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
4. Centaurium pulchellum (Sw.) Druce

Lesser Centaury

Annual 2–20(–30) cm tall, erect, light grey-green, glabrous. Basal rosette sometimes present or more usually wilted at flowering (or sometimes poorly defined) with 2–5 pairs of leaves. Rosette leaves 2–5 × 1.5–3 mm, lanceolate to ovate, acute, entire, 1-veined, broadly or slightly petiolate. Stem 4-angled, winged above, simple or branched mainly above, internodes 0.5–2 cm long as their leaves. Stem leaves (1)–3–6(–7) pairs, (8)–16–21(–23) × 2.5–9.5 mm, ovate, (1)–3.5–4.5(–5) × 0.5–2 cm, strong central vein and 2 weak lateral veins, acute or rounded-oblong, serrate and stippling stem but not connate. Increasing in size above the stem. Inflorescence simple or cymose, open and flat to dense. Terminal pedicel 1.5–3(–3.5) mm, lateral pedicels often longer. Flowers 4–5 merous (often 4-merous in small plants, or on lateral branches of big plants), 4.5–5 mm across. Pods with calyx lobes united. Calyx 5–10(–18) mm, calyx tube 1–6 mm, linear, acute, apiculate, tomentose in sls, V-shaped, but not winged. Calyx 2/3 to nearly ac., 5(–5.5) mm, corolla tube 4–6.5(–7.5) mm cylindrically ovoid, tomentose, to 2–3(–5) mm × 2–3. Corolla 1.4–1.9(–2.2) cm × 0.0–calyx. Anther locules at top of corolla tube. Mean pollen size elliptical, 2.5–3 × 1.5, linear, stigma 2-lobed, c. Seeds 0.5–0.6 mm, brown, smooth, velutinata. Chromosome numbers: 2n = c. 34 (1 count British database).

Centaury is largely scented with the leaves (mostly 2–4, sometimes up to 6) and the 1–3 flowers 5–10 mm long (figure 77). The very small, scented leaves are easy to distinguish. In C. pulchellum the flower buds are shorter than the sepals and the leaves are more or less sessile or shortly stalked (or less sessile) and the basal rosettes of lesser centaury are small. In coastal dune slacks, the very small corolla rim (which has corolla tube 3(–3.5) mm and 4(–5) mm long) differs from C. damascenon in having fewer (up to 4) flower buds 5–12 pairs, corolla 3.5–5 mm long with more corolla rim deciduous (figure 77). Most of the flowers are pulchellum and the flowers of each flower cluster occur in a 3:1 ratio in C. pulchellum. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column. The flowers of each flower cluster are usually 4-merous (sometimes 3-merous in small plants) and do not have a well-developed central column.
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 allopolyploidy 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>
<thead>
<tr>
<th>Character</th>
<th>Field n</th>
<th>mean ± s.e.</th>
<th>(1–)10–90 (–100) percentile range</th>
<th>Herbarium n</th>
<th>mean ± s.e.</th>
<th>(1–)10–90 (–100) percentile range</th>
<th>P (t-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internodes</td>
<td>321</td>
<td>10.4 ± 0.12</td>
<td>(5–)8–13 (–16)</td>
<td>627</td>
<td>9.3 ± 0.08</td>
<td>(4–)7–12 (–16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf length [mm]</td>
<td>321</td>
<td>24.2 ± 0.40</td>
<td>(6–)14–32 (–43)</td>
<td>578</td>
<td>16.7 ± 0.20</td>
<td>(6–)11–24 (–42)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf width [mm]</td>
<td>321</td>
<td>12.2 ± 0.20</td>
<td>(3–)7–16.5 (–22)</td>
<td>578</td>
<td>7.6 ± 0.10</td>
<td>(3–)5–11 (–17)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf length / leaf width ratio</td>
<td>321</td>
<td>2.02 ± 0.02</td>
<td>(1–)1.6–2.40 (–3.8)</td>
<td>578</td>
<td>2.3 ± 0.02</td>
<td>(1.3–)1.7–2.9 (–4.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Corolla length [mm]</td>
<td>321</td>
<td>28.6 ± 0.20</td>
<td>(12–)25–32 (–37)</td>
<td>796</td>
<td>26.2 ± 0.10</td>
<td>(15–)22–30 (–35)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Calyx length [mm]</td>
<td>321</td>
<td>15.8 ± 0.20</td>
<td>(5–)12–20 (–24)</td>
<td>796</td>
<td>11.6 ± 0.07</td>
<td>(5–)9–14 (–18)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Corolla length / calyx length ratio</td>
<td>321</td>
<td>1.86 ± 0.02</td>
<td>(1–)1–2 (–1.5)</td>
<td>796</td>
<td>2.3 ± 0.01</td>
<td>(1.5–)1.9–2.7 (–5.1)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

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

Data of A. McVeigh.

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
**Morphological data** Dorset/I of Wight vs European material:

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

- 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.

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*

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 ($G. \times davidiana$)
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”
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)

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 $0.9 \times$ 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* *

**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

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
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- Sep Greimler
- Andy Jones
- Liz Lavery
- Tommy Lennartsson
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- 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