

# The Improvement of Autumn-Flowering Gentians Through Breeding and Selection<sup>®</sup>

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## INTRODUCTION

In the author's opinion, there are already too many cultivars of autumn gentians. Many of the older cultivars are late flowering and have untidy growth habits with long, trailing shoots bearing single flowers. Mediocre seedlings have been named over the years. Some are difficult to grow and lack permanence in the garden, others are difficult to tell apart, undistinguished, and indistinguishable.

This paper reports on a gentian breeding programme started at Macplants Nursery in East Lothian 9 years ago which resulted in plants which are compact, yet robust, and vigorous. Many of these plants have multiheaded trusses of flowers with improved colour, conformation, and substance, some with attractive markings. A feature has been thick, broad leaves. Early to mid-season flowering has been another successful aim of breeding.

Autumn gentians are lime haters and will not grow on calcareous soils, such as occur in many parts of England. Even where soil conditions seem suitable many gardeners report lack of success. The breeding programme has resulted in a number of dwarf, very compact forms with promise for growing in pots, sinks, troughs, or perhaps raised beds provided with suitable free-draining ericaceous compost.

## AIMS OF BREEDING

- Improved, neater, growth habit to produce a plant that looks good in a pot for growing and selling
- Very small dwarf types suitable for trough cultivation
- Ease of propagation
- Permanence, overwintering capacity
- Plant health and vigour
- Improved flower colour: pale blue, dark blue, white
- Better flower conformation
- Attractive/interesting flower markings
- Early/mid-season flowering
- Longevity of flowering
- Floriferous/multiheaded forms

## BREEDING STRATEGY

A study of the floral mechanism has shown that autumn gentians are protandrous — i.e., within any one flower the anthers dehisce and release pollen before the stigma is receptive, a mechanism which encourages out-pollination. It is not known if there is a genetically controlled incompatibility system. I have treated the gentians as out-breeders and the strategy was developed accordingly.

The breeding and selection programme at Tynebank aimed at the following criteria: early flowering and floriferousness, of which multiheadedness is a factor,

flower size, confirmation, and marking of the corolla, striping, and spotting. Vegetative characters are especially important and selection of compact types, both tufted and low spreading, has been another objective. It is desirable for selling that a plant should "look good in a pot", this is also important of course for showing. Success has been achieved in breeding improved forms for container culture. Good tillering and rooting ability for ease of propagation is beneficial to both gardener and nursery operator. Vigour and persistence in the garden are other obvious aims, but less emphasis has been placed on this.

At first, the strategy involved deliberate hand pollination of parents selected for specific characters, for example aiming to combine good flower colour of one parent with early flowering of another. Crosses were carried out in the glasshouse using pot-grown plants. Flowers were emasculated before pollination and then covered. With very few exceptions, results were unpromising, although many hundreds of seedlings were raised to flowering size and a number retained for several years for further assessment.

Several difficulties were encountered, one was that seed formation may be inhibited by surrounding petal and sepal debris, causing capsules to rot before seed has had time to ripen. Debris must be carefully removed; this is time consuming. The problem is made worse by the cold wet conditions normally prevailing in a Scottish autumn.

Another difficulty has been that the number of parents contributing to seed production may be restricted because of sterility of certain genotypes — not all streams flow into the gene pool! A good example of this is *G. ×caroli*, potentially useful because of its consistently early flowering. Many hand-pollinations using *G. ×caroli* failed and, in my experience, it never sets seed in the garden. Reasons for sterility are not known. Scientific breeding of the autumn gentians is hindered by a general lack of knowledge of chromosome numbers, genetics, breeding systems, and floral mechanisms.

Many plants on the nursery were killed in the very severe winter of 1994-95. Gentians do not take kindly to waterlogged pots which are then frozen for weeks on end, plants eventually succumbing to root rot. There were high losses of hybrids as well as a collection of cultivars, assembled as possible parents. This proved to be a blessing in disguise as much mediocre material was cleared out. It was followed by rethinking and virtually a new start.

A more pragmatic system of breeding was started in 1995 based on an elite population, placed in spatial isolation, as far as was practicable, from other gentians. As pollination is carried out mainly by hover flies, rather than bees, the isolation distance may not have to be far. The far-ranging and discriminating honey bees seldom visit Gentians. Seed was harvested from each plant separately, pollen parents being unknown, but likely to be neighbouring plants within the elite population.

Plants initially chosen for the new breeding programme varied considerably in origin. They included selected seedlings obtained from open-pollination of a few chosen cultivars, notably 'Shot Silk' (raised at Aberconwy Nursery) and from the very variable, seed-propagated 'Glamis' (from Christie's Nursery).

Hybrids with a much more complex history proved to be particularly valuable components of the elite population. For example, in 1934 A.G. Weeks crossed *Gentiana farreri* (syn. *G. lawrencei* subsp. *farreri*) with *G. hexaphylla* resulting in *G. ×hexafarreri*. Dr. W. Lead, in the mid-1940s, produced *G. verna* from *G. veitchiorum* and *G. ornata*. In the early 1990s *G. ×hexafarreri* was cross-pollinated

at Tynebank with *G. verna*, virtually a four-way cross involving four distinct species. Amongst the progeny were several compact plants with broad leaves, but flower colour was rather poor. A selected compact hybrid was crossed with 'Barbara Lyle' (a seedling from *G. veitchiorum* raised by N.C. Lyle in the 1950's). This cultivar has excellent deep blue flowers but a rather poor straggly growth habit. A few plants from this cross combined the best attributes of both parents. Coded CH:B, they were included in the elite population. In autumn 1998 seed was taken from a single parent CH:B 51 and sown in mid-January 1999.

## SOME RESULTS FROM BREEDING TO DATE

**CH:B 51.** Seedlings from CH:B 51 proved to be very vigorous, with broad, thick leaves. At the young plant stage more than 70 were selected, mainly for compact habit, and grown on in 1- to 3-litre pots to allow freedom of expression.

Multiheadedness has been evident in all CH:B 51 progeny. Several novel growth forms and leaf types occurred, a few plants virtually unrecognisable as gentians, at least prior to flowering.

A number of CH:B 51 progeny have not yet flowered but so far a wide range of flower colour, size, conformation, and patterning has been obtained. Five petals is normal in gentians but six was not uncommon and seven petals occurred on some seedlings.

Overall the variation in vegetative growth and floral characteristics, from a single seed parent, has been quite phenomenal. This, as well as vegetative vigour (heterosis), is undoubtedly due to the complex genetic background resulting in 'built in' variation, as well as outcrossing with other non related genotypes within the elite population.

Thick, broad leaves, as well as deep, dark blue flowers are characteristic of *G. veitchiorum*. It is interesting to note that two 'doses' of *G. veitchiorum* were incorporated into the CH:B hybrids. Multipetalled flowers could have been derived from *G. hexaphylla*. Compact growth may relate to *G. ornata*.

**Dwarf Forms.** The programme has yielded a few dwarf, very compact types which may be suitable for growing in troughs, patio pots, or even on raised beds, provided with free-draining ericaceous compost. Some may not flower until the 3rd year from seed sowing. They are, however, interesting for their foliage and growth forms alone.

**White Flowered Gentians.** Improvement of white-flowered gentians is an important breeding objective. White-flowered seedlings arise spontaneously from time to time but are comparatively rare. Some have been named, but the older cultivars are scarcely worth growing because of late flowering, lack of flower colour purity and substance, and yellowish foliage. These failings are probably reasons why "whites" have not been popular. There is certainly much scope for improvement.

The breeding programme has yielded a number of promising white-flowered seedlings which flowered for the first time in 2000. Thick, glossy dark green leaves have been a feature as well as multiheaded growth habit and early flowering. Several plants possessed pure white flowers of good substance and conformation.

Top crosses (hand-pollinations between selected elite plants) have been made between selected whites to obtain further improvements. White is undoubtedly controlled by a recessive gene or genes so the progeny should breed true for flower colour.

## GENTIAN PROPAGATION AT TYNEBANK NURSERY

**Division.** Rooted offsets (thongs) are taken in from stock plants lifted from the open ground or from potted plants. This is the usual method of propagation. February to March is the appropriate time. Propensity to produce thongs varies greatly between clones or cultivars, this is undoubtedly why some have become rarely available or even extinct.

**Cuttings.** Shoot tip cuttings can be taken as soon as they become available in April-May. Cuttings taken June-July are feasible. Any flowering shoots that develop can be removed without detriment once rooting is well established.

Up to 100% rooting has been achieved this year with a few clones selected as prospective cultivars. Others only rooted with less than 20% success and with weaker root systems. Sleeved plugs have proved useful modules for rooting cuttings (or, indeed, growing seedlings). Gentian roots resent disturbance.

It is already apparent that the newer multiheaded types are more amenable to this method of propagation than the "old style" forms with single unbranched shoots.

Shoot-tip cuttings should prove a useful way of rapidly multiplying a prospective new cultivar. A single well grown plant in a 2-litre pot should be capable of yielding 50 cuttings. Each plant raised could itself produce 50 cuttings, thus 2500 plants could be obtained in 2 years. Micropropagation would be an unnecessary expense.

## GROWING GENTIAN IN CONTAINERS

Growing gentians in containers would enable them to be enjoyed in areas with calcareous soils such as many parts of England. Even where soil conditions are apparently suitable many gardeners find autumn gentians difficult to grow. Container growing of gentians is very popular in Japan and improved forms could be promoted there. In a container, growth habit and leaf form can be appreciated as well as flowering. Gentians need not be confined within the perimeter of the pot to look attractive. A trailing or spreading plant, provided it has a compact, multiheaded habit, can be effective in an appropriate container. A hanging basket would not be suitable because of watering problems. It is imperative that gentians are watered regularly throughout the growing season.