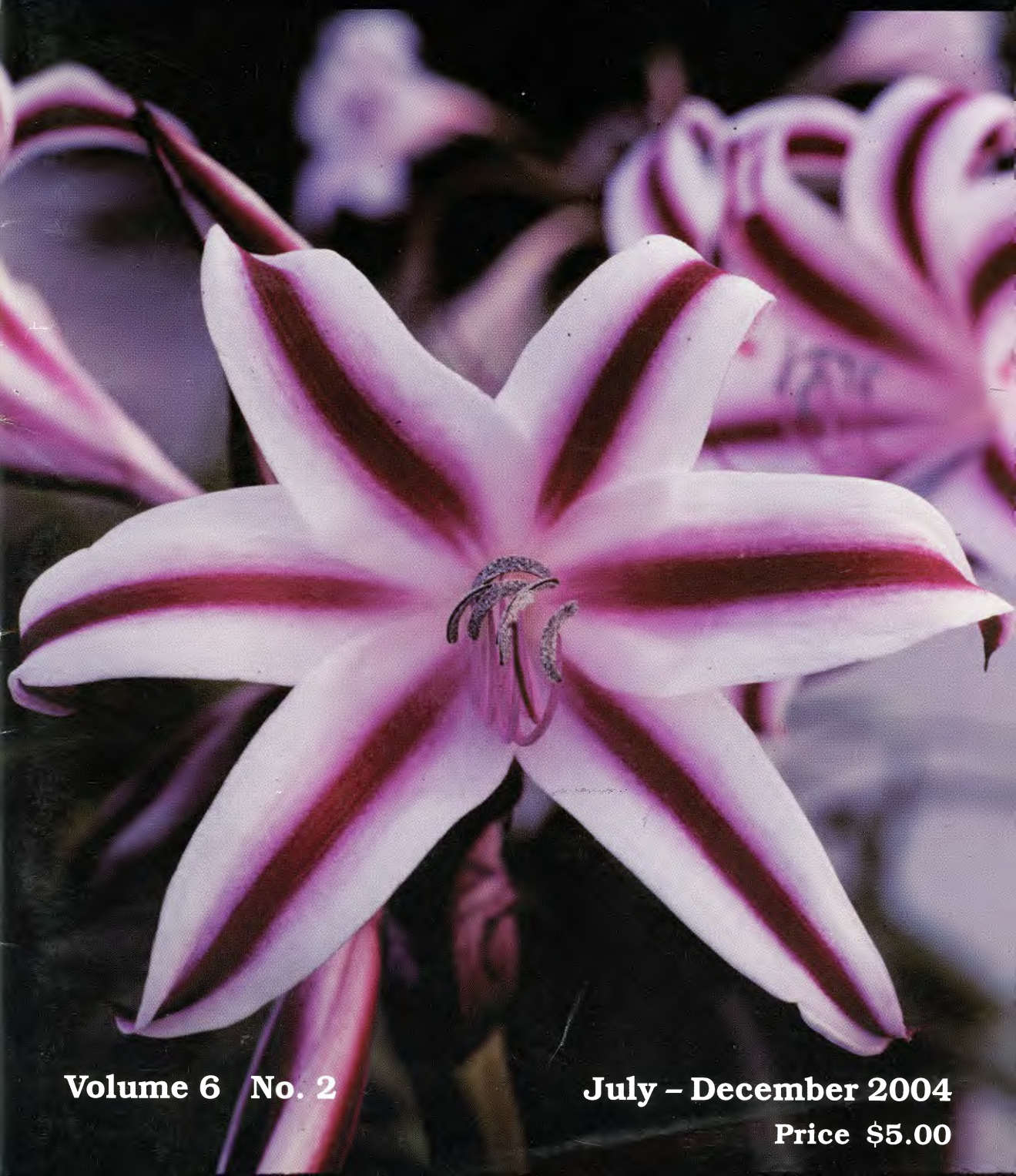
BULBS

Bulletin of the International Bulb Society



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International Bulb Society

Bulbs

The Bulletin of the International Bulb Society

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BULBS

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Crinum scabrum x *Crinum zeylanicum* 'Fancy Pants' by David J. Lehmiller, M.D.

First Words

Tony Palmer – Editor

It hardly seems five minutes since I was writing the last Editorial, but it is in fact too long ago as we are continuing to fall behind further with our publishing schedule. My apologies for that and my New Year's Resolution is to try and catch up somewhat over the next 12 months. Hope it doesn't go the way of so many well intentioned resolutions! One thing I am very pleased with is the continuing high standard of contributions I am receiving from some quite extraordinary people who are so passionate about bulbs, whether they earn their living from them or derive pleasure from them as their hobby, and who are achieving quite extraordinary results with breeding programmes or maintaining national plant collections.

We have examples of each in this issue. The beautiful cover picture is just one of Dave Lehmiller's wonderful collection of Crinums. His feature article, which is brim full of his own excellent illustrations, tells us about their hybridization, with insights into advanced Crinum hybrids. David Fenwick, who also needs no introduction to most of you and who now maintains several National Plant Collections in the UK incuding the one he is writing about this time – *Anomatheca* (now transferred into the genus *Freesia*). Some mouth-watering photographs of this underrated plant accompany his article.

Mark Bridgen and Eduardo Olate have written the other major article on *Alstroemeria* in Chile. Dr Bridgen is widely known for his breeding and research with *Alstroemeria*, and Dr Olate's current research includes plant tissue culture of native Chilean species with ornamental use, such as *Alstroemeria, Leucocoryne, Rhodophiala, Lapageria. Alstroemeria* cultivars have become very popular of late, so this is a subject of great interest.

Daryl Geoghegan from Australia tells us about his intriguing and successful recipe for growing many South African bulbs using 12 inch deep sand beds over clay. Proof of the pudding is in the pictures! The issue is rounded off with 3 book reviews. I hope you enjoy it and will be inspired to tell us about your own bulb ventures and experiences.

International trade in plant material

Just updating you on the current state of play in the issue of international trade in plant material. The latest I have heard from Joyce Fingerut, who co-ordinates the informal association now known as IHSEA - the International Horticulture Seed Exchange Advocacy which IBS belongs to, follows:

"The next step is that the International Plant Protection Organization (IPPC) will begin panel discussions with an eye to producing an International Standard for the movement of plants and seeds, based on NAPPO's Regional Standard ... probably sometime next year. These Standards do not have the force of law, but the signatory countries (http://www.fao.org/Legal/TREATIES/004s-e.htm) have agreed to bring their own legislation and regulations into compliance with Regional or International Standards. Thus, Canada, the US, and Mexico will be modifying their practices and regulations to refine and enact regulations regarding Clean Stock/Best Management Programs (see Implementation Plans, as mentioned above).

Because seeds are not produced by Seed Exchanges, but only handled by them, our societies would come under Best Management Programs. Arguably, our very seedex procedures and requirements constitute a Management Program. I have been asked, by the APHIS agent who was a US representative on the panel that drafted the Standard, whether IHSEA would be willing to pool its seedex procedures and its experiences and offer APHIS a protocol for "Best Management Practices."

For instance, the North American Rock Garden Society (NARGS) gives very specific instructions to its seed Donors, Intake Manager and Re-packagers regarding what is acceptable and/or required, in terms of seed cleanliness, identification and packaging. Having received seeds from other organizations, I am confidant that all IHSEA seedexes hold to equally high levels. A protocol produced by IHSEA would communicate that fact to regulators and Standard-writers, and give us our

first opportunity to have a voice in the formulation of future regulations."

In relation to the above Joyce has asked members to consider sharing of organizational seedex guidelines that could be combined into suggested Best Management Practices (we can all learn from each other's examples). The guidelines can be brief and summary, or detailed and specific. Also needed would be a few volunteers to discuss and help formulate the BMP – which would then be sent out to the members for comment and correction.

Watch this space! Hopefully the two sides are moving towards regulations which are effective but also contain a large measure of commonsense.

International regulations are only one of the things us poor bulb growers have to contend with. One of the other random factors to effect us is the weather and sadly a number of you suffered damage from the recent Northern Hemisphere hurricanes. Our thoughts are very much with you at times like that and our fingers are crossed for those of you in the Southern Hemisphere in the middle of the summer cyclone season there.

Take care and enjoy all the good things about bulb growing.

The following is a bit of advice from Mark Bridgen that I came across on the IBS forum. I thought it was worthwhile reprinting, and timely given his article on *Alstroemeria* in this issue:

Germinating *Alstroemeria* seeds is not always easy. If they are fresh seed, they will germinate faster. If not, try this:

1 Pour boiling water over the seeds.
This will help to crack the hard seed coat.

2 Leave the seeds in the water until it cools, and usually overnight.
Then, sow the seeds in typical warm conditions anywhere from 72-80F for 4 weeks.

3 If they have not germinated, put the moist seeds in the refrigerator for 4 weeks.
Keep them moist, but not wet.

4 Remove the seeds and return them to the warm conditions.
Remove seedlings as they germinate.

You may have problems with seed rot during this process. Also, due to the genetic variability, some seeds may germinate fast and some may be more recalcitrant. Be patient. As long as the seeds are firm, and not rotten, there is a chance that they will germinate.

Advanced *Crinum* Hybrids

David J. Lehmiller, M.D.

PHOTOS BY THE AUTHOR

Herbert (1837) in Amaryllidaceae provided the first definitive accounting of *Crinum* hybrids. He listed 23 interspecific (F-1) *Crinum* hybrids with which he was familiar, and his text included an additional 5 spontaneous hybrids of unknown or natural origin. Hybridization was one vehicle Herbert employed to define genera, and he apparently performed numerous crossing experiments during his lifetime. Regarding *Crinum* hybrids, he noted that some F-1 hybrids were seed sterile or rarely produced seed, whereas others were frequently seed fertile. He even commented upon the hybrid between *C. bulbispermum* and *C. pedunculatum*, noting that it was seed fertile, and that siblings (self pollinated) resembled the parent hybrid; but if the hybrid was pollinated with *C. bulbispermum*, then the progeny bore more resemblance to *C. bulbispermum*. Herbert thus recorded the first account of an F-1 backcross.

Although *Crinum* hybrids became commercially popular about the turn of the 20th Century and were disseminated throughout the tropics and subtropical territories, almost all commercial hybrids were F-1 hybrids or F-1 backcrosses. Unfortunately, seldom was the parentage accurately documented on many of these early commercial hybrids; open pollination in the garden was the norm, and many of the attributed parents were after-the-fact speculations. Likely a few F-2 hybrids surfaced over time, but the only detailed records of F-2 and complex hybrids ever published were provided by Howard (1980, 1982), and his accounts mostly pertained to his personal experiences. It was Howard who inspired me to commence hybridizing.

General notes on interspecific hybridizing

The object behind *Crinum* hybridizing is to produce a desirable product that does not exist in nature. Other than the novelty of being unique or different, hybrids can manifest beneficial properties that may be absent or poorly expressed in the parentage: hardiness, larger umbels, longer lasting flowers that do not droop, color enhancement, unique floral forms, greater scape yield per season, attractive or colorful leaf forms, disease resistance, etc. Also, it is possible to pursue specialty hybrids such as semi-dwarf hybrids (Figure 1.) and semi-aquatic hybrids.

FIGURE 1. Semi-dwarf F-1 hybrid: *Crinum baumii x C. lugardiae*

The yield from attempted hybrids is quite low, but it varies from species to species. I once tabulated the number of hybrids obtained over a six year period when utilizing *C. americanum* as the seed parent (Lehmiller 1992), and the number of actual hybrids from 686 attempted crosses was 15 or 2.3%. *Crinum moorei* is even more difficult to hybridize as seed parent than *C. americanum*, whereas *C. lugardiae*, *C. bulbispermum*, *C. variabile*, and *C. macowanii* are relatively easy as seed parents. Unfortunately some hybrid crosses yield imperfect seed that do not survive because of defective seed coats; these seed quickly succumb to bacterial rot at maturity. Other seed fail to germinate – but do not become impatient because sometimes seed can take as long as a year to germinate. I have yet to encounter a true species that "never" would accept cross (hybrid) pollination, although several (*C. jagus* and *C. campanulatum*) have yet to develop hybrid seed that have successfully germinated.

Hybrid seed are usually different in appearance from normal seed produced by the seed parent. You should be familiar with non hybrid seed, because unless you have absolute control over the fertilizing environment in your greenhouse, a stray cucumber

beetle, honey bee or hawk moth can sneak about undetected and ruin the experiment. Of course, if you are limited to garden bulbs, you must de-anther the buds prior to anthesis and protect the flower from moths and bees for several days. Enclosing the flower within a paper bag via a rubber band clutching the bag about the perianth tube works well. Often times, hybrid seed are much smaller than non hybrid seed; sometimes in the order of 3mm in diameter. When the seed are small, they should be protected from drying out until germination occurs. In this case, I seal them in airtight sandwich bags along with a few drops of water and place them where they receive direct morning sunlight until germination.

Interspecific F-1 hybrids generally produce bulbs with intermediate characters and usually demonstrate few noticeable differences in progeny resulting from the same hybrid cross. However, the results are not always predictable from the flower and leaf patterns of the parent bulbs. Sometimes a desirable feature appears in the hybrid which both parents lack: for example, both *C. forbesii* and *C. macowanii* have colorful flowers that droop early in the morning following anthesis, and *C. forbesii* has long perianth tubes, but the hybrid *C. forbesii* x *C. macowanii* has flowers with short sturdy perianth tubes that persist into the afternoon heat before drooping (Figure 2). Additional examples of F-1 hybrids are demonstrated in Figures 3-11. (Note: In all hybrid formulas presented, the seed parent in the cross is listed first and the pollen parent second.)

Not all F-1 hybrids yield beneficial or pleasing results. The beautiful pigmented coloration of *C. zeylanicum* all but disappears when it is crossed with *C. bulbispermum*.

Incorporating *C. americanum* into the cross often results in a hybrid that expends most of its energy producing offsets rather than scapes, and within a few years, one bulb becomes a maze of offsets. Sometimes (rarely) freaks are produced, such as bulbs that bear flowerless (barren) scapes or scapes with stunted malformed flowers.

Figure 2. Seed fertile F-1 hybrid: *Crinum forbesii x C. macowanii*

Most *Crinum* species possess $2n = 22$ chromosomes. One species, *C. distichum*, has $2n = 20$ chromosomes, and one species, *C. politifolium*, has $2n = 30$ chromo-somes. The number of chromosomes seems irrelevant regarding hybridizing though, as both *C. distichum* and *C. politifolium* readily cross with other species as well as with each other. On one occasion, we actually performed chromo-some counts, verifying

Figure 3. F-1 hybrid: *Crinum americanum x C. moorei* 'Pink Perfume'

Figure 4. F-1 hybrid: *Crinum paludosum x C. erubescens* 'Brighter Star'

Figure 5. F-1 hybrid: *Crinum rautanenianum x C. moorei* 'Patricia Hardy'

Figure 6. F-1 hybrid: *Crinum paludosum* x *C. kirkii*

Figure 7. F-1 hybrid: *Crinum politifolium* x *C. lugardiae*

FIGURE 8. F-1 hybrid: *Crinum lugardiae* x *C. scabrum* 'Peppermint Candy II'

FIGURE 9. F-1 hybrid: *Crinum flaccidum* x *C. americanum* 'Lil' Stinker'

FIGURE 10. F-1 hybrid: *Crinum asiaticum* x *C. moorei* 'Sal Gal'

FIGURE 11. F-1 hybrid: *Crinum scabrum* x *C. asiaticum* 'Exotica'

that *C. politifolium* had $2n = 30$ chromosomes and *C. moorei* had $2n = 22$ chromosomes, and that the hybrid *C. politifolium* x *C. moorei* had $2n = 26$ chromosomes (Lehmiller, 1992). There are reports of polyploidy in *Crinum*, but scant documentation exists about the occurrence of polyploidy in man-made *Crinum* hybrids.

Several observations of note regarding F-1 hybrids and backcrosses:

1) To obtain hybrids with diffuse dark pink or rose colored petals, *C. moorei* must be in the pedigree (Figure 12).
2) Hybrids of *C. moorei*, *C. fimbriatulum*, and *C. mauritianum* produce long scapes (Figure 13.)
3) Hybrids of *C. kirkii* are prone to exhibit pseudocarpy.
4) Hybrids of *C. macowanii* seldom make offsets.
5) Hybrids of *C. americanum*, *C. erubescens*, and *C. oliganthum* usually multiply rapidly via offsets, except when crossed with *C. macowanii*.
6) Hybrids of *C. macowanii* flower early in the spring, with scapes appearing just as the leaves emerge if the bulbs have been in dry dormancy.
7) Interspecific hybrids between species of Subgenus *Crinum* and Subgenus *Codonocrinum* are almost universally seed sterile (but not pollen sterile).

FIGURE 12. Diffuse dark-rose-colored hybrid: [*Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*)] x *C. moorei* 'Red Cloud'

FIGURE 13. Long scape F-1 hybrid: *Crinum variabile* x *C. moorei* 'Peyton's Place'

FIGURE 14. *Crinum bulbispermum* x (*C. forbesii* x *C. macowanii*)

FIGURE 15. (*Crinum forbesii* x *C. macowanii*) x *C. acaule*

FIGURE 16. *Crinum politifolium* x (*C. forbesii* x *C. macowanii*)

Complex hybrids

To make a hybrid is not difficult. Pollen from F-1 hybrids is almost always fertile, so simply fertilize an unrelated species with pollen from an F-1 hybrid and hope for success. If you are fortunate enough to make or acquire a seed fertile F-1 hybrid, then that route is also available. Several examples of hybrids involving the F-1 hybrid in Figure 1 are illustrated (Figures 14, 15, 16). There are several F-1 hybrids which rarely function as successful seed parents, such as *C. bulbispermum* x *C. lugardiae* or *C. bulbispermum* x *C. moorei*, but consider yourself fortunate when you accomplish such a feat.

There are several ways to produce complex hybrids:

1) Make an F-1 backcross — backcross progeny are frequently seed fertile. An example of a seed fertile backcross is *C. bulbispermum* x (*C. moorei* x *C. bulbispermum*) (Figure 17.). Then utilize the backcross as seed parent and cross with pollen from an unrelated species or another F-1 hybrid. Almost all pollen from F-1 hybrids is fertile.
2) Begin with a seed fertile F-1 hybrid such as *C. macowanii* x *C. paludosum*, *C. forbesii* x *C. macowanii*, or *C. bulbispermum* x *C. paludosum* – and cross it with pollen from an unrelated hybrid (Figure 18.).
3) Cross a species with pollen from an unrelated hybrid, yielding a hybrid. Frequently hybrids are seed fertile and can be used to make complex hybrids or can be pollen donors; *C. carolo-schmidtii* x

FIGURE 17. F-1 backcross: *Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*) 'Norma Justine'

FIGURE 18. Complex hybrid: (*Crinum forbesii* x *C. macowanii*) x 'Circus'. (Note: 'Circus' is a T.M. Howard hybrid derived from 'Carnival' x 'White Queen')

FIGURE 19. Seed fertile hybrid *Crinum carolo-schmidtii* x (*C. americanum* x *C. macowanii*)

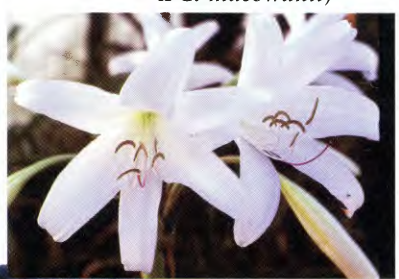

FIGURE 20. Flower detail of hybrid in Figure 19.

FIGURE 21. Complex hybrid involving hybrid in Figures 19 and 20: [(*Crinum forbesii* x *C. macowanii*) x *C. flaccidum*] x [*C. carolo-schmidtii* x (*C. americanum* x *C. macowanii*)]

FIGURE 22. Complex hybrid offspring grown from seed originating from the same fruit: [*Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*)] x *C. paludosum*

FIGURE 23. Complex hybrid from same hybrid fruit as Figure 24: {[*Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*)] x *C. paludosum*} x {*C. forbesii* x *C. macowanii*}

FIGURE 25. Complex hybrid: {A x B} x {C} (cv. 'Five Star')

(*C. americanum* x *C. macowanii*) is an example of a seed fertile hybrid (Figures 19, 20, 21).

The results of complex hybridizing experiments are not predictable. Oftentimes all progeny of a hybrid from the same fruit will appear similar, and if the experiment is repeated at a later date utilizing the exact same parent bulbs, the resultant progeny will often appear similar to the original cross. Any differences are usually noted in floral pigmentation. However, substitute into the hybrid equation an identical species but one collected from a distant locality, and the "same" hybrid may be somewhat or even strikingly different. In contrast, seeds from the same fruit of a complex hybrid usually yield vastly different progeny, especially in the floral form and floral pigmentation (Figures 22, 23, 24).

FIGURE 24. Same complex hybrid as Figure 23 but from a different seed

So the question arises: What is the ultimate goal in hybridizing? I don't have a good answer. It is just plain fun, and perhaps it is addictive. When you mix together the ingredients to produce a complex hybrid, you cannot even speculate about the outcome. The results always come as a complete surprise. For example: the following complex hybrid has the formula {A x B} x {C} with the former as seed parent. The ingredients are:

A = [*C. bulbispermum* x (*C. moorei* x *C. bulbispermum*)] — pink flowers (Figure 17.)

B = [*C. graminicola*] — dark pinkish purple striped flowers

C = [*C. rautanenianum* x *C. moorei*] — light pinkish flowers (Figure 11.)

The resultant complex hybrid has large, beautiful, pure white flowers (Figure 25.), something totally unexpected. I am fortunate to have acquired a large collection of species, including several recent ones with unusual floral forms – so I have new ingredients to add to the pot, and who knows what might come forth. Perhaps someday there will be a double-flower *Crinum* hybrid.

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Alstroemeria of Chile

Mark P. Bridgen & Eduardo A. Olate

ALL PHOTOS BY THE AUTHORS

Introduction

Commercial cultivars of *Alstroemeria,* also known as the Lily-of-the-Incas, Peruvian Lily, or Inca Lily, began to gain popularity in the 1970's, primarily as a cut flower crop. In recent years, hybrid cultivars have been grown as garden flowers and as potted flowering plants. The plants produce beautiful, large inflorescences of many different colors including purple, lavender, red, rose, pink, yellow, peach, orange, white and bicolors. In addition to their showy colors, the cut flowers have long postharvest vase lives up to 2-3 weeks. When commercial *Alstroemeria* hybrids are grown properly, the plants have an everblooming flower habit. New flowering stems are continuously produced from underground rhizomes after the requirements for flower initiation have been met. All of these valuable characteristics have made hybrid *Alstroemeria* very popular.

Native species of *Alstroemeria* exist in several South American countries including Chile, Brazil, Peru, and Argentina with the greatest diversity of species existing in Chile. These Chilean species are indigenous to a variety of habitats including the snowline of the Andes Mountains, coastlines of the Pacific Ocean, highland and temperate forests, and the Atacama Desert. Despite their rich diversity, the native species are of little commercial value because many of the plants go dormant for part of the year, the flowers are often small and insignificant, and the postharvest life is not always optimal.

Chile is located in the southwest corner of the South American continent and bordered by Peru to the north, Bolivia and Argentina to the east, the South Pole to the south and the Pacific Ocean to the west. Chile is a very long (4,200 km) and narrow country; nearly as long as the USA is wide. At its widest point, this diverse country is only about 240 km. The climates of Chile are very diverse: the northern part of Chile has the hot, dry Atacama Desert, the central part has Mediterranean-like weather, the southern part of Chile is cool and moist, and the most southern region is bitter cold. With oceans on the western and southern sides, the Andes Mountains reaching as high as 6,500 meters to the east, and a desert to the north, Chile evolved as an isolated botanical wonder with tremendous genetic diversity. Chile's geographical isolation has permitted the development of unique genera that do not exist anywhere else in the world.

The genus *Alstroemeria*

The genus *Alstroemeria* was first described by R.P. Louis Feuillet in 1714, but was named by Carolus Linnaeus in honor of Klas von Alströemer who took the first seeds from South America to Europe. The genus belongs to the subclass Monocotyledonae (monocots) and is a petaloid monocot in the superorder Liliflorae. In earlier years, *Alstroemeria* belonged to the Amaryllidaceae and Liliaceae families; however, now it is in the Alstroemeriaceae. The Alstroemeriaceae family includes two other genera, *Bomarea* and *Leontochir*. Some botanists consider *Schickendantzia* and *Taltalia* as different genera in Alstroemeriaceae, but the most recent taxonomic information considers these to be members of the genus *Alstroemeria* (Sanso and Xifreda, 2001).

Alstroemeria are herbaceous, geophytic plants that produce two types of shoots: floral and vegetative. Shoots are initiated on subterranean rhizomes that can grow as long as 120 cm (4 feet) or as short as 15 cm (6 inches). A fibrous root system develops from the *Alstroemeria* rhizome and the roots can become thickened storage roots as the plant develops giving the incorrect impression of a tuberous root. Leaves on the shoots are called resupinate because their leaf base twists 180° so the top surface (adaxial surface) faces down.

Flowers of *Alstroemeria* are irregular shaped (zygomorphic) with inferior ovaries; flowers arise in a terminal bracted umbel of cymes. Each cyme bears one to five sympodially arranged flower buds. The

perianth consists of six uniform tepals that open simultaneously. Mature blooms are funnel-shaped with their tepal tips curling outward. The sexual parts of the flower are dichogamous with the stamens opening and shedding their pollen before the stigma becomes receptive. The dichogamy is so pronounced that the age of the flower can be predicted by observing this phenomenon.

Alstroemeria species of Chile

The most recent taxonomic report for *Alstroemeria* indicates that there are approximately 33 species throughout Chile with 8 subspecies and 8 varieties (Muñoz and Moreira, 2000). The species are distributed throughout the county between 20° and 53° south latitude. However, the greatest diversity is concentrated in the central part of the country, which has a Mediterranean climate, between 28° and 37° south latitude.

Alstroemeria aurea

FIGURE 1. *Alstroemeria aurea* Graham.
A. Orange form with seed pods.
B. Yellow form.

Alstroemeria aurea Graham (Figure 1) is one of the most common *Alstroemeria* species found in the forests of southern Chile. The flowering stems and vegetative shoots are often 90-120 cm (approximately 3-4 feet) in length. Flowers are small (2.5-4 cm wide) with yellow, orange, and orange-red colors. *A. aurea* is one of the easiest of the *Alstroemeria* species to cultivate and can be found in many gardens in regions where they can tolerate cold (as cold as USDA zone 5). The original name for this species was *A. aurantiaca*.

Alstroemeria pelegrina

FIGURE 2. *Alstroemeria peregrina* L.
A. Common pink form
B. Rare white form
(A. pelegrina alba)

Alstroemeria pelegrina L. (Figure 2) is a very showy *Alstroemeria* that is found along the coast in central Chile north of Santiago (32° S). Plants can reach 60 cm (2 feet) in height and have large and showy flowers 5-7.5 cm (2-3 inches) wide. Flowers are typically bright pink, but there is a rare white-flowered form (Fig 2B). The leaves of this species are especially waxy probably due to the harsh ocean environment in which they live. This species was commonly used by the first breeders of hybrid *Alstroemeria* because of the ease of seed set. It is endangered because of development in locations where it naturally exists. *A. pelegrina* is especially tolerant to salt water and could be used to breed salt-tolerance into hybrids.

Alstroemeria werdemannii

A. werdemannii Bayer (Figure 3) is a desert species that grows well in very sandy soils along the coastal areas of northern Chile. This species has short internodes with fleshy, waxy leaves that are blue-green colored. Shoots are erect, not decumbent and plants are

FIGURE 3.
***Alstroemeria werdemannii* growing in the Atacama Desert, Chile.**
A. *Alstroemeria werdemannii* var. *werdemannii*

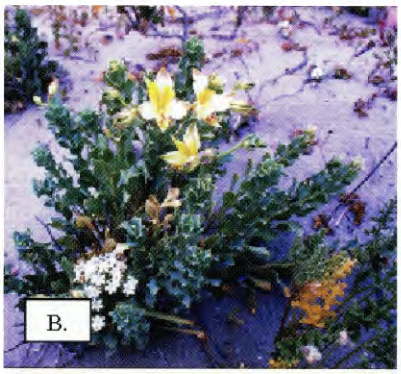

FIGURE 3.
***Alstroemeria werdemannii* growing in the Atacama Desert, Chile**
B. *Alstroemeria werdemannii* var. *flavicans.*

short (40 cm). Flowers are smallish approximately 2.5-3.0 cm wide (1 inch). Flowers of *A. werdemannii* Bayer var. *werdemannii* are pink (Figure 3A) and flowers of *A. werdemannii* var. *flavicans* M. Muñoz are yellow (Figure 3B). This species has very extensive root systems due to the harsh, dry environment in which it exists. *A. werdemannii* has a restricted distribution in its native habitat.

Alstroemeria ligtu

A. ligtu L. (Figure 4) was previously known as *A. haemantha* R. This species of *Alstroemeria* is widely distributed in Chile from Valparaiso in the north to Concepcion in the south and from the coastal regions in the west to the Andes Mountains in the east. *A. ligtu* grows tall to a maximum of 150 cm tall (60 inches); its long stem length makes it a good native cut flower. However, its foliage is linear and can be unattractive; by the time the plants flower, most of the stems have minimal attractive leaves present. Flowers of *A. ligtu* L. are not as open as most other *Alstroemeria* species and the tepals are more linear. Flowers from this species are small but colorful in pastel colors of dark orange, red, pink and white. *A. ligtu* tolerates a broader range of temperatures for successful growth and blooms in the middle of the summer.

FIGURE 4. *Alstroemeria ligtu*

Alstroemeria pulchra

A. pulchra Sims (Figure 5) is one of the most common *Alstroemeria* species in central Chile and is not endangered. This species grows in a wide range of Chilean environments from the ocean to the desert to the mountains. Plants are very vigorous and grow well in stony soils in full sun. Stems are as long as 100 cm (40 inches) in length. Flowers bloom in the spring with colors ranging from pink to pale pink to almost white. Seeds set well on these plants. *A. pulchra* looks very similar to *A. magnifica* and it can be difficult to distinguish the two species apart.

FIGURE 5.
Alstroemeria pulchra

Alstroemeria magnifica

A. magnifica Herbert (Figure 6) is often confused with *A. pulchra*. *A. magnifica* grows in the La Serena region of Chile along the coast in rocky regions and shares a habitat with *A. pulchra*. Natural interspecific hybridization probably occurs between the two species, which adds to the difficulty identifying the plants. *A. magnifica* has the largest and showiest flowers of the genus, approximately 8-10 cm wide (3-4 inches). Flower stems are often very long and are commonly supported by some other

FIGURE 6.
Alstroemeria magnifica

vegetation. Leaves on the flowering stems are scarce. Flowers are shades of purple, from pale lavendar to dark purple.

Alstroemeria pseudospathulata

A. pseudospathulata Bayer (Figure 7) is a very

FIGURE 7. ***Alstroemeria pseudospathulata***

short *Alstroemeria* that only grows up to 30 cm tall (12 inches). This species grows in a very restricted area of Chile and is endangered. *A. pseudospathulata* thrives in full sun in rocky soils very high in the Andes Mountains as far as 2,000 meters above sea level. The foliage of *A. pseudospathulata* is very thick and a bluish green color. The plants flower in the summer and have brilliant yellow flowers. Although *A. pseudospathulata* plants are much smaller than *A. aurea* plants, they have similar sized flowers. *A. pseudospathulata* are good alpine plants and very winter hardy.

Alstroemeria presliana

A. presliana (Figure 8) is another species that grows in high altitudes approximately 1,500-2,000

FIGURE 8. ***Alstroemeria presliana***

meters above sea level. They can be found in the Los Andes mountain range or the coastal mountain range. The plants flower in the summer with small, pink/lavender flowers that have 2-6 florets per umbel. The foliage of *A. presliana* is sessile and linear and plants reach a height of no more than 40 cm (16 inches).

Breeding *Alstroemeria*

The diverse and colorful genera of *Alstroemeria* create a tremendous potential for the breeding of new hybrids. Their protandrous flowers prevent self pollinations and naturally encourages cross pollinations. Our breeding work since 1987 has demonstrated that *in vitro* embryo rescue is often needed for interspecific hybridization to be successful. The protocol that we use is relatively easy. *In ovulo* embryos can be aseptically removed from hybrid ovaries approximately 7-20 days after pollination. They should be aseptically cultured on ¼ strength Murashige and Skoog (MS) salts and vitamins (1962) with no growth regulators and placed in the dark at 18°C until germination.

FIGURE 9.
Alstroemeria cultivars.
A. 'FreedomP' B. 'Sweet LauraP'
C. 'Mauve MajestyP' D. 'LibertyP'

Germination may occur quickly, or it may take several months. After germination, seedlings can be subcultured onto full strength MS medium with 2 mg benzylaminopurine (BA) per liter and no agar until they reach a suitable size to be removed from culture. This protocol can also be used to obtain sterile triploids and tetraploids (2n = 4x = 32) (Lu and Bridgen, 1997). Cultivars that have been introduced from this breeding program include 'Freedom[P]', 'Liberty[P]', and the only fragrant cultivar in the world, 'Sweet Laura[P]'. The newest, winter-hardy cultivar to be introduced in 2006 is 'Mauve Majesty[P]' (Figure 9). Our breeding program with

Alstroemeria has been successful during the past 18 years because of the generous funding by the American Floral Endowment, the Gloeckner Foundation, and Cornell University.

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Table 1.

Species of *Alstroemeria* in Chile

A. achirae
A. andina
  A. andina venustula
A. angustifolia
  A. angustifolia velutina
A. aurea
A. crispata
A. cummingiana

A. diluta
A. diluta diluta
A. diluta chrysantha
A. exerens
A. garaventae
A. graminea
A. hookeri
A. hookeri maculata
A. hookeri recumbens
A. kingii
A. leporina
A. ligtu
A. ligtu incarnata
A. ligtu simsii
A. lutea
A. magnifica
A. magnifica magenta
A. magnifica sierrae
A. magnifica tofoensis
A. mollensis
A. pallida
A. patagonia
A. pelegrina
A. pelegrina alba
A. philippii
A. philippii albicans
A. polyphylla
A. presliana
A. presliana australis
A. pseudospathulata
A. pulchra
A. pulchra lavandulacea
A. pulchra maxima
A. revoluta
A. schizanthoides
A. schizanthoides alba
A. spathulata
A. umbellata
A. versicolor
A. violacea
A. werdermannii
A. werdermannii flavicans
A. werdermannii werdermannii
A. zoellneri

Mark Bridgen

Dr. Mark Bridgen is a Professor of Horticulture at Cornell University and serves as Director of the Long Island Horticultural Research and Extension Center. Dr. Bridgen's areas of expertise include floriculture and ornamental horticulture, plant propagation, herbaceous ornamental plants, and plant tissue culture and micropropagation. Dr. Bridgen has received several awards during his 21 years in academics; he was chosen as a Fulbright Fellow in 1999 and has also received the Excellence in Teaching Award and the Faculty Adviser Award. Mark has published more than 130 publications and is widely known for his breeding and research with *Alstroemeria*, the Lily-of-the-Incas. Dr. Bridgen's breeding research focuses on the geophytes of Chile and now includes projects with *Leucocoryne, Rhodophiala, Conanthera*, and *Zephyra.*

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Eduardo A. Olate

Dr. Eduardo A. Olate is an Assistant Professor in the Department of Plant Science at the Pontificia Universidad Catolica de Chile. His current research includes plant tissue culture on native Chilean species with ornamental use, such as *Alstroemeria, Leucocoryne, Rhodophiala, Lapageria*, and others. Dr. Olate teaches graduate classes in Plant Tissue Culture and Plant Biotechnology. He teaches undergraduate classes in Commercial Production of Cut Flowers and Ornamentals, Plant Propagation, and Greenhouse Design and Management. Eduardo was a graduate student under the guidance of Mark Bridgen; the two of them have traveled throughout Chile extensively to study the native flora.

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NCCPG National Plant Collection® of Freesia *(Anomatheca)*

By David Fenwick

Freesia (*Anomatheca* Group) Transferred to *Freesia* from *Anomatheca* by Dr. Peter Goldblatt

I first discovered these plants about ten years ago and just shortly after I started collecting *Crocosmia*. Over the next couple of years I obtained six plants. These were *Freesia laxa*, *Freesia laxa* ssp. *azurea*, *Freesia laxa* 'Alba' *Freesia laxa* 'Joan Evans', *Freesia viridis* and *Freesia grandiflora*; all of which, with the exception of *Freesia grandiflora,* were what I thought were winter rainfall species in South Africa. However this was far from true and I later discovered that *Freesia laxa* comes from both winter and summer rainfall areas.

Originally all the *laxa* types were grown under cover as winter rainfall species. All flowered here during Chelsea Week in May with the exception of F. *l.* subsp. *azurea* which flowers a little earlier. I discovered their suitability as summer flowering bulbs on sowing a little seed in the middle of January one year, as this is the time I usually start sowing all sorts of bulb seed. Rather amazingly to me at that time, I discovered they only took six months from sowing to flowering. This intrigued me so I decided to look at them in a little more detail as it was obvious that they had far more horticultural value than I first thought.

On researching them more I discovered that they were very closely related to another genus I was collecting and researching, namely *Crocosmia*. One question had stuck in my mind for ages – could *Freesia laxa* be used to discover how and why so many different *Crocosmia* hybrids were bred in such a short space of time in the late 19th Century?

Victor Lemoine of Nancy, France was responsible for breeding the common montbretia, *Crocosmia* x *crocosmiiflora* around 1879 – a cross between *Crocosmia aurea* and *Crocosmia pottsii*, then called Montbretia. Lemoine went on to breed a further 55 hybrids until 1908, although most were bred before 1900.

Anomatheca would make a good study as this group had not really been hybridised before and the only problem I would have if I were to compare *Anomatheca* breeding to *Crocosmia* breeding, is in making an inter-specific hybrid, or in "finding one". I've always thought myself a lucky person and whilst crossing *F. grandiflora* with *F. laxa* I also decided to attempt a cross of *F. laxa* subsp. *azurea* with a plant I obtained as *Lapeirousia* 'Naticoke'. The former never produced any seed at all, but the latter did. I then had to find out more about *Lapeirousia* 'Naticoke'.

'Naticoke' came to me from the Reed's Garden in East Devon, UK; the only information passed to me at that time was that it was an American hybrid. I have never since found out any more information about this hybrid, even on joining the IBS several years ago. However I am now nearly 100% certain

***Freesia* 'Shelley'**

that because of the expected behaviour of its progeny in breeding. 'Naticoke' is indeed *Freesia laxa* x *Freesia grandiflora*,

The first cross between *F. laxa* subsp. *azurea* and 'Naticoke' gave rise to a very distinct hybrid, *F.* 'Plum Scrumptious', named for its very deep plum coloured central markings. The most recognisable feature of this plant however, is that the ground colour is white but becomes suffused with pink and lilac towards the end of its segments.

My very first attempt at *Anomatheca* breeding was in crossing *F. laxa* with *F. l.* 'Alba' to try and achieve a pure pink, as one would expect to get a pink by crossing a red flower with a white one. The normal colour of the progeny of this cross is white with red central markings. In the UK these are represented by the form *F. l.* 'Joan Evans'. However one percent of this cross did turn out pink and one of these was selected, grown on, and later named *F. l.* 'Sunset Boulevard'. This hybrid was subsequently used in crossings with 'Plum Scrumptious', and has recently produced a uniformly coloured lilac *laxa* type hybrid, which I have named 'East of Eden'.

The latest hybrid of merit to be selected is *F.* 'Shelly'. This came as quite a shock as it arose after selfing 'East of Eden' – a shock for I have found *F. laxa* hybrids usually come fairly true from seed if selfed. Thus different rules do apply after an interspecific has been produced and backcrosses are thus more likely to vary. This was the information I was looking for regarding early *Crocosmia* production and the reason why Lemoine produced so many hybrids in such a short space of time.

***Freesia laxa* 'Joan Evans'**

Plant Listing

Freesia laxa syn. *Lapeirousia cruenta* and *Anomatheca laxa*

Variable in colour in the wild with salmons, pinks, whites and reds occuring naturally. These also naturalise and will produce plants similar to the hybrid below, 'Joan Evans'. The species occur both in the summer and winter rainfall areas of South Africa. Thus in the northern hemisphere the species can be grown under glass for flowering in May or in the garden for flowering from late June. This species can also be grown as an annual as it can flower from seed in just 5-6 months. Because of this it is now being grow commercially in large amounts and is frequently seen offered in Garden Centres in the UK. But it is also grown in colder climates, and in places such as Canada, as an annual. Here I let it seed and naturalise itself throughout the garden.

Freesia laxa 'Joan Evans'

White with red markings, this is a hybrid of *F. laxa* with *laxa* 'Alba'; this plant is also circulating erroneously as *Anomatheca divaricata*, which is non-legit, and the implied *Laperousia divaricata* is completely different. If selfed and grown from seed, plants produced are variable in marking, and the red markings can be smaller and less pronounced.

Freesia laxa subsp. *azurea*

A pale lilac blue form which flowers earlier, but is slightly weaker than the rest for some reason. Best treated as a greenhouse plant in the UK as it is less hardy than *F. laxa*.

Freesia laxa 'Alba'

Pure white form of the species with no markings. For me here I consider it less hardy than *F. laxa*.

Freesia laxa (cream form)

Bred by Phil Waterman, Plymouth, Devon, UK. Cream form of the species without markings.

Freesia laxa 'Rainbow Hybrids'

Bred by Don Rix, Pine Heights Hippy's, Queensland, Australia. Shorter plants than the UK strain but these don't bleach much in the sun. Colours range from plants like 'Joan Evans' to a really nice pale pink. Recommended garden plant for climates a little warmer than mine.

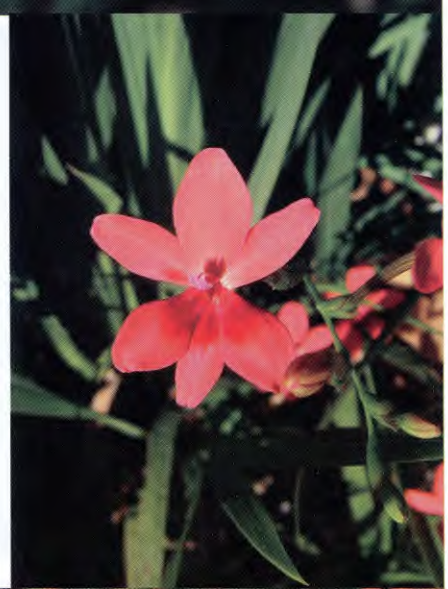
Freesia laxa 'Sunset Boulevard'

Bred by myself. A pure pink form of *laxa*, bred here by crossing *Freesia laxa* with *F. l.* 'Joan Evans'. As hardy as *laxa* here.

***Freesia laxa* 'Star of David'**

Freesia laxa 'Sunset Giant Pink'

Bred by collection holder. Sadly now lost but this was another cross from *Freesia laxa* with *F. l.* 'Joan Evans', but has to be mentioned here for the plant was over 2 feet tall.



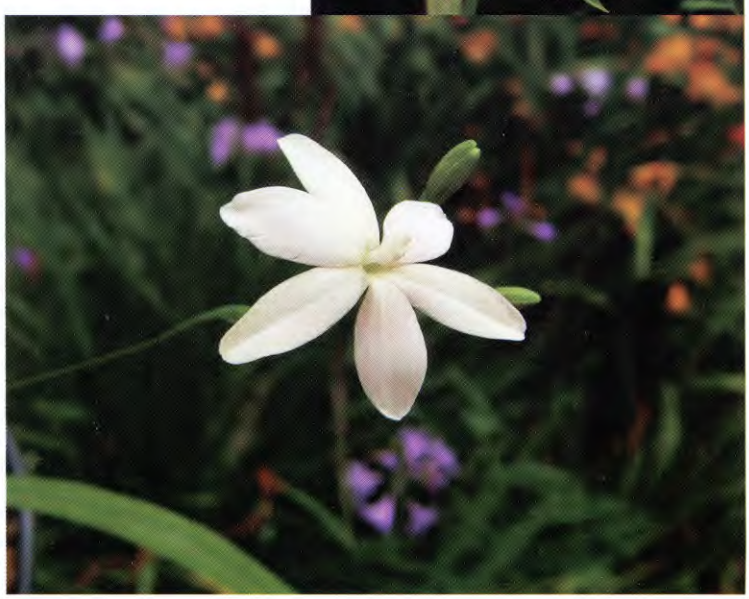
Freesia laxa

Freesia laxa 'Star of David'

A hybrid 'found' in the garden here, I also frequently see it being offered elsewhere as *Freesia*. or *Anomatheca laxa*. It is a pinky red form of *laxa*. A dwarfer plant with starry, bi-symmetrical flowers. It is also quite hardy here.

Freesia laxa x *grandiflora* 'Naticoke'

Origin Unknown. Potentially an inter-specific hybrid between *F. laxa* and *F. grandiflora.* It has intermediate features from both parents. Early to flower, and at the same time as *Freesia laxa* subsp. *azurea*. Flowers, of a pinky-lilac with deep purple markings.



***Freesia laxa* 'Alba'**

***Freesia laxa* 'Sunset Boulevard'**

***Freesia laxa* 'Shelley'**

***Freesia* 'East of Eden'**

Freesia (*laxa* x *grandiflora*) x *laxa* 'Plum Scrumptious'

Bred by collection holder. Bred here of 'Naticoke' and *Freesia laxa* subsp. *azurea* parentage. A white with pink tips with plum markings.

Freesia ((*laxa* x *grandiflora*) x *laxa* 'Plum Scrumptious') x *laxa* 'East of Eden'

Bred by myself. A completely new colour for a *F. laxa* backcross. Lilac flowers, bred here three years ago.

Freesia laxa 'Shelly' (*F.* 'East of Eden' x *F.* 'East of Eden')

Bred by myself. A very large white, probably the largest flowered *Anomatheca*, with rose markings. Named after a friend of the family, Shelly Driscoll, a very large, single lady who readily blushes.

Freesia viridis

A winter rainfall species producing larger much rounder corms than *F. laxa*, and bearing spidery yellowy-green flowers in late spring.

Freesia viridis var. *crispa*

Very similar to the above but with undulating leaf margins.

Freesia grandiflora

The only summer rainfall species of the *Anomatheca* Group, producing larger red flowers about the size of a two pence piece. Flowers in July here.

Sand/Clay – The preferred medium?

By Daryl Geoghegan

ALL PHOTOS BY THE AUTHOR

I remember my excitement when I discovered the Amaryllids of South Africa. Like many gardeners in my country, very few of us knew of these strap leafed plants with big colourful blooms. My first seeds to arrive from South Africa were *Brunsvigia gregaria*. I was experimenting at the time with growing seeds and bulbs under lights in boxes of pure sand as I had read that the less vegetative matter in the soil the less chance of disease and rot. This seed germinated rapidly producing a leaf and roots.

After babying these seeds, checking them 4 times a day and reading more on the subject, I was hooked! That was 9 and 1/2 years ago and many 1000's of seeds have since been germinated under my care.

As bulbs are nature's adaptation to poor soils, the main focus for success in growing amaryllidaceous bulbs was a concentrated effort to figure out in what type of soil these bulbs will grow and flower well. I have read many folks explanations of what soil PH to have, what fertilizers to use, and how much sun/shade, etc. to provide. It can be stated that the really gifted growers/collectors understand what is needed to obtain excellent results from any collection. That is, they understand the plants requirements. This is fundamental for keeping your collection not only alive, but thriving. This enables you to produce seeds and offsets to expand and disseminate your collection.

During the last two years my wife and I obtained a small 3.5 acre property at Barnawartha, in the state of Victoria, Australia. When I first looked at the property I had no idea of the soil content and reasoned that I would buy in the soil needed to cultivate the bulbs here. As our land is on the flats, our horizon is unobstructed and our sunlight intensity is far greater than my previous block in town. I had the entire collection in pots but wanted to get it into the ground ASAP as the sun was boiling the bulbs in the black pots. I dug beds in the paddock after softening the soil, and to my surprise the soil was a sandy/clay with a very high percolation rate (how fast the water runs through the soil), yet it was dense and hard as a rock, not soft at all until it was watered.

I planted all of my bulbs straight into the paddock in full sun, watering every three days during the summer months. The bulbs grew the best I had ever seen them grow. Root and leaf growth was at least 3–4 times faster than before and it has been a great delight to see the bulbs do so well in the paddock soil. I have since found out that this property was a dairy farm 120 years ago and has


Bulbinella triquetra


Lachenalia orthopetala


Moraea polystachya

been grazed over from then until now. Our climatic conditions (wet/freezing winters and hot/dry baking summers) are the toughest I have ever grown bulbs in and they love it! It has become clear to me that I had not really experienced excellent cultivation in town using the methods I was using. In reality, I was dreaming. At this new place the majority of my bulbs are in the same soil, same position and get the same amount of water. Included in the bulbs that I grow in the open are *Crinum* species, *Boophone*, *Ammocharis*, *Nerine*, *Hippeastrum* and rainlilies. Accompanying bulbs like *Eucomis*, *Iris*, *Alstromeria* and *Lilium* also do well in the full sun.

My winter growing collection is in pure sand on clay. The sand is at least 30cm (12 inches) deep and all the winter growers rest on a bed of clay. Many species love this type of cultivation. *Haemanthus*, *Gethyllis*, *Hessea*, *Strumaria* and *Brunsvigia* species that come from winter growing climates have responded very well to deep sand cultivation. Although the sand is deep, some consideration is needed to figure out the amount of summer water required. If the sand is too deep, many of the bulbs will perish in my area due to the extreme summer heat which dries up the soil too much. This is where the clay comes into action. As the sand dries, it maintains a dry area around the bulbs, whilst the clay enables the bulbs to obtain some moisture during the dormant period. I have dug up the bulbs during this period to discover that the roots have firmly grown into the clay below, anchoring the bulb and sustaining them too. This season I have planted corn over the bed to shade them better during the really hot months. We all love fresh corn on the cob!

Having the two growing media described above does not replace the need to raise some seeds in pots. As my environment can be at times very unforgiving, I still raise certain seeds under cover. Once these are old enough, I plant them out in the paddock and they do well.

It has been my pleasure to share this information with you. I share all my information/seeds/bulbs online at www.mainlyamaryllidsgarden.com

Daryl Geoghegan.

Babiana dregei

Babiana vanzyliae

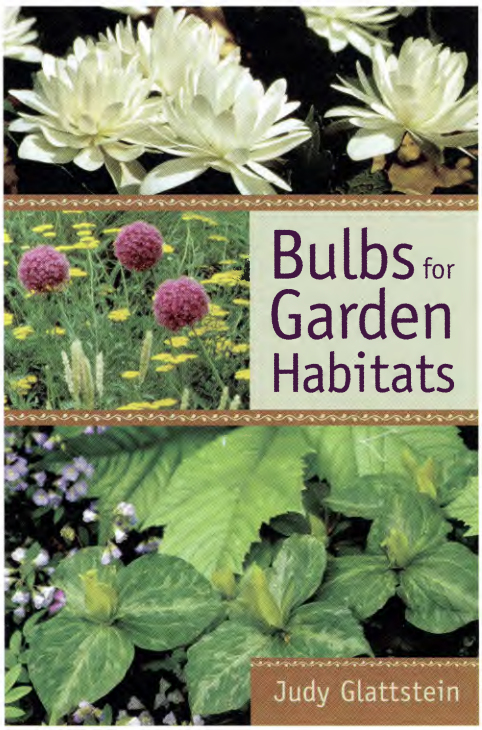
Ferraria divaricata

Book Reviews

BULBS FOR GARDEN HABITATS

Judy Glattstein. Timber Press, Inc., Portland, OR.

Hardcover, 296 pp, color photographs..$29.95..
ISBN 0-88192-693-0..2005..



From the very first page of Judy Glattstein's *Bulbs for Garden Habitats*, it is evident that the author enjoys all things geophytic and has a definite knack for sharing her love through writing. This is one of those rare works that not only provide in-depth information for the novice—it even goes so far as to include a detailed section describing the differences between a true bulb, a corm and a rhizome in addition to an overview of the principal geophyte families—but also provides a great armchair read for more advanced growers.

Rather than falling into the trap of providing an encyclopedic treatment of her favorite bulbs, Glattstein goes one step further and groups many bulbs according to which climates and conditions they are best suited. After all, there is no point in struggling to grow a trumpet daffodil in Texas when a hand-me-down crinum will provide years of delight with almost no effort on the part of the gardener. While this treatment is not as groundbreaking as the publishers claim, *Bulbs for Garden Habitats* packs a surprising amount of information into its 296 pages, with separate chapters dealing with geophytes for temperate woodlands (including an additional chapter on North American natives), Mediterranean climates, Texas, the South and Southeastern USA, waterlogged places and rock gardens.

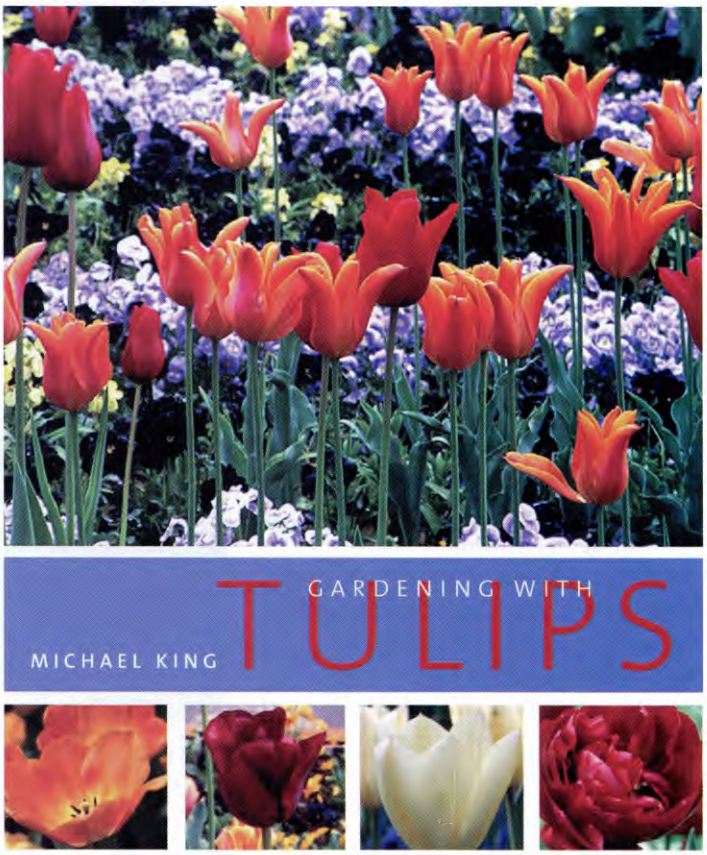
The appendix provides information about potentially invasive species and includes an impressive list of sources. But perhaps the most interesting part of Glattstein's book is the methodology that was employed in its research. When the author has no first-hand knowledge of a particular habitat, she turns to those who do and thus provides input from many seasoned gardeners from each region in question. Often, however, a mix of personal experience and outside testimony meld together to create a charming hybrid. I dare anyone not to laugh out loud upon reading the hilarious section dedicated to snowdrops (*Galanthus* sp.), no matter what climate they may call home. Furthermore, Glattstein tends not to limit herself exclusively to horticultural experts and publications for some of her information and, when this happens, the result is fresh, original and thoroughly captivating. A case in point is the fascinating description of *Ismene* (*Hymenocallis*) *amancaes* which was inspired by information received from her brother, Ben Orlove, who had lived in Latin America doing anthropological field research. Not many writers take the time to research how certain geophytes are known and appreciated in their native lands and this particular section provides a thought-provoking glimpse of the impact this yellow-flowered *Ismene* has had on Peruvian culture.

Aside from a few unfortunate editorial problems that result in minor taxonomic inconsistencies throughout several sections of the book, *Bulbs for Garden Habitats* is an engaging and enthusiastic text that is just as much of a good read as it is a good book about bulbs.

Corey Thompson

GARDENING WITH TULIPS

Michael King. Timber Press, Inc. Portland, OR. Hardcover,
192 pp, over 470 photos, $29.95.
ISBN 0-88192-744-9. 2005.



Michael King begins *Gardening with Tulips* with a mercifully terse general introduction to the tulip. The next chapter, "Tulips in Contemporary Gardens," is well worth the read for anyone who wants to make effective use of tulips in their garden. *Gardening with Tulips* might have been better titled *Designing with Tulips* because design is the real heart of this book. An avid admirer of tulips, the author has a wonderful array of ideas on the aesthetics of tulips in the garden. While expressing his disdain for the over-use of traditional massive beds of tulips he offers many ideas for how to use tulips in different ways. Bedding-out schemes are not abandoned completely as he readily admits there are places and tulips best suited for that approach, but he does offer some refreshing variations to consider. The latter portion of the chapter discusses his many and imaginative ideas for garden companions for tulips. I admired his observations of how individual tulip selections uniquely connected with the textures, colors, and forms of their companions. Unfortunately, while many of his design ideas are illustrated, far too many "mug shots" of individual species are used where more informative photographs are needed. Also, as a gardener, I was frustrated by his overly sanguine description of the mechanics of executing his ideas and his rare mention of the unattractive aftermath of the flower display. He gives due deference to the potentially catastrophic disease *Botrytis* (tulip fire) in the back of the book, but makes the questionable claim that gardeners can rely on vigilant rouging to control the disease on perennialized tulips in the small garden.

The final chapter is about the growing of tulips and addresses many of the pertinent cultural questions in a useful but quick and superficial manner. Another horticultural concern is the book is written for the climate of Amsterdam. The reader is on her own to adapt recommendations to other climates.

"Twenty Classic Tulips" is a chapter devoted to the history and aesthetics of twenty tulip selections, and a host of their close relatives. The individual history of cultivated tulips is a passion of the author's so the book is a good source of brief but fascinating stories of how particular tulips have come to us. The author admits that an interesting history is a sufficient reason for him to grow a tulip. But mostly his discussions are based on aesthetics. His engaging enthusiasm made each and every one of the twenty selections seem like an aesthetic gift from the gods.

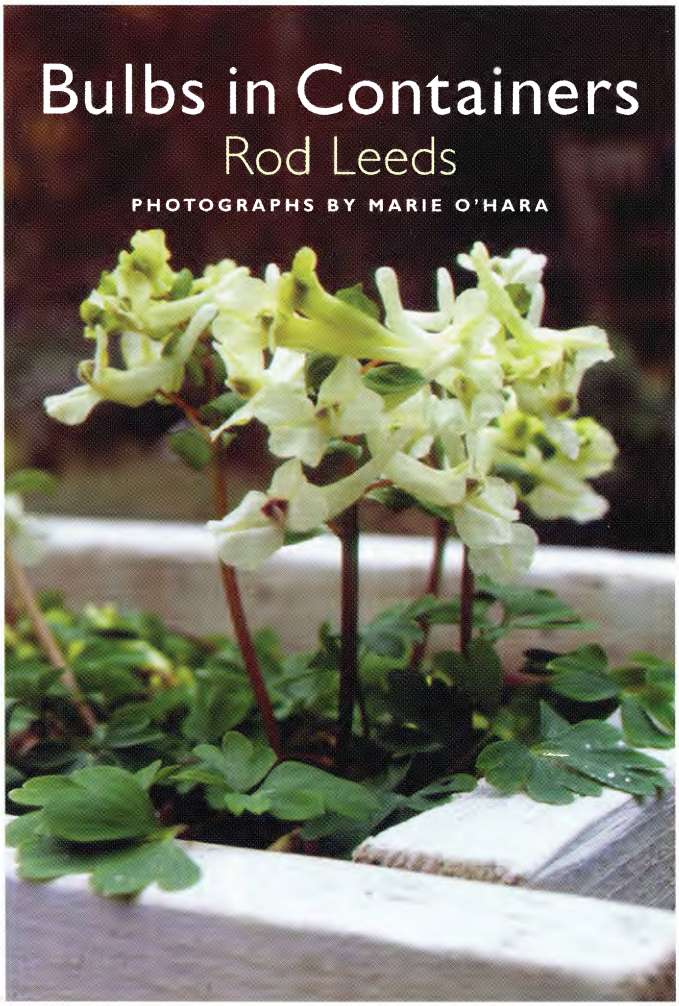
A chapter on color continued the aesthetic theme dwelling on the subtle color variations of a long list of tulip selections and how those colors might be utilized in the garden. If you don't think of yourself as a "colorist" you will be overwhelmed.

Gardening with Tulips is a great book on the topic of designing tulips into gardens. I hope buyers don't expect more than that.

Chuck Gleaves

BULBS IN CONTAINERS

Rod Leeds. Photographs by Marie O'Hara. Timber Press, Portland Oregon. 2005. Hardcover. $29.95. 6" x 9." 103 color photographs, 9 black and white photographs. ISBN 0-88192-735-X.



If I had a potting shed, this is the book I would want to keep on the shelf for quick reference. Rod Leeds shares over 25 years of experience growing bulbs in containers in England.

The book is written in three sections. The first, "A Photographic Year in Containers," is useful because the bulbs are alphabetized according to their blooming season. This makes quick work of figuring out what to plant when.

While experts may be familiar with most of the bulbs in this book, not all of these bulbs are common or easily found. Novices and experienced growers alike will enjoy this comprehensive collection of both familiar and uncommon bulbs that the author feels anyone can grow. There is detailed information on how to care for each bulb, including planting medium, suitable container, proper placement, combinations and what works as well as what does not. It is an excellent reference for a bulb enthusiast who would like to have something in bloom throughout the year.

The second section "Bulb Genera Suitable for Containers" discusses more bulbs and has more information allowing you to look up bulbs alphabetically regardless of blooming season. There is information about how the author has successfully grown them and information about how they grow in their natural habitat. Plenty of troubleshooting information is also included. Mr. Leeds shares his knowledge of problems that could occur and how to avoid or treat them. There are instructions on how to build various types of bulb shelters for storing them in the dormant stage, or growing them in climates where they need to be sheltered.

The third section is titled "Practicalities". This section covers environmentally friendly methods of bulb propagation, something the author encourages. There is information on which bulbs set seed easily, how to collect and store them, viability, germination time and length of time from seed to bloom. Here you will find information on which bulbs can be divided easily and which cannot. Leeds has done a wonderful job of demystifying the process of bulb scaling, bulb chipping, bulb scooping and bulb scoring. The novice can feel confident in following the detailed instructions, with accompanying photographs, when trying any of these methods. This is written like a recipe, no details are left out. There is even a list of equipment to have on hand before you start.

This book is like a perfect garden, there are blooms here for every gardener. From the novice learning about new bulbs to the seasoned gardener who hasn't the time to get out of the dirt and think about which bulb to grow in which season, the answers are here. Following the well thought out and thorough instructions in the book, anyone should be able to have beautiful containers of blooms throughout the year.

Carolyn Craft

xHippeastrelia is facultatively apomictic

By Ben J.M. Zonneveld

ALL PHOTOS BY THE AUTHOR

Two years ago I bought what I thought was a nice fat *Sprekelia* bulb. On flowering it turned out to be a hybrid with *Hippeastrum* (see picture). This was confirmed by its nuclear DNA content. To start with *Sprekelia*, there are at least two types of *S. formosissima* differing in nuclear DNA content and in flower size. Nuclear DNA content is measured in picograms (pg) and1 pg is ten to the minus 12 gram. For comparison: humans have 7 pg. There is a *S. formosissima* with 148 pg per nucleus that is a tetraploid and *S formosissima* "Oriental Red" that is hexaploid with 205 pg. Now most of the large ('Dutch') Hippeastrum hybrids around are tetraploids with about 60 pg of DNA per nucleus. As you know, offspring of a cross get half the chromosomes (that is also half the mass of DNA) of the father and half of the mother. So a parent with 20 pg and another with 60 pg per nucleus will give offspring with 10+30 = 40 pg unless some strange things happen as shown here. So the amount of nuclear DNA I found in my *xHippeastrelia* of 138 pg is nicely in between parents with 62 and 205 pg. This shows that the *S. formosissima* used was the hexaploid form (providing the other parent was a tetraploid *Hippeastrum*).

I crossed the two flowers on my *xHippeastrelia*

with itself and with a large red tetraploid *Hippeastrum* with about 12 (!) flowers per scape. Both crosses were "successful" and did give each about ten seedlings. Of each cross I measured the nuclear DNA content of four seedlings. Surprisingly all had about the same amount of DNA i.e.140 pg and this is the same as the mother plant, the *xHippeastrelia*. This suggests that all 8 seedlings were derived from the mother plant by apomixis. That is to say the pollen probably only stimulated the development of the embryo's but did not contribute any genetic material. At least in the case of the cross with the *Hippeastrum* an intermediate value of about 31 + 69 = 100 pg would have been expected. I have not seen the flowers as I sowed them this summer but suppose they are all identical to the mother *xHippeastrelia*.

So far so good. This spring the *xHippeastrelia* flowered again. Based on the earlier found apomixis I did not use any hippeastrum pollen but instead used pollen of the hexaploid *Sprekelia*. To my surprise, it turned out that these crosses were successful. That is to say, the hybrids with 169.8, 168.7 and 170.3 pg were intermediate between the two parents with respectively 137 and 205 pg. So it seems that the *xHippeastrelia* is only facultative, apomictic. It cannot be excluded that the use of other hippeastrums will give a different result. I would like to hear from those who have made crosses with *xHippeastrelia*.

Measurements were done by flow cytometry with *Haemanthus albiflos* with 76 pg as internal standard and with propidium iodide as the fluorescent dye. For further details see my articles on nuclear DNA content of all species of *Hosta*, *Galanthus*, *Helleborus*, *Clivia* (in Herbertia), *Agapanthus* etc.

TO SUMMARIZE THE DATA:

	pg DNA
Sprekelia formosissima	148
Sprekelia formosissima 'Oriental Red'	205
Hippeastrelia	137
Red *Hippeastrum* used here	62
Hippeastrelia x itself	
No 1	140
No 2	142
No 3	142
No 4	143
Hippeastrelia x red *Hippeastrum*	
No 1	138
No 2	142
No 3	143
No 4	145
Hippeastrelia x *Sprekelia* 'Oriental Red'	
No 1	170
No 2	169
No 3	170

Guidelines for IBS Members . . .

who would like to take part in the online seed and bulb exchanges run so successfully by Herbert Kelly

First let me explain that most of the offerings that IBS provides through its BX & SX, are extremely rare, elusive, and unobtainable anywhere else in the country. Twenty to thirty years ago, these botanical treasures were only available to a select few. We have made it convenient for the amateur, as well as the professional botanist, to obtain these items at one convenient location. Without this service obtaining these treasures would come at a prohibitive cost. Listed below are Guidelines to help you use the IBS BX & SX, successfully.

1 DO NOT SEND YOUR DONATION UNTIL YOUR REQUEST HAS BEEN CONFIRMED

2 Please send your mailing address with every request. Your phone number would be appreciated also.

3 Please send your requests, *with the original subject heading that I've sent to the IBS forum, (for each bx or sx), each time.* Not doing so creates more paper work for me. Send this to me privately, NOT to The IBS Forum.

4 All donations must be sent to:

International Bulb Society
PO Box 336
Sanger California 93657-0336

1 All IBS MEMBERS PARTICIPATING IN THE BX & SX MUST KEEP THEIR ACCOUNTS PAID IN FULL, EVERY 30 DAYS, OR PRIVILEGES WILL BE SUSPENDED, UNTIL BROUGHT CURRENT. Payment can be made by Check, Money order or Cashiers check. Master card or Visa can be used, by contacting IBS Treasurer, Pam Kelly, at (559) 324-7676 or pkelly1668@aol.com

2 Many of the rare seeds and bulbs offered are in short supply, so unfortunately we cannot supply all wants, each time something is offered. We cannot list bulb and seed availability at convenient times to please everyone - as much as we try – in all Time Zones. Try to keep a watchful eye on the IBS Forum postings as it is first come, first served.

3 All material is shipped from us in fresh condition. Once it is delivered to the shipper, it becomes your property. We cannot be responsible for loss or damage. Donations are due once the package is shipped. There are no warranties expressed or implied.

4 Please watch IBS forum, to see if a particular BX OR SX is closed, before making your request.

5 You must be a paid member of IBS, to participate in any BX OR SX offerings, so make sure your membership is kept up to date.

6 Please mark you remittance with the specific BX OR SX number, or numbers, each time, before sending to the IBS TREASURER.

7 Please reply to me privately at herbk76@aol.com not to ibsmembers@yahoogroups.com

If you have any questions, or need help, email me at herbk76@aol.com

Herbert Kelly Jr.
Director IBS BX AND SX

Thank You

To all that donated bulbs and seed in 2005:

Patty Allen
Barbara Ciravolo
Tim Eck
Betsy Feuerstein
Alberto Grossi
Rob Hamilton
Rich Hart
Thad Howard
Herbert Kelly Jr.
Victor Lambou
David Lehmiller
Michael Loos
Jerry May
Judy McBride
Alan Meerow
Bill & June Paldi
Kevin Preuss
Troy Ray
Jim Shields
Tony Skittone
Riverbanks Zoo & Garden

Your generosity, and unselfish devotion to The International Bulb Society (IBS), pushed the Bulb Exchange (BX), and the Seed Exchange (SX), to new records in 2005. Because of your donations, we were able to distribute 213 offerings of seed and bulbs, from January 1, 2005 to December 31, 2005. This now stands as the largest annual BX and SX distribution of seed and bulbs in IBS history.

My sincere thanks to all of you for helping me make the IBS BX and SX, such a great success.

Herbert Kelly Jr.

Director IBS BX and SX 2005

The IBS would like to acknowledge the continued generous support of the LEF Foundation in 2005

TWO IBS PINS TO CHOOSE!

(So why not buy both?)

IBS has now produced TWO International Bulb Society pins. Both have been produced in a very limited quantity and are destined to become valuable collector's items. Actual size is one inch (25 mm) high x .75 inch (19mm) wide with a tie tack-type back. Number one features *Galanthus nivalis* on a dark blue field (enamel) with "IBS" in gold tone and the whole framed in a gold tone edge surrounding the enamel. The second pin features a photo of *Hippeastrum papilio* with IBS in orange on a maroon background.

"Order one or both!"

$10.00 each

These beautiful collectors items are available only while supplies last. Hurry! Order now.

NAME: .....

ADDRESS: .....

CITY ..... STATE ..... ZIP OR POSTAL CODE .....

COUNTRY: .....

QUANTITY ORDERED:

Galanthus nivalis ..... *Hippeastrum papilio* ..... TOTAL .....

TOTAL ENCLOSED: $ .....

Send your check, cash, or postal money order made out to:
"International Bulb Society" (US funds only)
to: Dave Lehmiller – IBS PIN OFFER,
3530 Fannin, Beaumont, TX, 77701, USA

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PO Box 336
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