Gentians of Britain and Ireland
Tim Rich & Andy McVeigh

BSBI Handbook no. 19

BSBI Gentian Handbook
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Gentianella pulchella (L.) DC

Habitat
In calcifuge, shallow, calcareous gravels and appointments. In Britain, G. pulchella grows on coarse sandstone and limestone soils, and in calcareous grassland. It is also recorded from calcareous grassland in Ireland. The distribution of G. pulchella in Britain is primarily in the north and west of England, with a few scattered populations in the south. In Ireland, it is particularly common in the west and south-west. It is a calcifuge species, with a preference for calcareous soil conditions.

Reproductive biology
Gentianella pulchella is a biennial or short-lived perennial. It flowers in late summer or early autumn, producing pinkish-purple flowers that are arranged in a loose, drooping cluster. The flowers are hermaphrodite, with both stamens and pistils present. The seeds are dispersed by wind, and the plant can form clonal populations in calcareous grassland.

Conservation status
Gentianella pulchella is a species of calcareous grassland, and is therefore vulnerable to habitat loss and fragmentation. It is listed as a "Vulnerable" species in the UK Biodiversity Action Plan, and is protected under Schedule 8 of the Wildlife and Countryside Act 1981. In Ireland, it is listed as a "Vulnerable" species in the National Parks and Wildlife Service's Species Action Plan for Ireland.

References
Also just published! See leaflet!
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 alloplody 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</th>
<th>Herbarium</th>
<th>$P$ (t-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internodes</td>
<td>321</td>
<td>627</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf length [mm]</td>
<td>321</td>
<td>578</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf width [mm]</td>
<td>321</td>
<td>578</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leaf length / leaf width ratio</td>
<td>321</td>
<td>578</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Corolla length [mm]</td>
<td>321</td>
<td>796</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Calyx length [mm]</td>
<td>321</td>
<td>796</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Corolla length / calyx length ratio</td>
<td>321</td>
<td>796</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
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
In Europe 3 taxa (G. Mansion work):
• diploid subsp. *acutiflorum*
• tetraploid subsp. *tenuiflorum*
• + widespread European taxon, informally ‘*C. ×tenuiflorum*’
  (allotetraploid derivative of *C. tenuiflorum* × *C. erythraea*)
**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>
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<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**
- one Ubsdell count of UK material = diploid (yet pollen sizes suggests tetraploid)

Hence described treated as new English endemic = *C. tenuiflorum* subsp. *anglicum* *
- presumed to have arisen through isolation and local adaptation following reflooding of the English Channel
- **Post Handbook**: Now seen very similar material from N and W France

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 ed 4 “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 *Gentianella anglica*

- Since 1993 TR has 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 had intermediates which were 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.
- But there were “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
- Relegated to subspecies: *G. amarella* subsp. *anglica*

- Consequently the hybrid *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, though clustering suggests some differentiation
  • Hence overall subsp. hibernica not maintained

PCA: black UK, green Ireland
Post Handbook

Blackstonia may be annual and biennial (page 21); detailed studies needed!

Centaurium intermedium also in v.c. 60 West Lancs (page 60)

Gentiana verna from Ingleborough (page 130) has been strongly queried!

Gentiana lutea naturalised on cricket field Horwich, v.c. 59 South Lancs, 1954 (MANCH)
Andy and Tim would like to thank
• Stacey Baldwin
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• Colin Pope
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• Mike Wilcox
• Phil Wilson

and everyone else who has helped with information etc since 1993