IMPROVING AUSTRALIAN DAISIES BY BREEDING

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We have been involved in plant breeding for almost 12 months, concentrating on the Australian Asteraceae and, in particular, on the genera *Brachyscome* and *Helipterum.*

The project evolved after trips to Europe and the U.S.A. revealed a strong interest in Australian daisies for use as "indoor potted colour" and "balcony plants," as well as for landscape use

Traditionally, daisies such as chrysanthemum and gerbera have been amongst the top four sellers in both the pot-plant and the cut-flower markets throughout the world. Australian daisies are quite different from these and their unique nature, beauty, and suitability for pot culture have particularly excited overseas growers. For example, Prof. W.U. von Hentig of the Geisenheim Institute in West Germany has developed a form of *Brachyscome multifida* for the European market and this plant now commands sales of about 6,000,000 units per annum in that market place.

Plant breeders in Holland, Germany, and the U.S A. are aware of the opportunities in breeding Australian daisies and thus the development of a breeding program in Australia is of prime importance if this country is to share in some of the benefits to be gained in the marketing of our flora in other countries

After studying the overseas markets and trends we have developed a set of objectives for a breeding program. The prime objective is to breed an on-going supply of desirable new Australian daisies which can be protected by Plant Variety Rights.

These new plants should satisfy the following criteria.

1. Be suitable for use as "Indoor Potted Colour" and as "Balcony Plants" in a range of climates including low light areas.
2. Have attractive form and habit.
3. Come in a range of colours suited to fashion needs of particular countries or areas.
4. Have good cultural characteristics. They should be
   i) easy to clonally propagate by either cuttings or tissue culture
   ii) easy and quick to grow as a uniform flowering crop
   iii) relatively pest and disease resistant.
5 Have good shelf life and shipping characteristics.

With these objectives and criteria in mind, Plant Growers Australia (P.G A.) established a collection of Australian daisies covering 21 genera and over 120 species and forms from a wide

range of different climatic and geographic areas. From the collection we selected the genus *Brachyscome* and the genus *Helipterum* for our initial breeding program.

Having targeted the species for improvement and set some specific criteria for selection, we then developed some detailed breeding programs and commenced trial work. In the main, our methods involve the standard controlled cross-pollination, both within and between species, which is a feature of most traditional plant breeding practices. To achieve satisfactory results, we feel that a glasshouse is essential, and ideally the house should be used exclusively for breeding purposes. It should be well sealed, to prevent drafts and insects interfering with pollination and preferably have a provision for lighting and heating to extend the flowering season. Watering is best carried out by drip irrigation. A well designed and managed glasshouse will result in healthier and more vigorous plants and consequently the production of ovules and pollen will be improved. At P.G.A. we have adapted a plant quarantine glasshouse with a dual chamber for insect exclusion, and this has proved most effective.

While pollination can be regarded as a simple process, controlling the event to achieve a desired result can be complex and often very difficult, depending upon the plant in question. In the Asteraceae, controlled pollination is complicated by the nature of the inflorescence which is a capitullum, or aggregate of small flowers (florets) arranged in a head. On any one capitullum, there can be male, female and bisexual florets and some may also be sterile. The outer florets on the head open first and are often more fertile than the innermost florets which open last.

The Asteraceae also shows a diversity of compatibility systems. Some are self compatible while others, such as many of the brightly coloured "Paper Daisies" are strongly self incompatible. To develop an understanding of the pollination mechanisms involved, we have taken great care to conduct controlled pollination trials on isolated florets which have been emasculated. Where self incompatibility can be proven, as has been the case with all *Brachyscome* species tested, the need to emasculate female parents prior to cross pollination is eliminated.

At P.G.A. our breeding programs have involved both intra-specific crosses and wide crosses between different species. To date, only some of our inter-specific crosses have been successful and from these we are presently growing on a number of F_1 *Brachyscome* seedlings. We have found that even within a species such as the *Brachyscome multifida* group, which is represented by more than a dozen different forms, some crosses have been easier to make than others. Inter-specific hybridisation

has been more difficult in both the *Brachyscome* and *Helipterum* and our task over the next twelve months is to develop techniques which may overcome the barriers to hybridisation. Such techniques may involve treating the stigma, either physically or chemically, to aid fertilization; or adopting embryo rescue where embryo abortion is the problem. Preliminary examinations of stigmas, ovaries, and pollen tube development should indicate where the barrier exists and which technique would be most applicable.

With only limited experience in plant breeding we feel that it is appropriate for us to apply fairly basic plant breeding principles and to identify and overcome problems sequentially rather than to adopt expensive technologies at the onset. Nevertheless, modern breeding methods cannot be overlooked and we will use tissue culture techniques to enable us to carry out *in vitro* culture and maturation of embryos, *in vitro* seed germination, and mutation breeding by means of gamma irradiation of plant tissue. These techniques will be used if and when the need arises. We believe that with this philosophy, and with well organised and committed breeding programs, there is a great potential in using plant breeding as a tool to improve many Australian native species for ornamental use.