

BREEDING ORNAMENTAL PLANTS

K.R.W. HAMMETT

*Horticulture and Processing Division
Dept. of Scientific and Industrial Research
Private Bag, Mt. Albert
Auckland*

It is not my intention here to discuss breeding techniques. The sheer diversity of ornamental plant material makes that impossible. Indeed, faced with such diversity, my starting point must be to ask, "What is an ornamental plant?"

A possible definition would be, "any plant that is cultivated primarily for its decorative value." Such a definition is very open-ended and really does not give a breeder much guidance. A breeder of food plants knows pretty much what is required of him. Namely, his plants should produce the largest possible yields in the shortest time with minimum cost and trouble. Once produced the product should have maximum shelf life, be easily transported and, of course, be edible. In contrast, the breeder of ornamental plants has as his raw material virtually the whole of the plant kingdom — subjects ranging in size from forest trees to ground-hugging alpenines. Even more important, he or she is in an area of taste and fashion, where none of the criteria are permanent.

For these reasons, the breeder of ornamentals is much closer to a painter or composer than to a scientist. Certainly a good breeder will have a good grounding in the basic scientific principles of genetics and will keep up with the latest technical developments, but equally, good painters and composers are well grounded in the fundamental techniques of their chosen field of activity. The real difference between breeders of ornamental plants and those working with utilitarian plants lies in creativity. The breeder of ornamental plants has to have the ability to visualise what he wishes to create. This is perhaps the most important component of his work. Only when he has a clear vision can he start to devise ways to achieve this goal.

I believe it is important that people involved in the nursery and garden centre sectors of the horticultural industry, as well as in parks, see themselves as being part of an art form. Ornamental horticulture should certainly be considered an art rather than just a craft. The way buildings and everyday surroundings are complemented by plants is a very obvious statement of a people and their culture. The first impression of a country and its people is often gained on the drive from an airport to the nearest city.

It is not just a matter of saying "O.K., I suppose gardening can be considered as an art." It is important that we realise that our art form is more challenging than any other. A painter uses colour in two dimensions, while a sculptor works in three dimensions and usually makes little use of colour. In contrast a gardener works in these spatial dimensions using an infinite variety of colour and texture. However, most important, he has to contend with a fourth dimension — time. A planting is never static; its appearance changes with the time of day, the weather, and with the seasons. To maintain a planting in an attractive condition over an extended period is a great achievement and we should feel justifiably proud that we are part of this activity. When we see our industry in this light we can then start to claim our place alongside other visual arts — architecture, music, and dance.

If we now step back and look at the vast range of plant material used for ornamental purposes, we find a surprisingly small proportion has been specifically bred. Many trees and shrubs are used in the form they were found in the wild. Most variations have occurred by chance, have been spotted and have been preserved by vegetative propagation. Rhododendrons and a few other genera are notable exceptions to this generalisation, but longevity and the length of time between generations has discouraged detailed breeding of shrubs and trees.

It is also important to maintain a cultural and historical perspective. Some peoples cannot comprehend why anyone would grow plants which have no obvious utilitarian use, while others have taken an interest in ornamental plants since prehistory. The affluent have generally been able to devote time and resources to ornamental plants, while the poor have been more concerned with staying alive.

Our knowledge of what was done in the past depends on what sort of records were left. For instance, we know much more of what went on after the development of printing than before and we tend to have a better knowledge of what was recorded in European languages than in others. It is true that in most cases, where the stages in the development of a plant can be traced most often that plant will have been taken to Western Europe, developed, and redistributed from there. We should not, however, forget that ornamental plants were developed by ancient cultures in the old world, such as those in Persia, China, and Japan, and by the Incas and Aztecs in the New World, long before people from Europe "discovered" them.

The development of communication between Europe and the rest of the world and the introduction of new plants to Europe, starting in the 16th century, created great interest. From this time plants started to be grown simply for pleasure. This is reflected by the publication of books such as *Paradisi in Sole* by Parkinson in 1629, and records of "Tulipomania", the remarkable speculation in tulip bulbs which occurred mainly in Holland between 1634 and 1637.

It was from this period that the first flower "fancies" can be traced. Flower fanciers tended to be artisans who bred flowers as a hobby. In Britain, during the respective flowering seasons, competitions and exhibitions were held, often in association with a meal, at the local inn. As flower hobbyists were, until this century, known as "florists", their get-togethers were often styled "florists feasts".

By the middle of the last century the following were considered to be the main florists' flowers: carnation, pink, tulip, ranunculus, hyacinth, auricula, gold-laced polyanthus, primrose, pansy, viola, violet, chrysanthemum, and dahlia. Others with a lesser following were: double daisy, hollyhock, hepatica, pentstemon, stock, sweet rocket, sweet william, and wall-flower.

As with any sport, rules were developed and ideals were set. It is clear that rapid progress was made in achieving such ideals. Taking the dahlia as an example, within 30 to 40 years of its introduction as a semi-double at the beginning of the last century, it had been transformed to a fully double and highly formal "florists' flower".

It is important to realise that this intense breeding was carried out well before Mendel started his experiments which led to our understanding of the principles of genetics. It should be remembered, though, that similar interest in the development of specific breeds of animals had been going on at the same time, with equal success. Indeed it was the close interest and association that Charles Darwin had with breeders of domestic animals and plants which helped him formulate his ideas on evolution. An understanding of genetics is a help to any plant breeder, but the practice is at least as much an art as a science, especially in the case of ornamentals. Often an experienced exhibitor, who knows exactly what he wants to produce, makes an excellent breeder.

Traditionally, with florists' flowers the flower itself was very much the centre of attraction. These were most commonly exhibited on boards. This emphasis was frequently at the expense of the plant and no interest was taken in developing plants primarily for use in garden design. It has only been

during this century, when show rules were changed, that more emphasis has been given to features of the plant such as stems, plant height, and garden worthiness. Even so, it is true, especially when the term is broadened to include flowers used in the modern cut-flower trade, that most ornamental breeding has been carried out on plants grown for their flowers rather than whole plants used in a landscape sense.

With the advent of the industrial revolution, newly-made fortunes and an interest in glasshouses, many of the florists' flowers suffered a decline. This was accentuated by the views of people like Jekyll and Robinson, who popularised natural rather than formal gardens and flowers. During such periods of decline, genetic material may be lost, as was the bizarre carnation, or may just survive in cottage gardens or in the collections of a few enthusiasts. The gold-laced polyanthus survived only by a very small quantity of genetic material being sent, in 1945, from an old-time enthusiast in England to a specialist polyanthus breeder in the USA. I have checked this story in some detail and it does appear that we have retained this characteristic or combination of genes only by the very thinnest of threads. Now with a revival of interest in florists' flowers, both amateur and commercial breeders are making use of this material.

In my own case, I realised over twenty years ago that, although the original sweet pea, *Lathyrus odoratus*, was bicoloured (i.e. where the standard petal is a distinct colour to the wing petals), all sweet peas commercially available at that time were self-coloured. Happily, Major Turrall of Yorkshire, England, had collected and maintained some ancestral cultivars over many years. Shortly before his death he made these available to the seed trade and today they are listed as curiosities in seed catalogues. I have used some of these cultivars to produce a strain of sweet peas combining modern ideals of flower form and stem length with the bicoloured characteristic and strong scent of the ancestral types. Had Major Turrall not made his collection it would not have been possible for me to have made this development.

Remember, plant breeders do not create new characteristics. They simply attempt to recombine what is available into the most favourable combinations. New techniques of genetic manipulation are emerging. If some of these make it possible to break down breeding barriers between species and genera this will offer great scope to ornamental plant breeders. However, such techniques are some way off for practical use and the use of tailor-made synthetic genes is further away still. It is,

therefore, essential to preserve as wide a diversity of genetic material as possible.

This brings me to another problem facing ornamental plant breeding. Compared with breeders of food crops, fully professional breeders dealing with ornamentals are few. Most flower and bedding-plant seeds are produced by a very limited number of large companies, mainly in the USA, Europe, and Japan. Even in these companies the ratio of flower breeders to people working on other crops is low. Their aims are dictated by marketing concerns and their interest is currently directed at the production of dwarf plants, which flower very quickly from seed and which can withstand mechanical growing technology. Relatively little effort appears to be made to maintain collections of genetic material for possible future use. Presumably cost and the mobility of the breeders between companies works against this. This lack contrasts with strenuous international efforts which are being made to create gene banks of major food and fodder species. As a result, professional breeders are dipping more and more into collections maintained by enthusiasts. Most often these enthusiasts have very limited space and time, which limits the range of material they are able to maintain. If individual enthusiasts are breeding as opposed to maintaining a collection, the genetic base of their material is likely to be very limited. Taking the sweet pea as an example, the late-flowering Spencer type used for exhibition in Britain is now bred almost exclusively by amateur exhibitors. Most current show-winning cultivars have been produced by, or derived from, cultivars bred by just two people. These people have made their parentage records available to me. No more than 10 cultivars have been involved in the developments made in the last 40 years, and some of these foundation cultivars were almost certainly related. Like the professional breeder with his cost constraints, the amateur is often an exhibitor breeding for success on the show-bench. Show schedules almost invariably discriminate against certain types. Breeders will not breed material which will not be used, so the genetic pool is further diminished. Certainly crosses I have made indicate depressingly little genetic variation in the modern sweet pea.

The sweet pea is not an exception — the breeding of an increasing number of flowers is being left to amateur enthusiasts. Taking dahlias as an example, up to about 15 years ago, large dahlia nurseries with large collections bred and introduced their own novelties. Now nurserymen find it much cheaper to launch novelties bred by leading exhibitors who are quite happy simply to have their names recorded in the

catalogues. The exhibitor/breeder usually has a small garden and specialises in only one or two types of dahlia. On top of this, in Britain particularly, it is easier to win prizes with white or yellow blooms which can be sheltered from the weather without loss of colour. The result has been the introduction of many wonderfully refined white and yellow dahlias and not much else. The problem is compounded because other colours fall behind in quality and the amateur breeder is not prepared to use such material in his crosses.

Similar trends in the nursery industry worldwide, where the range of plants has been reduced but greater numbers of each type are produced, have the potentiality of making it difficult for future plant breeders. Plants widely listed only a few years ago are now hard to obtain. The extent of the problem will differ among species, but as it is becoming increasingly difficult to obtain plant material from the wild, private collections and those in botanic gardens will assume increasing importance.

Collections should not be thought of simply as repositories — they are a very important source of reference to a breeder. A good plant collection and a wide range of catalogues, both old and current, are basic plant breeding tools. While quarantine requirements make introduction from overseas troublesome, it is almost invariably easier and cheaper to introduce something which already exists than it is to breed a similar plant. A collection enables a plant breeder to observe potential parents over an extended period. People sometimes think that breeding starts with pollination. In a well planned programme, observations start several seasons before any crosses are actually made. This is why experienced exhibitors often make good breeders of exhibition quality plants — they know their plant material intimately.

We are perhaps lucky in New Zealand, in that at a time when our nurseries were starting to follow the world trend of becoming factories for a limited range of plants, horticulture in the widest sense should be looked to as a possible saviour for our flagging economy. At least a man concerning himself with flowers is not now as suspect as he was fifteen years ago!

Since the first settlers arrived, plants have been continually introduced to New Zealand. As a proportion of these settlers had lived in various parts of the world before settling in New Zealand, quite a lot of plant material was introduced directly from its country of origin. Consequently, we now have a rich heritage of plant material, some of which is unavailable elsewhere. Because a good proportion of our population has received a sound basic education over the years, we have had

quite a number of people who have between them bred a wide range of plants. Much of the detail has been unrecorded and as a country we have not afforded these people the recognition they deserve. The story of the kiwifruit and some other New Zealand fruits are now well known, but in the area of ornamentals we have, perhaps, an even richer inheritance. Camellias, carnations, orchids, daffodils, dahlias, gerberas, lilies, rhododendrons, and zantedeschia spring immediately to mind. Some of these developments have found a place on the world market, while others, although of merit, have not received the promotion necessary to compete with overseas introductions.

Breeding a good new plant is only a starting point. If it is to find a place in world horticulture, each new development must be linked with good nursery management and good promotion. In New Zealand we have an ideal climate for plant breeding. If this activity can be supported by long term planning which will put in place the other essential links in a commercial chain, we could become the horticultural Mecca of the Southern Hemisphere.

REFERENCES

- Darwin, C 1868 *The Variation of Animals and Plants under Domestication* John Murray, London.
- Genders, R 1963. *The Polyanthus* Faber & Faber London.
- Kaden, V 1982 *The Illustration of Plants and Gardens 1500-1850* Victoria and Albert Museum, London
- Parkinson, J 1629. *Paradisi in Sole*. London. Methuen & Co. (1904 facsimile).
- Turrall, J F 1965 *The old Sweet Peas* *Jour. Royal Hort Soc* 90 23-29.
- Wratt, G S and H C Smith, 1984 *Plant Breeding in New Zealand* Butterworths. Wellington, N Z

THE LIGHT INTEGRATING METER — AN ALTERNATIVE METHOD OF MIST CONTROL

JAN VELVIN
Lyndale Nurseries
P.O. Box 81022
Whenuapai, Auckland

During the summer of 1982 Lyndale Nurseries set up a propagation unit at a new site in Whenuapai. This unit consists of four 60 × 20 ft. (18 × 6m) PVC film-covered tunnel houses containing a central bed with bottom heat and a mist facility plus two side beds without heat but with mist, including a weaning option, i.e. 1/1 to 1/10 misting. All the houses