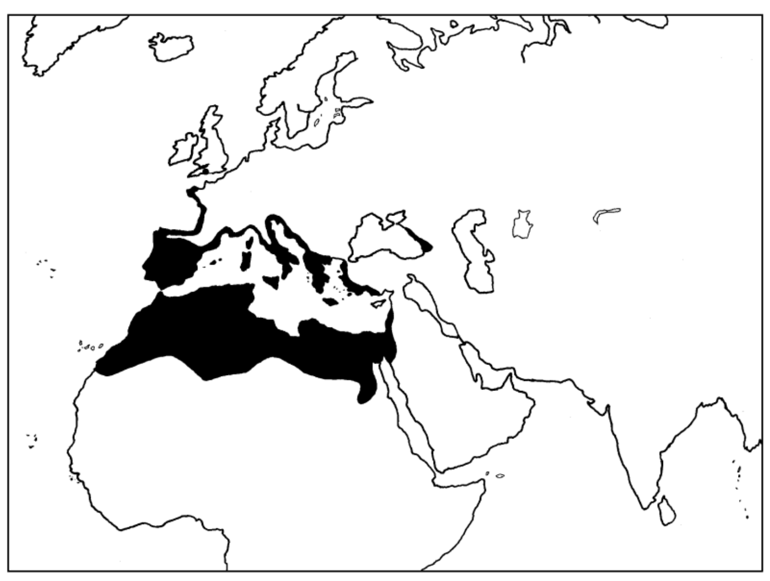
- first collected by C. C. Babington in 1837 in Guernsey (site now destroyed)
- subsequently found on Isle of Wight in 1879 by F. Townsend and Dorset in 1935 by R. Good

In UK a very rare species, refound on I of W by Paul Stanley

In Europe:

- diploid subsp. *acutiflorum*
- tetraploid subsp. *tenuiflorum*
- + widespread European taxon, informally '*C. ×tenuiflorum'* (allotetraploid derivative of *C. tenuiflorum* × *C. erythraea*)

- **BUT** none look like English plants



N Spain

Britanny

Spain (Stace)

Morphological data Dorset/I of Wight vs European material:

	Mean Europe	Mean Dorset/IoW	T test Probability	significance
height cm	17.5	17.3	0.870917	NS
No. internodes	8.1	6.3	0.004188	**
Mid stem leaf length mm	9.8	11.4	0.06141	*
Mid stem leaf width mm	2.1	3.6	8.34E-06	***
Mid stem leaf L W ratio	5.1	3.4	0.000728	**
Terminal pedicel length mm	2.1	3.3	0.074825	NS
calyx length mm	8.0	8.9	0.000503	**
corolla tube mm	9.7	10.6	0.005761	**
corolla lobes mm	3.0	3.6	7.94E-06	***
total corolla mm	12.0	14.2	0.004047	**
corolla calyx ratio	1.5	1.6	0.46553	NS

- Dorset/I of Wight plants are different – generally bigger with broader leaves, and retain these in cultivation.

DNA (based on G. Mansion's work)

- ITS1 Dorset sequence is *C. tenuiflorum* (differs in 1 base pair)

Cytology

- As yet unknown (pollen sizes suggests tetraploid)

Hence describing this is as new English endemic = *C. tenuiflorum* subsp. *anglicum**

- presumed to have arisen through isolation and local adaptation following reflooding of the English Channel
- Guernsey material may be subsp. *tenuiflorum* s.l.

* Rich, T. C. G., McVeigh, A. & Stace, C.A.(2018). New taxa and new combinations in the British flora. *Edinburgh Journal of Botany* doi: 10.1017/S0960428618000288

The case of *Centaurium erythraea* x *littorale*

- Wheldon (1897) noted two forms of *C. littorale* on the Lancashire coast
    - normal widespread form
    - large form with the relatively long calyx: corolla tube ratio of *C. littorale* but the broader stem leaves and habit of *C. erythraea* (*Erythraea littoralis* var. *intermedia*).
- These regarded as of hybrid origin and *C.* x *intermedium* widely used for sterile tetraploid *C. erythraea* x *littorale*
- Ubsdell (1976a, b, 1979) showed the large form was a hexaploid forming cytologically stable, self-sustaining populations which were reproductively isolated from the parents, and suggested it should be a new allopolyploid species
    - Typification shows *Erythraea littoralis* var. *intermedia* belongs to these
- CTW and Stace acknowledge these hexaploids but did not separate them
    - Stace "… the latter could be treated as a distinct new sp. but the parents themselves are so close this is not feasible."

Courtesy of Phil Smith, we went to see the Lancashire plants in 2018

C. intermedium

- Tall (to 40 cm), fertile, hexaploid
- Lancashire endemic

C. erythraea x *littorale* = *C.* x *klattii*

- Small (to 15 cm), infertile, tetraploid
- UK, Europe

- Admittedly hard to separate in the field without fertility data.

The case of *Centaurium latifolium*

- First discovered in Lancashire in 1803, extinct by 1871
- Looks distinct with dwarf habit, nearly orbicular 5-7 veined stem leaves, small 7-9 mm long sessile flowers, fertile

- Wheldon & Salmon (1925) suggested that it may have originated as *C. pulchellum* x *C. erythraea* small form
- Melderis (1972) regarded it as a mutant of *C. erythraea*

To me (like Melderis) it fits better as part of the many and varied range of dwarf and round-leaved forms of *C. erythraea* found around the coast of Britain.

- Closer to *C. erythraea* than *C. erythraea* x *pulchellum*

- Would really like to have been able to grow plants and do DNA analyses (may be able to resolve this if old DNA can be extracted satisfactorily).

- Relegating it to a variety = *Centaurium erythraea* var. *latifolium**

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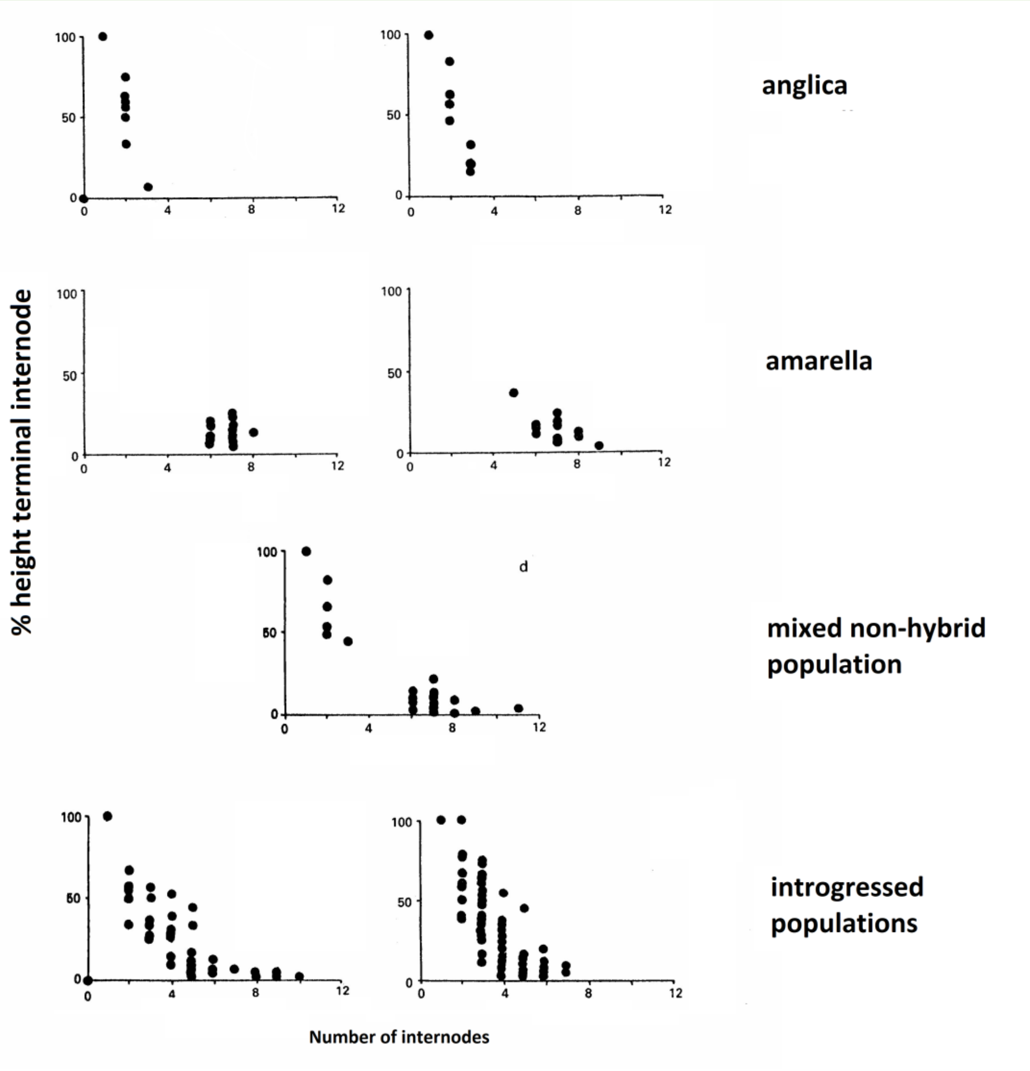
The case of *Gentianella anglica*

- Since 1993 I've been saying *G. anglica* is a species, differing from *G. amarella* in
    - small size 1–15 cm tall
    - Few 1–3(–4) internodes
    - terminal internode 40–100% of stem height
    - flowering typically (March-)May-June(-early July)

- Tried several times to cultivate it without any success beyond first year

- a few populations have intermediates which I treated as hybrids (*G.* x *davidiana*)



Watsonia **21**: 313-325

Using AFLPs on British plants only, Wingfield et al. (2003) found *G. amarella*, *G. uliginosa* and *G. anglica* to be closely related

- In mixed populations of *G. anglica* and *G. amarella*, individuals of the two species were genetically more similar to each other than they were to individuals of the same species from other populations.
- "morphological and phenological differences between the taxa regardless of the fact that apparently there is no, or very little, genetic difference"

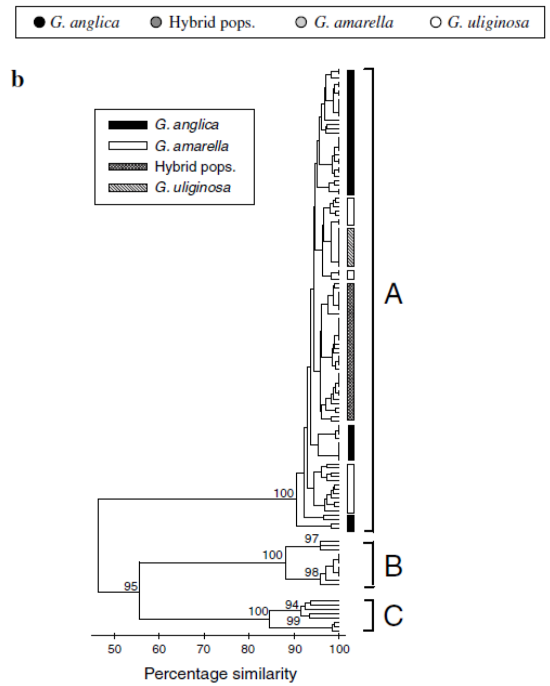


Fig. 2. **a**) PCO plot showing the relationship between the five species included in the study, and **b**) UPGMA dendrogram showing the same relationship. The bootstrap values placed above the forks of the dendrogram show the percentage of times the group to the right of that fork occurred – only percentages greater than 75% are shown. *A* = *G. anglica*, *G. amarella*, *G. uliginosa* and hybrid populations; *B* = *G. campestris*; *C* = *G. germanica*)

Plant Syst. Evol. 237: 137–151 (2003)

Conclusion

- *G. anglica* has been recently derived from *G. amarella* as early-flowering form
- Relatively few characters separate them
- Completely interfertile
- Should be relegated to subspecies: *G. amarella* subsp. *anglica**

- Consequently *G.* x *davidiana* is no longer recognised
  - Such intermediate plants included in the variable subsp. *amarella*

- This also fits better with subsp. *septentrionalis* (retained as subspecies)

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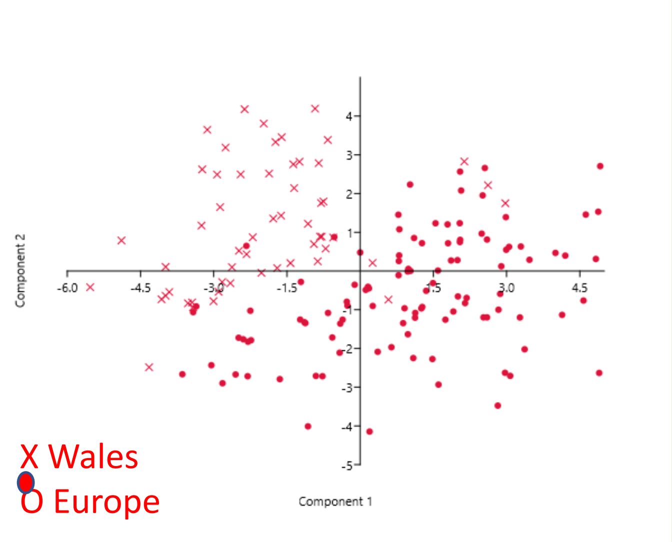
The case of *Gentianella uliginosa*

- Pugsley first noted in 1923 Tenby plants was similar to European *G. uliginosa*
- characterised by:
  - **annual** with 0–2(–3) internodes (mean 1.3)
  - terminal internode on c. 1.7 × the internode length,
  - terminal pedicel forming up to 70% of total height
  - calyx teeth very unequal in width and usually out-curved

- A rare plant of South Wales and North Devon dune slacks (reported in error for v.c. 102)

- Molecular studies by Winfield *et al.* (2003) showed that British plants ascribed to the European *G. uliginosa* were genetically part of *G. amarella* (as above)

- Our studies with Gerard Oostermeijer and Sabrina de Carvalho found that British plants were genetically different from Swedish *G. uliginosa* (unpublished).
- Furthermore, morphologically, European *G. uliginosa* differs from South Wales '*G. uliginosa'* by having more internodes (mean 3.2), terminal internode 0.9 × the average internode length and a short terminal pedicel forming 20% of total plant height.



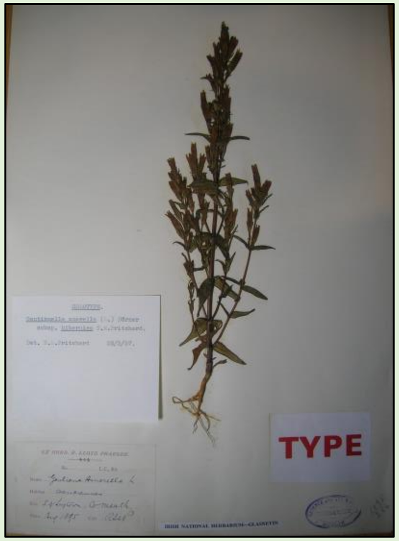
- Conclude South Wales '*G. uliginosa'* has evolved from subsp. *amarella* as an annual ecotype adapted to dune slacks around the Severn Estuary – a new taxon = *Gentianella amarella* subsp. *occidentalis**

- * Rich, T. C. G., McVeigh, A. & Stace, C.A.(2018). New taxa and new combinations in the British flora. *Edinburgh Journal of Botany* doi: 10.1017/S0960428618000288

G. amarella* subsp. *hibernica

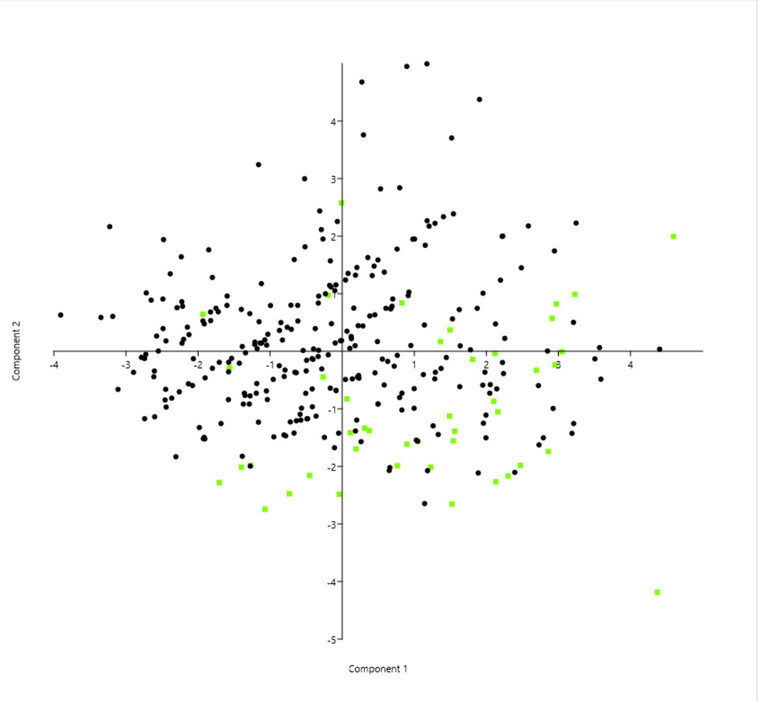
Pritchard (1959) described all Irish plants as subsp. *hibernica*

- relatively longer corollas 19-22 mm
- more internodes 7-11
- a very contracted terminal internode



- Irish field population samples show almost complete overlap with subsp. *amarella*
    - Hence subsp. *hibernica* not maintained

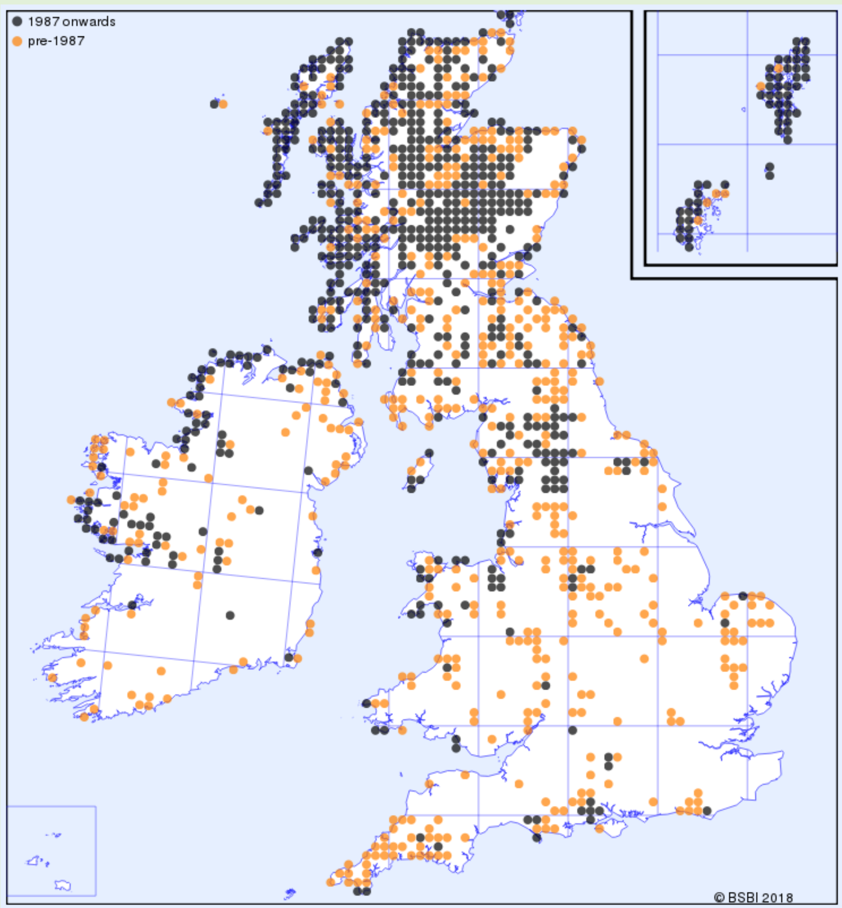
Foines

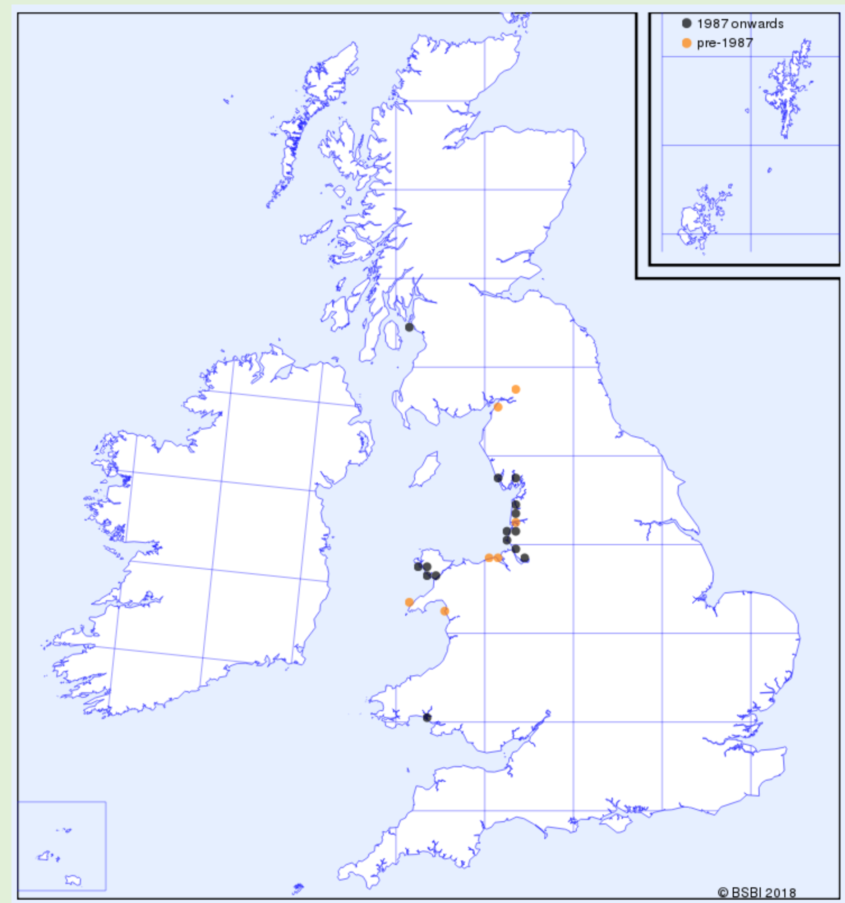


PCA: black UK, green Ireland

The next job is the maps – is anyone busy …?!

- Keeping very simple, pre/post 1987 only





Andy and Tim would like to thank

- Stacey Baldwin
- Julia Carey
- Sabrina de Carvalho
- Sep Greimler
- Andy Jones
- Liz Lavery
- Tommy Lennartsson
- Lola Lledó
- Gerard Oostermeijer
- Colin Pope
- Noel Pritchard
- Ivor and Jane Rees
- Phil Smith
- Clive Stace
- Paul Stanley
- Seren Thomas
- Willow West
- Mike Wilcox
- Phil Wilson

and everyone else who has helped with information etc since 1993