BREEDING AND PROPAGATION OF *ALSTROEMERIA* FOR POTTED FLOWING PLANT PRODUCTION

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Alstroemerias are familiar to many as cut flowers or landscape plants. They have been domesticated and hybridized to produce a group of generally tall, herbaceous perennials often regarded as half-hardy or tender. The genus *Alstroemeria* is classified in the family *Alstroemeriaceae.* Uphof (4) described 62 species in the genus which consists entirely of plants native to the South American continent, specifically the countries of Argentina, Brazil, Bolivia, Chile, Ecuador, Paraguay, and Peru. Alstroemerias successfully exploit a wide variety of environmental conditions. Indigenous species are locally used for decoration as well as harvested for food, since dry, fleshy roots can be milled to produce flour.

Modern commercial cultivars of *Alstroemeria* are interspecific hybrids, containing genes from at least two species (1). Cultivars are usually propagated by rhizome division (2). The subterranean rhizome bears numerous buds which gives rise to both vegetative and reproductive shoots throughout the growing season. The rhizome also produces roots, some of which become swollen and develop into tuberous storage organs. A typical propagule consists of a rhizome segment containing shoot buds and possessing both fibrous and tuberous roots.

During 1986 a program to develop and produce alstroemerias for the potted plant industry was initiated. Collection of plants, hybridization, selection and propagation were identified as key components of the program. Plants and seeds, as foundation materials, were collected from both public and private sources A population of dwarf hybrids was obtained from a breeder in California, and several species were bought from commercial seedsmen. Seeds and plants of Chilean species were collected from natural populations. Seeds of Brazilian species were procured through a collaboration with Brazilian scientists. A list of species currently in our collection is presented in Table 1. The collection serves as a source of genetic variation for future improvement of alstroemeria hybrids and as a repository for conservation of germplasm.

Table 1. List of alstroemeria species procured for development program

Name	Source	Origin
A aurea (A aurantiaca)	P	Chile
A. caryophyllaea	P	Brazil
A diluta ssp. *chrysantha*	C	Chile
A magnifica	C	Chile
A. pelegrina	C	Chile
A. psittacina	P	Brazil
A pulchra	C	Chile
A. angustifolia ssp *angustifolia*	C	Chile
A. hookeri ssp *hookeri*	C	Chile
A ligtu ssp *simsii*	C	Chile
A paupercula	C	Chile
A revoluta	C	Chile

Legend P = Purchased from seedsmen, C = Collected

The breeding effort was directed at creation of plants with the following characteristics: a) dwarf habit, short flower stems, b) many flowers per stalk, c) many flowering stalks per plant, d) long-lived flowers, e) bright attractive color, f) year-round performance, g) predictable flowering, and, h) sterility or reduced seed set.

Fertilization is achieved by transfer of pollen from anther to stigma. In fertile crosses, 6 to 8 weeks is required for seed maturation. Seeds dehisce with a sharp 'crack', as the segments of the dry wall of the capsule explode. In the breeding program capsules are generally collected prior to dehiscence of seed. Plants in the hybrid population obtained from California were mostly cross and self fertile. Practically no seed was produced when such plants were crossed with the species or when crosses were interspecific.

A technique was developed for excision of ovules from developing capsules and subsequent in vitro culture of such ovules. The method was used successfully with a variety of parental lines. The overall efficiency in conversion of excised ovules to plants was between 2 and 5%. In general, four months of in vitro culture involving at least 2 culture cycles were required to complete plant formation.

Seeds produced as a result of the hybridization program were subjected to dry heat (32.2 °C) for 28 days. Heat treated seed were sown in a commercial Peat-Lite mix and placed in a greenhouse for germination. Seedling emergence was observed after 4 weeks and was generally complete after 8 weeks. Seedlings were transplanted to either 4 or 6 in. pots when at least three shoots were developed. Depending on time of year, 10 to 14 weeks after transplanting, the flowering plants were evaluated. Plants received 240 ppm N from a commercial 20-10-20 fertilizer. From a population of approximately 25,000 seedlings 20 individual plants were selected as suitable for pot plant production. These select individuals were

numbered and when large enough were divided to produce two plants. One plant was maintained in the breeding program for further hybridization and the other was retained as a stock plant for propagation.

Since large numbers of high quality, uniform plants will be required by finished product producers, we chose to develop a micropropagation method for *Alstroemeria*. Initially following leads from the literature (5), various explants such as leaf pieces, pedicel, peduncle, and stem segments were transferred to media enriched with various concentrations of cytokinins and auxins in factorial combinations. In one case out of over 500, a pedicel segment regenerated into a single shoot, which on further culture was observed to be incapable of rhizome formation. Callus growth was observed on some explants in some media but no adventitious rhizome buds were produced. The pursuit of adventitious regeneration was discontinued due to a lack of positive results and micropropagation through culture of totipotent buds was investigated (3). Rhizome tips were excised from vigorous greenhouse grown plants and sterilized by immersion in a 10% dilution of commercial bleach for 25 min. Buds on the rhizome were dissected out with the aid of a microscope, and transferred to test tubes containing medium gelled with agar. After approximately four months of culture, multiplication was observed. Explants, made up of a rhizome segment and 2 or 3 shoots, were induced to root by transfer to and culture on a medium containing indolebutyric acid. Plantlets were established in soil by transfer to a commercial Peat-Lite medium contained in plastic trays which were placed in a greenhouse equipped with a high pressure fog humidification system. After 2 weeks in fog, plantlets were transferred to ambient greenhouse conditions.

Two-year-old multiplying cultures of *Alstroemeria* are maintained in our laboratory and have regularly supplied plants for finished-pot production. No variations in the propagules have appeared to date Flowering was observed to be uniform within clones and no treatments were required for flower induction.

Although our experience is limited, it seems that alstroemerias appear to be ideal for exploitation as a potted flowering plant. There is a very large pool of variability in the genus and it is possible using current technology to overcome natural barriers to sexual reproduction. We are confident that we have only just begun to develop plants suited to the needs of the US market.

LITERATURE CITED

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