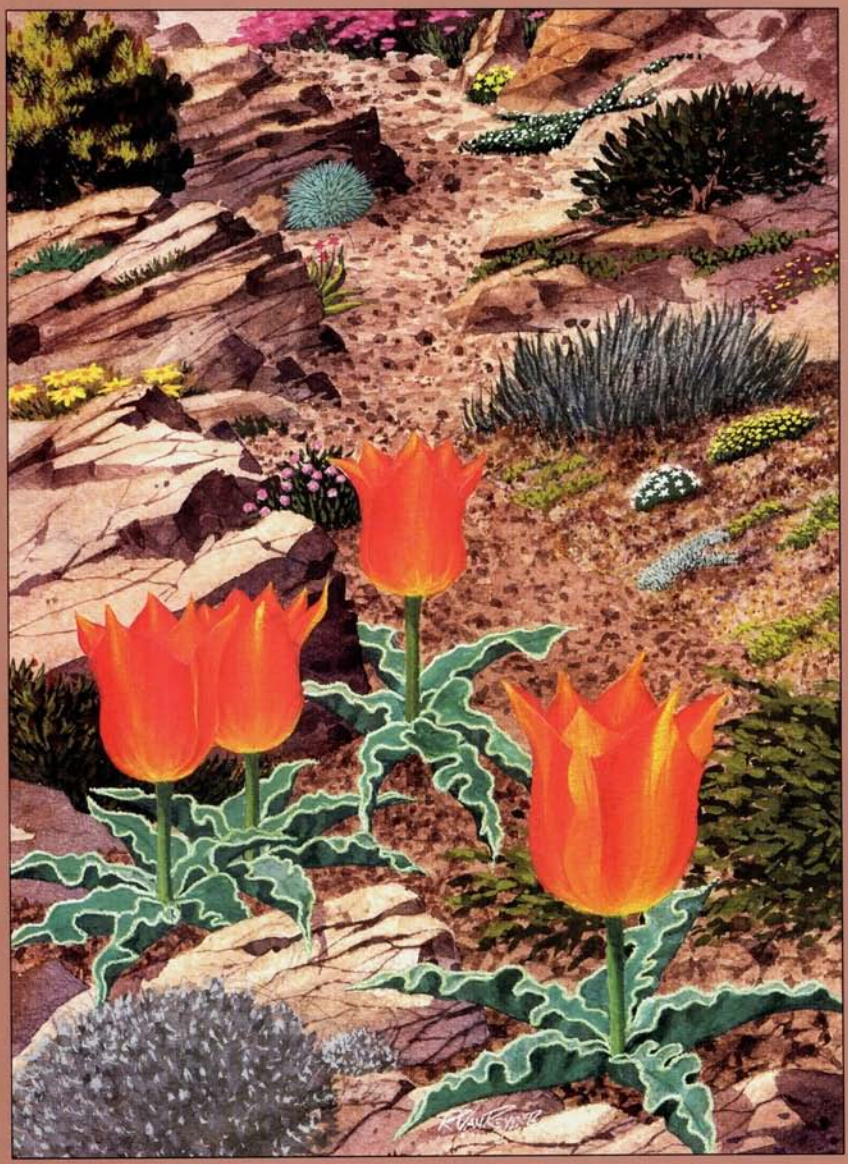
ROCK GARDEN



QUARTERLY

VOLUME 55 NUMBER 2 SPRING 1997

COVER: *Tulipa vvedevenskyi*
by Dick Van Reyper

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ROCK GARDEN QUARTERLY

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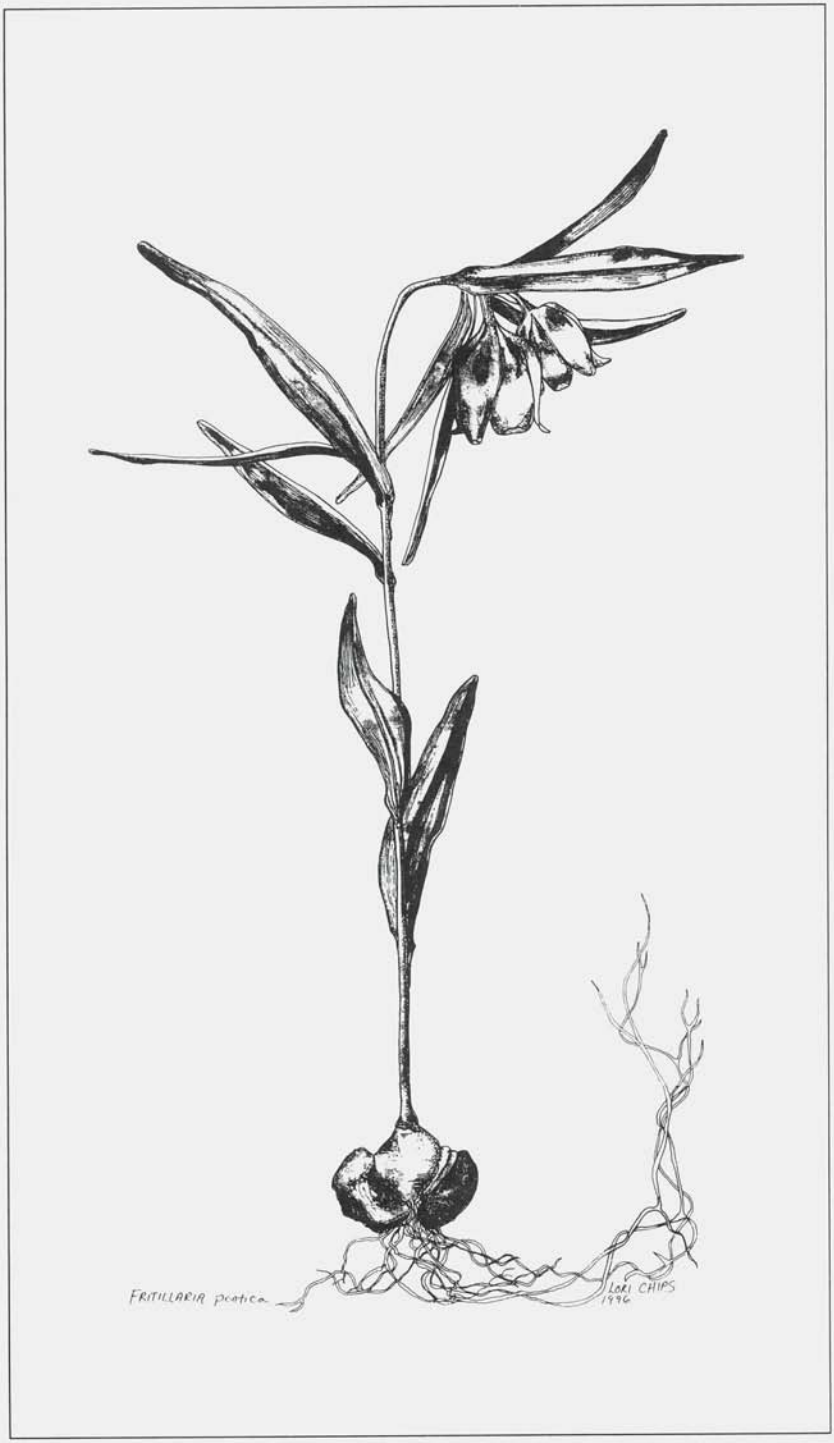
VOLUME 55 NUMBER 2 SPRING 1997

FEATURES

DEPARTMENTS


FRITILLARIA pontica
LORI CHIPS
1996

LIFE WITH BULBS
IN AN OREGON GARDEN

by Molly Grothaus

Our garden is on the slope of an extinct volcano, with an unobstructed, full frontal view of Mt. Hood. We see the side of Mt. Hood facing Portland, with its top-to-bottom 'H' of south tilted ridges. On that hot August day when we chose the property, we didn't consider that the open view also meant that there was nothing to break the coldest winter winds that come roaring down the Columbia Gorge and make our garden at least half a zone colder than surrounding areas.

Nor did we consider the heavy clay soil, with occasional pale orange spots from iron. After years of annually adding large amounts of sand, bark chips, and compost, we have built a friable soil suitable for growing bulbs. All the beds around the house are raised by a two-brick-high edging with frequent drainage spaces at the bottom.

As I walked around the garden on a winter day there was an obvious difference between the temperature at the house level and the temperature at the bottom of our garden. There is an even greater range on a hot summer day between our south-facing rock garden and the shady, north-facing bed near the house. Armed with a light meter and a recording thermometer, I began to discover how large the variation in warmth and light can be in an acre and a half of garden.

These investigations led to an interest in the original habitat of bulbs and how to duplicate suitable habitats in this garden. When I was keeping good germination records, I found that most bulbs are easier than alpines to grow from seed. The only real requirement is patience, because bulbs often take a year or longer to germinate and two to four, or more, years to bloom. Saying that often evokes groans, but if bulb seeds are started every year, it is only the first wait for bloom that seems a long time. And once bulbs are planted in the ground, they just sit there and multiply like money deposited in an IRA. It's hard not to feel like a miser counting his riches when you see how nicely the bulbs have multiplied to provide material for trading and more bulbs for another patch in the garden.
I use white plastic drink cups in which to start seeds. They are large enough for the amount of seed usually received from seed exchanges and have the advantage of a write-on surface. I record the name, source, date

planted, germination date, and a brief description of the flower. This is especially useful for seed collected in the wild, which may turn out to be something other than the collector thought. And I add a note about what the original habitat was like, because even if the seed weren't collected in the wild, that bulb still knows what it needs to have a long and happy life in the garden.

After the seedlings have hardened a little, I often move them undisturbed from the plastic cup to a 4"-square, plastic pot with more room for root growth for at least a second season.

Some years ago when we were in England, we had a chance to see E.B. Anderson's bulb garden at Lower Slaughter. He had the most exciting collection of bulbs I have ever seen. He was a chemist before he retired and, later, when I ran across his bulb fertilizer recipe, I mixed some together and got excellent results. He used 2 parts superphosphate, 1 part blood meal, 1 part sulphate of potash, 1 part dolomitic lime—4 1/2 ounces of the mix to a bushel of potting soil.

This is the mix I use when repotting the nearly three hundred pots of bulbs in our frost-free greenhouse and when resetting bulbs that have become crowded outdoors. Most of the bulbs in the greenhouse are there for the pleasure of being able to see them in bloom at bench height earlier in the winter than they would bloom outdoors. The January blooming *Narcissus cantabricus* var. *petunioides, N. romieuxii,* and that tiny *N. hedraeanthus* need protection from the winter weather. Some of the cyclamen, *Cyclamen mirable* with pink markings on the leaves, and *C. rohlfsianum* from Africa, would be too hard to replace. *Cyclamen libanoticum, C. graecum* and that very beautiful form of *C. graecum* which has been called forma *gaidurowryssii* var. *malingeri* are not hardy outdoors. Some forms of *C. hederifolium* and *C. coum* which have unusual leaves stay in the greenhouse. Outdoors these two species seem to have reached a critical mass and turn up everywhere growing conditions suit them. *Cyclamen cilicium* and the summer blooming *C. purpurascens* grow happily outdoors but are less enthusiatic about volunteering.

In a normal year, we have very little rain in the summer but have an annual total of about 35" (almost twice that amount last year.) That is too wet to grow many beautiful bulbs native to the high Middle Asian deserts. The pots of the *Rhinopetalum* section of *Fritillaria* are given water for three to four months starting in December. In late January the nose of *Fritillaria sewerzowii* emerges like a glaucous, brown, and shiny intercontinental missile. It shoots upward to 20" and unfurls 18 to 20 dusty gold, reflexed flowers with purplish-gray reverse in the upper leaf axils. The seed was collected in "Russia," so I suppose this is related to the larger form of *F. sewerzowii* found near Tashkent. In February, the pink flowers with purple-horned bases of *F. stenanthera* open, and *F. bucharica* blooms a little later with 12" stems of many, flared, white flowers. Unless seeds have been set, the leaves die back quickly, and these pots and others in the *Rhinopetalum* section spend the rest of the year under the bench.

Near the greenhouse is a grouping of 114 flue tiles set in seven rows on a slightly north-facing slope. The tiles are cast of reddish cement, 12" x 16" and 12" deep. Only the west end of this bank of tiles is in full sun and is never watered. This is where the species tulips from the Middle Asian deserts are growing. In their native habitat they are watered by heavily mineralized snow melt, and so I use a

liquid 12N/55P/6K fertilizer as the leaves emerge, and twice more, the last after flowering. Right now there are 33 flue tiles with a different species of tulip in each, and three with *Sternbergia lutea.* Among my favorites are *Tulipa batalinii* 'Bronze Charm'; *T. cretica,* white, flushed pink; *T. humilis* 'Persian Pearl' and 'Odalisque'; *T. tarda,* star-shaped, white with a broad yellow base (photo, p. 92); and *T. molgotavica,* orange-red. The flue tiles have the added advantage of keeping stoloniferous tulips in their alloted space. As soon as the leaves die down, each tile is topped with a rectangle of heavy roofing paper cut to fit. This assures the tulips a good summer baking and restrains the leaves of the sternbergias so that they don't overtop the flowers, and reduces weeds in the tiles. The tulips are uncovered in mid-November; the sternbergias in mid-September. With this treatment, many of the tulips have lasted 20 years or longer. The same results could be accomplished with a cold frame.

This bank of tiles has heavy hardware cloth under it, topped with fairly large gravel, filled with my best imitation of that bulb's native soil mix, and all dressed with an inch of pea gravel. Herbaceous alpines grow in the front row of tiles to provide summer interest. All the spring-blooming crocuses like these conditions, as do many fritillarias, including *F. orientalis* (photo, p. 91), *F. acmopetala, F. messenensis, F. pyrenaica,* and *F. ruthenica. Fritillaria pallidiflora* (photo, p. 90) is one of the easiest to please and grows here and in several other areas. My favorite is the tubby, little *F. tubaeformis,* which has huge flowers for its size.

The tiny, wine-striped *Colchicum kesselringii* is a spring bloomer, followed in the autumn by the small *Colchicum baytopiorum* and *C. corsicum.* This east portion of the bank is watered lightly and occasionally during the several summer months when we have little or no rain.

On the north side of the house is a raised bed about 65' long and 18' wide, home to bulbs that like woodsy conditions. The soil is high in humus, and the only fertilizer used here is a top dressing of half leaf mold, half sand every fall, after the bulb foliage has died down. The sand prevents the leaf mold from getting gummy in our heavy, winter rains. A large magnolia and two large, old rhododendrons provide additonal shade. The blooming season begins in October with *Galanthus reginae-olgae* ssp. *reginae-olgae* and is followed shortly by *G. caucasicus* and a number of others. The short-stemmed, large flowers of *Leucojum vernum* open with the later *Galanthus.* Two dozen species and forms of *Erythronium* grow here. Over many years, I have found that *E. tuolumnense* and *E. multiscapoideum* multiply faster than other species. *Erythronium revolutum* is the easiest from seed, which can be scattered under rhododendrons to make a beautiful spring ground cover—in a few years. The front of this bed has some of the shorter erythroniums, including *E. dens-canis* 'Snowflake', 'Frans Hals' (violet pink),and 'Rose Beauty' (dark pink). *Erythronium umbilicatum* has deep gold flowers with the outer tepals marked a rusty red. *Erythronium cliftonii* is another short species, at least in the form I received from Wayne Roderick. Its leaves emerge a glossy, dark brown with apple-green markings.

Most of the trilliums in the garden are also in this bed, two dozen forms and species. The small, white *Trillium rivale* from the Siskiyous is at the front. It bears both leaves and flowers on long stalks. The stalks of the fertilized flowers continue to elongate and bend over until the ripe seeds are deposited

around the parent clump (which itself mutiplies faster than most trilliums). I have excellent directions for growing trilliums from seed, but the only success I've had is with our little native, *T. parviflorum*. *Trillium erectum*, with mahogany-red flowers, forms a bowl as it increases. The yellow flowers of *T. luteum* are attractive, and so are the dark red flowers of *T. vaseyi*—even though their long peduncles drop the flowers below the leaves, requiring some gymnastics from viewers.

At the back of this bulb bed are the glossy, green leaves of *Arisaema ringens*, looking like an oversized trillium. The leaves last on into the summer and are followed by a large clump of red seeds, all providing a background for other bulbs. The curious, helmet-shaped flower is interesting but almost completely hidden under the leaves. *Arisaema sikokianum* has huge, green leaves with a white center pattern and remains handsome until fall. The large, striped spathe with a snow-white spadix is unusually attractive. The trifoliate *Arisaema candidissimum* has a beautiful, white spathe striped pink. It doesn't emerge until June, and when it does flower, the spathes all point in different directions.

Corydalis lutea is used as a summer ground cover and is pulled up every fall. About the time the bulbs have finished blooming volunteers appear. *Corydalis solida* 'George Baker', a deep brick red, is treated much more gently. Various ferns and hepaticas, *Haberlea rhodopensis* var. *fernandi-coburgii*, *Asarum shuttleworthii*, and the marbled-leaf *Asarum hartwegii* are still interesting after the bulbs have died down. *Uvularia grandiflora* and *Epimedium diphyllum* are good in the bulb bed, because they are both clumpers and won't run over the space of some bulb while it is resting.

There is hard work in the bulb year, in July and August, when hundreds of bulbs have to be lifted and divided or repotted. Yet I have had a 40-year romance with bulbs, and by now they are everywhere in this garden. Narcissus bloom among emerging peonies in a bed bordered on three sides by driveway. The outer edge makes a splendid isolation ward for over-eager multipliers. As soon as flowers appear on *Crocus tommasinianus*, *Muscari armeniacum*, and *Crocus speciosus*, they are dug up and banished to the peony bed where their dying foliage will soon be hidden.

I look forward to the appearance of each of my favorites. In the autumn *Crocus banaticus*, growing on the sunny side of the peat bed, bears flowers with pointed segments, the inner ones noticeably smaller than the outer (photo, p. 99). All the segments, as well as the feathery stigma, are the same shade of lavender. I grew this from seed collected at Banat in what was once Yugoslavia. I am fond of *Crocus heuffianus*, which is a rosy lavender with a dark purple chevron on the inner segments. It was grown from seed from the former USSR and has suffered the ignominious fate of being lumped into *C. vernus*. The appearance of *Narcissus triandrus* with its swept back perianth, or the cupped segments of *Crocus goulimyi*, or the fragrant flowers of *Muscarimia moschata*, are all a joy. The best part of life with bulbs is seeing old friends emerge and bloom each year, all through the growing season, in their preordained and expected sequence.

Molly Grothaus, is famous for her bulb gardens and alpines. She is also a co-founder of the Berry Botanic Garden in Portland, Oregon and a former editor of the American Rhododendron Society Quarterly.

NUTS ABOUT BULBS:

IN A MINOR WAY

by Andrew Osyany

Most of this issue of the *Quarterly* can be taken as early drum beating for Ontario Underground, the next NARGS winter rendezvous in Toronto, which will focus on bulbs. I would like to mention a few favourites that might not be as well known as they deserve. I have thrown over the alphabetical approach in favour of a roughly seasonal progression.

In the Paradise of Shelburne, Canada, there is good snow cover on the ground all winter, and the usual minimum temperature is about -24°C. Spring is a moveable feast. *Galanthus, Eranthis* and *Merendera trigyna* (photo, p. 90) duke it out for first bloom anywhere between the third week of March and the third week of April. Fall-blooming colchicums have a bad press on account of their long-persistent, large, spring leaves, but the spring-blooming members of the colchicum alliance have quickly disappearing, small leaves. The flowers of *M. trigyna* are as large as those of the ghastly hybrid crocuses. The individual tepals flare out and are elegantly tapered to a point. The colour is a solid, pleasing, soft pink—somewhat variable from year to year and from location to location. When the flower goes over, the whole structure falls to pieces, because the tepals are not united into a tube at the base; and that is the characteristic which caused *Merendera* to be split off from *Colchicum*. Vegetative increase is slow. I have *Merendera* both in sun and semi-shade. I have had no seed-set from any member of the colchicum group; either we lack the correct pollinators, or in each case my colony is a single clone only and does not fertilize itself. There are no problems with pests and diseases for this plant; however, because it is so delicious, you must protect it from Master Rabbit.

Still in the first brigade and also from the Caucasus-Turkey-Iran region is *Corydalis angustifolia*. True to the species name, the individual dark green leaflets are much narrower than in, say, *Corydalis cava*. This is a small corydalis with glistening white flowers which charm everyone. An easy and reliable doer, it sets a good amount of seed; you can grow new plants to flowering in two to three years. You will face strong competition; both Master Rabbit and Yecchi Gastropod will want to devour the

plant, while ants will make off with fleshy arils on the seeds. It is worth the trouble to protect it, however, as it is such a lovely plant. Why is it not more widely available? I have this in semi-shade but have also had it in full sun.

Sporting the high-gloss, yellow flowers prevalent in the genus, *Ranunculus kochii* has been with me since 1992. The plant is prostrate, with thick, fleshy, round leaves. The 16 or so petalled flowers are 3-4 cm across and light up the semi-shady spot under the juniper in mid-April. This is a great plant, much more attractive than its illustration in Rix and Phillips. The flowers last a fair length of time, but one day you will look and find that the flower receptacle, withering petals, embryonic seeds and all, have been rollercoastered to the ground . However, increase is very modest, as fertilization is infrequent.

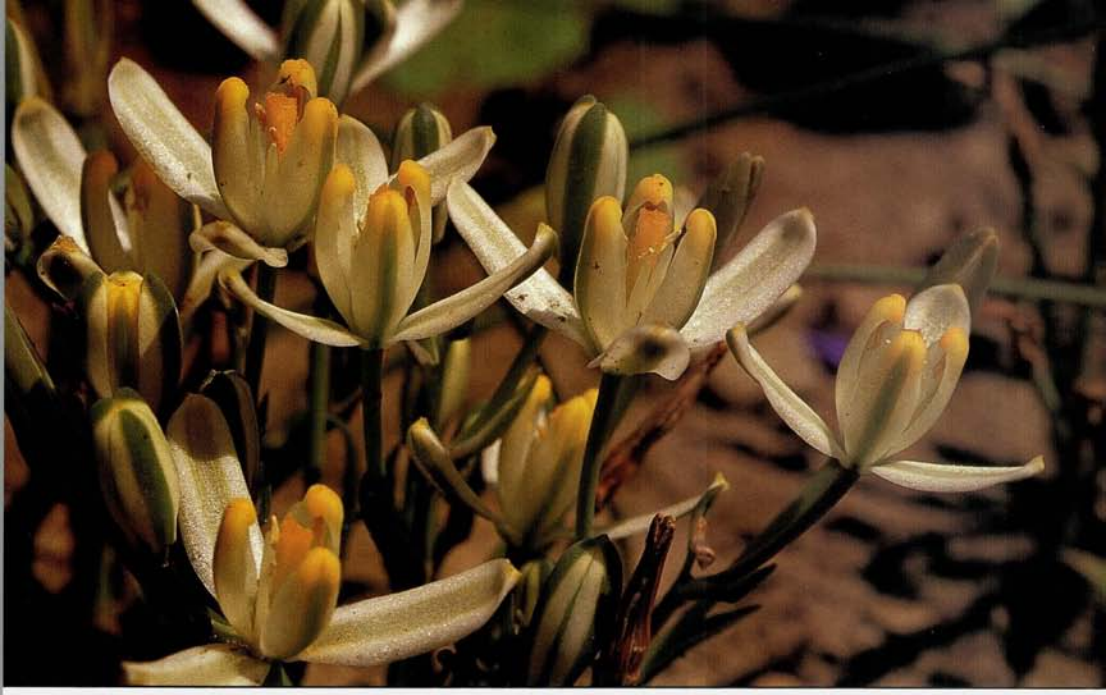
Staying with the colour yellow—so divisive of gardeners—another early spring bloomer is *Gagea pratensis.* The genus is related to *Lloydia,* and the 50 or so species in Europe, Asia and North Africa are almost all yellow. Many are mingy—at least according to the prevailing illustrations. *Gagea pratensis* blooms close to *Ranunculus kochii* in my garden, but about two weeks later. Leaves are grassy and few; the wide-opening flowers are narrow-petalled and have a greenish cast and some greenish markings to them. The flowers are about 2cm across and quite nice. Seed is sometimes available. A few years ago Josef Halda had a white *G. vaginalis,* which sounded absolutely irresistible, but unfortunately I did not manage to bring it to blooming. English-speaking gardeners will have a decision to make about the musical pronunciation of the genus: will you gauge or gag?

Another genus with a bad press harbours a number of very charming early bulbs that are well-behaved good-doers in the rock garden and are also suitable for troughs. I have two with names; the others are only known as "spp." Early May is the time for these little ornithogalums, all quite similar, but not exactly the same. *Ornithogalum nanum* (photo, p. 89) will throw up grassy leaves in the fall sometimes, and then next spring you look down among the tufts for the stemless, bright white flowers that sit on the ground. Grown to bloom in three years from seed, it has flowered splendidly for the last seven years. *Ornithogalum balansae* has strappy leaves and somewhat larger and more flat-opening flowers of the same clear white colour. This one I have in semi-shade, while the former has mostly been in scree—neither increases as much as I would like.

Scilla rosenii first arrived in 1988, without any description. I have loved it ever since. Toward the end of April, about two weeks later than *S. sibirica,* this gem comes into bloom. Leaves are strap-like, and the flower stems reach to 15cm. Each stem has a single, good-sized flower at the top. The colour is a light, pinkish blue; bluer at the tip, turning more pinkish in the middle, and then fading into white at the base of the petal. What makes the flower really distinctive is the reflexed petals . Here it does very well in semi-shade. Seed is difficult to collect ahead of aril-loving ants.

Scilla is a genus of about 80 species, and as soon as I had six quite distinctive ones in my garden, I thought I would expand my collection. I filled in the checkerboard seed order form of a well-known bulbous seed supply firm with all the scilla numbers and sat back to wait. Nothing arrived, so I sent a reminder. This was not acknowledged,

con't. p. 145—



Albuca humilis (p. 145) photos, Andrew Osyany

Ornithogalum nanum (p. 88)

Fritillaria pallidiflora and *Ranunculus lutescens* (p. 85) Molly Grothaus

Merendera trigyna (p. 87) Andrew Osyany

Fritillaria orientalis (p. 85) photos, Molly Grothaus

Fritillaria recurva (p. 120)

Grothaus garden, east end of *Erythronium* bed, showing *Erythronium tuolumnense*, *E. revolutum*, and *E. multiscapoideum*, and *Trillium ovatum* (pp. 83-86)

Tulipa tarda (p. 85) photos, Molly Grothaus

SOME SPRING CROCUSES

by John Grimshaw

When writing about crocuses the problem is where to start. Although these are the quintessential flowers of spring, the crocus season in my English garden lasts seven months, with over 140 taxa contributing to the display. In most years the display is continuous, even though only a single bloom may be out in the dull days of early December, a lean period which serves to demarcate the autumn- and spring-flowering species. In most years by Christmas we have a selection of choice species in flower outside, but as I write in late January 1997 we are still anticipating even the earliest of the spring flowerers; they will be doubly welcome when they arrive, and there should be a tremendous, concentrated display as they all come out together. It is this resurgence of colour from chilly soil and dank conditions that makes spring crocuses so alluring. Autumnal-flowering species must compete with other flowers and foliage for the gardener's attention.

The December gap is most often closed at Christmas by the appearance of the slim buds of *C. imperati* 'De Jager' (photo, p. 98), a selected clone of ssp. *suaeveolens* from the area around Rome. It provides an excellent example of the contrast between the two ranks of three perianth segments ('petals') in a crocus flower. The outer rank is usually a different colour from the inner rank, and it is very often this contrast that provides the interest to the flower. In 'De Jager' the "outers" are a yellowish buff, decorated with three thin, purple stripes; in bud and when the flower is closed during inclement weather this has exactly the same camouflaging effect as a tiger's stripes, and as a result I have often missed seeing the first flowers until they open and reveal their purple interiors. Flowers are advertising gimmicks, and crocuses do it well, flaunting bright colours in the sunlight in the hope of attracting the few passing bees. Crocuses open when there is a sudden change in temperature, and so may give a brilliant display in the sunlight of a bright morning after a hard frost, but remain closed after a mild night, although temperatures are equal.

Since I started growing crocuses I have been an absentee gardener, seeing my plants only during occasional weekends and vacations from school

and college, and although I try to be in the garden as much as possible at crocus time, it is never long enough. To prolong my pleasure from them I usually pick a selection of tight buds just before I have to leave, wrap them carefully in damp tissue in a plastic box, and take them with me. They expand as soon as they are taken from their wrapping, and great pleasure can be got from arranging them so that the open flowers support each other, forming a multi-coloured mound over a shallow dish.

This absentee gardening has its frustrations. In 1985 I sowed seed collected from my *Crocus korolkowii*, a species from central Asia with exceptionally glossy yellow flowers with bronze exteriors; it is another reliable early flowerer. In December 1989 one of the seedlings flowered with very pale flowers, quite unlike its parent but closely resembling the related *C. alatavicus*. I knew, however, that I had no *alatavicus* when the seeds were collected, so that it must be an odd *korolkowii* and was potted up individually. I spent three of the next four seasons away in Africa, and with the diminished care available the corm dwindled and split up into many small ones, the result being that it is only now that I have had the chance to see my baby in flower again! It has been worth the wait. The outer segments appear grey, but in reality are creamy-white with dense, minute stippling of deep purple, in what my mother calls a codskin effect. The inner segments are a soft, creamy white, more white than cream, but with enough cream to be noticeable. The throat is deep purple, a final confirmation that it is not *C. alatavicus*, whose throat is always yellow. I call it *C. korolkowii* 'Snow Leopard', after that elusive, soft grey cat of the central Asian mountains.

Growing crocuses from seed is very rewarding and can lead to some choice variation. The "Crocus King" of the first half of this century, E.A.Bowles (1865-1954), by diligently sowing seed annually of the purple *Crocus sieberi* ssp. *atticus*, raised one of the finest white crocuses in existence, "after," as he wrote, "thirty years of hopeful expectation." This is *C. sieberi* 'Bowles' White', like most variants of *C. sieberi* ssp. *atticus*, a robust, solid garden plant with the added attraction of early flowering. 'Bowles' White' is predominantly white but retains the deep yellow throat characteristic of *C. sieberi*. I grow it in the lawn with its relations 'Firefly' and 'Violet Queen', both mauve with the yellow throat. Of the two 'Firefly' (photo, p. 98) is the more attractive, with paler flowers than the rather lacklustre 'Violet Queen'. I always want to write 'Violent Queen', a name I did once see, labeling a Michaelmas Daisy.

Other subspecies of *C. sieberi* are less well known, and ssp. *sieberi* from Crete is very seldom seen, which is a great pity as it has marvelous diversity of markings on the outer segments. Unfortunately, it is not hardy, but some of the markings were passed to a hybrid with ssp. *atticus*, *C. sieberi* 'Hubert Edelsten' (photo, p. 99), in my opinion one of the best spring crocuses. The inner segments are a soft lilac-white, but the outers are rich, glossy purple, with a transverse white band dividing the colour into two blocks. With the yellow throat it is a paragon that is only distantly challenged by *C. sieberi* ssp. *sublimis* forma *tricolor*, in which the upper, purple part of the outer segments is separated from the yellow base by a white band, "a lilac egg in a silver and gold egg-cup," according to a friend of E.A. Bowles.

Although crocuses populate both my rock garden and alpine house in

considerable numbers, my favourite way of growing them is to plant them in grass, and I have found that most of the common species do very well in these comparatively rough conditions. If I had the space and will-power I would try to grow them in single species patches, but I lack both and enjoy a magic carpet of colour instead. The spring version of the carpet starts with the lilacs and white of *C. sieberi*, with the bright yellow, small flowers of *C. ancyrensis*, and continues through the Joseph's coat of the *C. chrysanthus* cultivars to the purples and whites of the *vernus* group—although this is a gross simplification, as the crocuses share the same ground with snowdrops and daffodils galore!

Crocus chrysanthus cultivars are a mixed bag of selections and hybrids from the wild parents *C. chrysanthus* and *C. biflorus*. Most are beautiful, robust, and easy garden plants, but a few have dull or even murky colours ('Advance' for example), or a poor constitution like 'Blue Peter'. If I were confined to three only I would choose, without hesitation, the Award of Garden Merit trio 'Blue Pearl', 'Cream Beauty', and 'Snow Bunting', whose pastel colours and floriferousness place them in the first rank of crocuses. 'Blue Pearl' is a selection of *C. biflorus* ssp. *pulchricolor*, but although the other two are hybrids, they retain the mark of their *chrysanthus* parent in their black-tipped anthers. In the grass they look well either mixed or as separate colours and are fortunately cheap enough to plant generously. Other *chrysanthus* cultivars such as 'E.P. Bowles' [sic] and 'Zwanenburg Bronze' are rich, golden yellow with brown streaks or blotches externally; 'Warley' is a large, white one with a purplish-brown exterior that gives a lot of attractive seedlings.

Self-sown crocuses are always exciting because you never know what will appear. I am particularly (foolishly?) fond of the arch self-sower, *C. tommasinianus* (photo, pp. 97, 98). It can indeed be invasive and is not recommended by people growing collections of the choicest and rarest of species, because it can be rather a strangling thug, but under deciduous trees and shrubs or in the lawn it is a delight. It is typically pale lilac, but the intensity of its colour varies greatly, and whites are common. There are even pink ones, or at least the nearest to pink a crocus ever gets; you can buy them under the clonal name 'Roseus', but the clarity and quality of the pink is variable. Darker purple 'tommies' are often hybrids with *C. vernus*, which contributes its particular depth of colour. The excellent 'Ruby Giant' is one such.

I feel that there is great potential to develop a fine series of hybrids between *C. tommasinianus* and *C. vernus* (photo, p. 100). At present, beyond 'Ruby Giant', only 'Haarlem Gem' (photo, p. 97) is commercially available: it is a chubby flower with almost grey outer segments and a good lilac interior, resembling *C. vernus* more than *C. tommasinianus*. I have selected several attractive clones from a mixed population of *C. tommasinianus*, *C. vernus* and their hybrids in Oxford, and have named three. 'Wandering Minstrel' ("a thing of shreds and patches") is a hybrid, with broad streaks of darker lilac on the pale exterior of the outer segments; they are irregular in location and extent, and appear to be the product of transposable genetic elements, just like the streaks in *Rosa gallica* 'Versicolor' or *Geranium pratense* 'Striatum'. 'Pieta' is a much admired, marbly-white hybrid with rounded segments and faint purple veins, while 'Jericho', named for

that area of Oxford, is a pure *vernus* type with glossy, bright purple tips and bases to the segments. In some of the more northern and easterly populations of *C. vernus* ssp. *vernus* (photo, p. 99, 100) the flowers are often purple-tipped, or have a white patch at the very apex and a purple blotch extending farther down the segment. Such plants were formerly known as *C. scepusiensis* or *C. heuffelianus* (photo, p. 99), but Brian Mathew regards them as mere colour variants of the widespread ssp. *vernus*. They are seldom seen in gardens but are extremely attractive, as well as being easy to grow. It is a shame that fat, vulgar Dutch clones, too large and flamboyant for the tasteful rock garden, have spoilt the reputation of the wild *C. vernus*, which is one of the very best for planting in grass (photo, p. 100). It is anciently naturalized in certain places in southern England and behaves as a wild plant, although it was originally introduced. These plants are often a bluish purple, but whites and striped variants occur. Presumably the wild variants of *C. vernus* increase too slowly to be worth cultivating in the bulb factories of Holland, although they grow very easily from seed, and unless you have a stock and are prepared to raise large numbers from seed, it is hard to acquire sufficient with which to be extravagant.

It was difficult to know where to start, and it is difficult to know when to stop, but I must say something about yellow crocuses. Although the striped and purply ones are my favourites, I could not do without three yellow ones. Firstly, there is *C. flavus*, a very well-tempered species from the Balkans and Turkey (photo, p. 98). E.A. Bowles likened its flower to a little tongue of flame, and equated it with the *Crocus* mentioned by Sophocles in 'Oedipus Colonos', breaking out like fire beneath the feet of the broken-down Oedipus as he returned home to Colonos. The bright orange-yellow flowers are a good companion to the pale lilac of *C. tommasinianus*, and some selections self sow their rich russet-red seeds almost as generously. In cultivation *C. flavus* has occasionally hybridized with the Crimean *C. angustifolius*, a pretty plant but not in the first flight, to form the hybrid *C.* x *luteus*. One of the resultant clones is the old plant known as 'Stellaris', with abundantly produced although smallish bright yellow flowers, feathered externally with five chocolate-brown lines. It is sterile and reputedly not vigorous, but it enjoys my garden and gives a good display each spring. The other clone of *C.* x *luteus* I want to mention is the large 'Golden Yellow' (photo, p. 100), the standard, large yellow crocus sold by the million every year. It is a sterile triploid that has been known at least for the past two centuries. Although it is so common, and rather too large for the rock garden, it is one of the finest bulbous plants in existence and should be planted generously in borders: spring would not be the same without it.

Further reading:

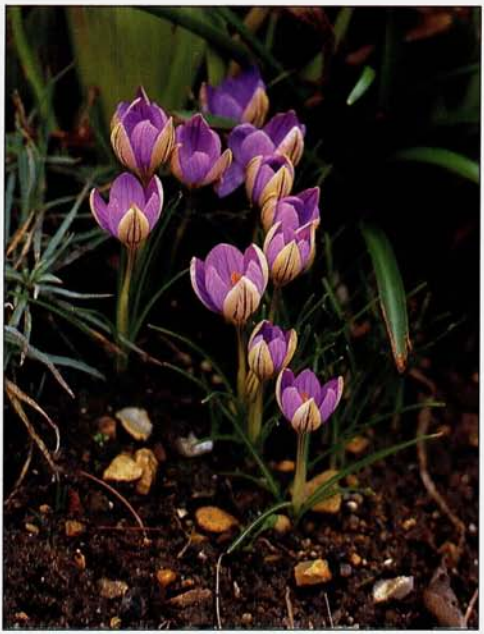
E.A. Bowles. 1924 (revised & better edition 1952) *A Handbook of Crocus and Colchicum for Gardeners*. The Bodley Head: London.

Brian Mathew. 1982. *The Crocus*. B.T. Batsford Ltd: London.

John Grimshaw gardens in Maidenhead, England. He is a dedicated croconut and galantophile as well as a keen grower of many other plants.

Crocus tommasinianus in Oxford Botanic Garden (p. 95) John Grimshaw

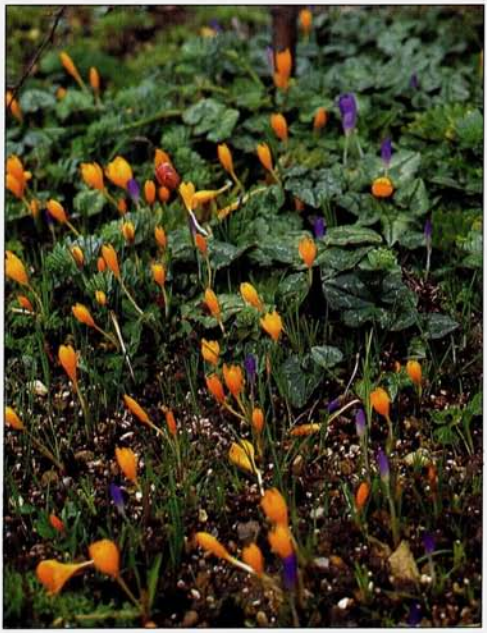
Crocus vernus 'Haarlem Gem' (p. 95) John Grimshaw



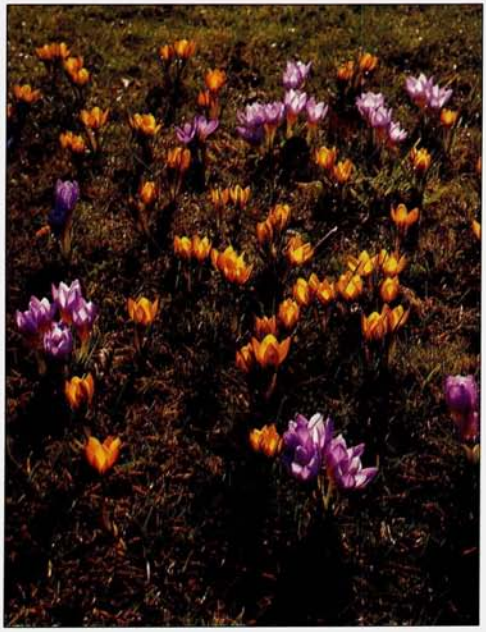
Crocus imperati 'De Jager' (p. 93)

Crocus etruscus (foreground), *C. tommasinianus* (background, p. 95); garden of late Primrose Warburg, Oxford.

Crocus flavus (p. 96) and *C. tommasinianus* (p. 95) in garden of Alan Edwards, Surrey, UK



Crocus sieberi 'Firefly' (p. 94) and *C. etruscus* photos, John Grimshaw



Crocus heuffelianus, now considered a color variant of *C. vernus* ssp. *vernus* (p. 96)
Molly Grothaus

Crocus banaticus (p. 86) Molly Grothaus

Crocus 'Hubert Edelsten' (p. 94)
Panayoti Kelaidis

Crocus vernus ssp. *vernus,* at Oxford (pp. 95, 96) photos, John Grimshaw

Crocus x *luteus* 'Golden Yellow' (p. 96)

ARISAEMA BOCKII
AN ATTENUATA MYSTERY
by Guy Gusman

This story began a few months ago on the Worldwide Web: *Arisaema bockii* had been rediscovered, and seed was distributed among American *Arisaema* lovers, via the North American Rock Garden Society! Now some plants were reaching maturity and flowering for the first time. Of course, many gardeners were looking for information on this species. Soon they discovered that all that was available was a large question mark.

Discussion ensued between amateurs and professionals, along with exchanges of photos and slides, and it soon became apparent that at least two different species are currently widely grown under this single name. Indeed, some seed originated from Russia, and other seed directly from China. Unfortunately, neither was accompanied by collection data. The basic question was, "Of what species are we speaking?" This is a particularly knotty problem with *A. bockii*, because, to say the least, the species is not well known even in the scientific literature—but we will return to this point later. I just want to underline here the immense advantage of having the opportunity to sow seed collected in the wild with all the appropriate related field notes. This has been made possible as recently as this autumn by an expedition to China which included some members of NARGS. Moreover, since these collectors had the kindness to offer seed to the Seed Exchange, we now have, I feel, a unique chance to grow these species yet again and to consider some problems of taxonomy, which, in our case, read like a detective novel.

Attenuata is a sectional name created by Engler at the beginning of the century, to include many species of *Arisaema*. Recently, however, this section was abandoned by J. Murata (1984), who pointed out that it was too heterogeneous and consisted of two geographically and morphologically distinct groups of species. Indeed, some are native to Indo-China and Malaysia, with evergreen leaves and usually, as in arums, neuters, or sterile bristle-like flowers, on their spadices. Murata places these in the section Fimbriata. The remaining species are found in southwestern China, and they have deciduous leaves, and no neuter flowers, and were rightly relegated by Murata to section Tortuosa.

But these last species, with a sympatric distribution, have many characters in common which are not shared by other members of the section Tortuosa. For this reason, we will here retain Engler's name Attenuata to refer to them, but here to signify a subsectional grouping.

Recently, it has become easier to travel in China. Areas which are not considered tourist spots are now open to foreign tourists for the first time in many decades. This is particularly interesting for us as plant lovers. Many species were discovered long ago but either were not introduced into cultivation or were progressively lost. By now, many have been collected again, and with our modern methods of propagation, one can reasonably assume that they will soon become available in the nursery trade. For this reason, it seems to be the right moment to have a look at some of the least widespread Chinese species belonging to Attenuata and related to well-known plants such as A. *tortuosum* (Wall.) Schott and *A. dracontium* (L.) Schott, which are widely cultivated in our gardens, and at all the members of section Tortuosa.

Although the species we have in mind have a less stately appearance than these two, nevertheless they can be considered as quite handsome. Like their taller relatives, one or two leaves emerge from the pseudostem, but with a smaller number of leaflets, usually not exceeding five, and the peduncle on which the inflorescence is borne, is without any conspicuous markings. The spathe is commonly green fading yellow, or whitish in one species, as we will see later. The spadix is always long, exerted from the spathe-tube, extending in a long, tapering tail.

Having established their common characteristics, let us turn to the differences between the two leading species, *A. bathycoleum* Hand.-Mazt. and *A. yunnanense* Buchet. If the first is quite solitary and distinct, the second, on the contrary, has many close relatives.

Arisaema bathycoleum, a small species, can be identified at once in the wild: its unique leaf, at most trifoliate or even simple, is an uncommon feature among adult arisaemas. Moreover, when three linear, lanceolate folioles are present, the angle between the midveins of the central leaflet and its neighbors is less than 90°—also a very unusual disposition, often compared to a bird's foot. The plain, green inflorescence looks like a long tube ending in a narrow, acute limb. Its spadix-appendage ends in a long, green or purple, thin thread curved down, sometimes to the ground. *Arisaema bathycoleum* grows in Yunnan, where the tallest specimens reach up to 40 cm. We saw many flowering specimens in July, in rocky meadows around Lijiang. As this species is quite distinct and doesn't vary, it had the good luck to be described under one name only and without any varieties.

As *A. yunnanense* is one of the commonest arisaemas in Yunnan, this name suits it well. But apart from northern Yunnan, it is also found in the neighboring provinces of southwestern Sichuan and western Guizhou. As a result of its wide distribution, some confusion arises. This species is a medium-sized plant, still with a green inflorescence, but its elongated spadix-appendage, well exserted from the spathe-tube, has the usual S-shape, as in *A. tortuosum*, and is held erect before fading. One or two leaves are present; the leaflets are ovate, shortly petiolulate or subsessile; the margins are entire or serrate; the apical part is obtuse. Buchet's description corresponds to specimens with trifoliate leaves. We indeed came

across this species , namely near Dali, where it grows abundantly in quite dry conditions, among rocky meadows, often at the foot of bushes.

George Forrest collected similar species, one in the Lijiang area, and the other, with wider leaflets, near Dali. Engler described them and named them respectively *A. talense* and *A. talense* var. *latisectum*. But he also honestly noted that he never saw *A. yunnanense*. Of course, he correctly put both in the same section, Attenuata. Things were complicated, because the specimens of *A. yunnanense* were deposited in the Herbarium of the Museum at Paris, while Edinburgh Herbarium was entrusted with *A. talense*. Of course one can easily understand that half a century elapsed before the synonymy of *A. talense* and *A. yunnanense* was recognized and published by H. Li in her *Flora of China* (1979).

Some twenty years before, Engler also described another related species as *A. bockii*. Bcck von Rosthorn collected this species eastward in southeastern Sichuan, near Nanchuan, at exactly the same latitude. Unfortunately, the collection was made in September, and the plants were out of flower; the fruiting spike illustrated in Engler's *Das Pflanzenreich* shows only a sessile spadix-appendage typical of the members of the group Attenuata: "*Spatha ignota*," Engler says, meaning the spathe is unknown. The figure illustrates a one-leafed specimen with five leaflets, much in the style of *A. yunnanense*. This species has been brought into cultivation again by the Botanic Garden of Moscow and distributed through the NARGS Seed Exchange. Let us note that the first pictures of plants grown from these seeds match Engler's description quite well. When in Dali, we saw many specimens in flower, and, amazingly, we noticed plants with three and five leaflets and one or two leaves growing side by side, sometimes variegated, all with the same inflorescences. All these "species" obviously appear to be nothing more than variations on a common theme and fall in the normal variation range of *A. yunnanense*. Remember that arisaemas are unsurpassable in this regard.

Arisaemas are exceptional among the aroids in their paradioecious behavior: every new growing season, depending for example on environmental conditions, the spadix bears male flowers only when the corm is small or on weak specimens. Adult specimens, under good conditions, usually develop female flowers only. That is the rule for *A. yunnanense* and *A. bathycoleum*. On the other hand, other species, such as *A. tortuosum*, bear bisexual spadices when mature. This is what happens with the two following members of the Attenuata.

Arisaema prazeri Hook. f. is not endemic to China. It is widespread in the border regions of southern Yunnan, northern Thailand, and northern Myanmar (Burma) at low altitude, below 1,800 m, and enjoys more tropical conditions. All authors agree to put this species in the vicinity of *A. yunnanense*. It has one or two trifoliate leaves, shortly petiolulate leaflets, green inflorescence, and an elongate spadix-appendix, 8-10 cm long. Nevertheless, some differences can be pointed out, such as an inflorescence sometimes slightly glaucous and purple-tinged in its upper part and, as already above-mentioned, a bisexual spadix when mature.

Let us point out that, in the past, most arisaemas were collected by one traveller, often a missionary, a diplomat, etc., and described later by a different person on the basis of a few, even just one or two, pressed herbari-

um specimens. It was thus impossible for botanists, working in their offices, to appreciate the natural variations and evaluate the possible synonymies. Today these descriptions still spread confusion in *Arisaema* taxonomy.

On the other hand, *A. odoratum* J. Murata et S.K. Wu is a simple case. It has recently been discovered by a Sino-Japanese expedition (1993) in an area northwest of Kunming, around 1,400 m. According to the original description, *A. odoratum* looks like a small version of *A. yunnanense*, but with a white flower, a bisexual spadix, and a chromosome number which is one of the smallest of all arisaemas, 2n=22, rather than the usual count of 2n=28. A color photo of a flowering specimen taken in the wild illustrated the original paper. Moreover, the description is based on living specimens observed in their native habitat, and so little confusion is possible.

We have yet to see any specimen of *A. odoratum* which, to our knowledge, is not yet in cultivation. We are all impatient for seed to become available. Then we could appreciate its fragrant inflorescence, said to smell of *Michelia champaca* or of jasmine. Let us hope that botanic gardens who have it now in cultivation will contribute to its distribution—perhaps again through that great institution, the NARGS Seed Exchange.

Guy Gusman travels widely in Asia, where he discovered the charms of arisaemas. Now he grows them in his woodland garden near Brussels. He frequently visits libraries and herbariums, where he takes notes on specimens and photographs them.

ARISAEMAS IN THE 1990S

AN UPDATE ON A MODERN FASHION

by Jim McClements

The evolution of arisaemas into popular plants for woodland and shady rock gardens has occurred, at least in North America, largely in this decade. While many species of this genus were appreciated and cultivated by a select few here as well as in Europe and Japan prior to the 1990s, it has only been recently that large numbers of gardeners have become interested in them.

As one who has been perhaps slightly "ahead of the curve" in this regard, I can relate closely to this phenomenon. Prior to the late '80s, when I became a "serious" gardener, I considered "Jack-in-the-Pulpit" to be a somewhat weedy curiosity in the spectrum of native plants. It was when I first saw *Arisaema sikokianum* pictured in an article by Judy Glattstein in *Fine Gardening* in 1989, and later in the "flesh" in Harold Epstein's garden, that I was thoroughly bitten by the bug and launched an effort to acquire and grow as many species of *Arisaema* as possible. I would bet that *A. sikokianum* has inspired many others to do the same.

Why all the new-found interest and popularity? While almost anyone will agree that *A. sikokianum* and *A. candidissimum* are spectacularly beautiful, most gardeners would consider the other species to range from moderately attractive, through interesting, to downright ugly— although I myself would be hard-pressed to name one of the latter. Of course, I know people who consider some trilliums not to be garden worthy. There's no accounting for taste!

Perhaps the foremost reason for arisaemas to be suddenly one of the "in" genera is the upturn in woodland and shade gardening. More of us find ourselves living in shaded spots, particularly in areas with warm summers, and are looking for plants which will grow with little or no sun and still provide flowers and foliage interest through the spring and summer, all requirements which arisaemas meet nicely. Most have quite attractive, occasionally variegated, foliage of all different shapes and sizes, usually persisting into the fall months. Flowering occurs at different times in different species, with *A. sikokianum, A. ringens* and other Japanese species coming on in early spring, followed by a sequence of bloom of the other species into early

July. Woodland gardeners find this most helpful in keeping things interesting after the first flush of spring ephemerals has run its course.

In second place is probably the increasing availability of these plants. Unlike the aforementioned trilliums, arisaemas are easy to grow from seed, with the beauties, *A. sikokianum* and *A. candidissimum*, being among the easiest. Seeds need no cold period, and seed-to-flowering time can be compressed by using "artificial winters," thus getting two growing seasons into one calendar year. It was not long ago that *A. sikokianum* was being sold by a well-known nursery for upwards of $50 per plant and seeds were about $1 apiece. That has changed dramatically, and is changing for *A. candidissimum* as we write. While there is no question that many of the Asiatic *Arisaema* now being sold are being wild-collected, this should be a short-lived problem as production from seed catches up with demand, unlike the continued collecting pressure on trilliums and other natives that are difficult to grow commercially.

The third factor that has attracted me to the genus has to do with the perception that with arisaemas there seems to be a reachable, finite goal for the plant collector! Most male readers will relate to the boyhood urge to collect stuff, a habit that many of us have not quite outgrown. (This trait does not seem to carry over to the female of the species, being probably a remnant of the "hunter-gatherer" role of the caveman.) I'm sure that I would be incredibly wealthy today if my mother, and later my wife, had not thrown out all of my boyhood treasures! So far at least, my wife is not throwing out arisaemas, and with a total of about 150 species available in the world, growing them ALL is not out of the question! I think you get the idea.

The last interesting attribute of the genus to be mentioned for this brief discussion is the fascinating "sexual orientation" of arisaemas. This has been variously described as being "paradioecious" or exhibiting "sequential hermaphroditism," which has a nice ring to it. What it boils down to is this: Most species are dioecious (bearing tiny flowers of only ONE sex on the spadix). Young plants start off as male. When they build up enough strength (translate: starch stored in the corm) they either abruptly or gradually (depending on the species) become female, now having the stamina for motherhood (seed production). A few species remain bisexual (*A. tortuosum* and *A. flavum*, for example), while most eventually become totally female (no male flowers), and stay that way unless something happens that reduces their strength (drought, being stepped on, etc.) in which case they may revert to the male status and only produce pollen until they have regained enough stored energy to make seed again. Several interesting papers have been written on this subject, but I've given you the gist of it.

Communication over the internet has brought networking to the fanciers of arisaemas. In the past year I have been exchanging e-mail with fellow *aficionados* from New Zealand to Europe, as well as from all over North America. Aroid-L is a group, similar to Alpine-L, communicating by e-mail, through which a fair amount of *Arisaema* information is exchanged (although many of the contributors are interested only in tropical aroids.)

Earlier this year a brand new list, Arisaema-L, has been started as a spin-off from Aroid-L. This has resulted largely from the activities of the AEG (Arisaema Enthusiasts Group), founded by Ray Stillwell of Raleigh, North

Carolina, which up to now has been an informal seed and information exchange, accessible by both e-mail and snail-mail, where those interested in the genus can obtain much literature, including keys to the Asiatic species made available by John Wurdack, a long-time NARGS member, and one of the few who were growing arisaemas long before the rest of us.

Also on the internet is an arisaema web page, complete with color photos of many species, compiled by NARGS member Roy Herold and considered by many to be the best example of a horticultural web page on the net.

What is desperately needed at this time is a comprehensive book on arisaemas and the development of a taxonomic treatment that combines the species from different parts of the world into an intelligible key, eliminating the confusion, synonymy, and duplication that exists. Most of the species are native to Asia, and while the Japanese, Chinese, Nepalese, and Taiwanese species have been written about separately and fairly extensively keys provided, the species overlap throughout Asia, and the same plant may have two or three different names, having been found and described by different people in different countries, perhaps only one mountain range apart! A step in the right direction has been the almost universal acceptance of dividing the genus into 13 sections. We'll have to await further developments along this line.

The article which precedes this on one of the 13 sections of the genus *Arisaema* is partly a result of the networking described above. Guy Gusman, the author, and I have been exchanging e-mail regularly for the past year or so between Dover, Delaware and Brussels, Belgium. We often write two or three times weekly, which would have been impossible without e-mail, where at least two weeks would have passed between letters. I think that Guy may be the one who will do the needed definitive work on clarifying the genus, certainly being the most knowledgeable about it of all those with whom I'm in contact. He has explored for *Arisaema* in the wild all over Asia and grows more different species in his garden than I knew existed a year ago.

The more we know about these plants, the more fun it gets to be!

Jim McClements gardens in Dover, Delaware, where he says it is too hot for rock gardening, so he gardens in the woods. Major interests include trilliums, arisaemas, and anything else weird that will grow in the shade.

Hymenocallis occidentalis

Spider Lilies

Hardy Native Amaryllids

by Don Hackenberry

Spider lilies are among the serendipitous discoveries that await when you venture into our Southeastern wetlands. They are at their most diverse in Florida, where there are six to eleven species, depending on who is counting. But one or another can be found from North Carolina to Texas. Most species inhabit the coastal plain, but two of them, *Hymenocallis coronaria* (Le Conte) Kunth and *H. occidentalis* (Le Conte) Kunth, have made their homes farther inland and upland than the others, and this renders them more eminent candidates for cultivation in northern gardens. In both of them, from a robust daffodil-like bulb rise sturdy daffodil-like leaves in spring. They are slow to enter summer aestivation, and at least some trace of them may remain in August (the time may vary), when a stout scape rises, and bears at its top, in an umbel, about eight white flowers (two or three open at once) with six, long, narrow perianth segments joined toward the base by a delicate membrane. This is its corona. Some members of the Amaryllidaceae have a corona, some don't. Some, such as *Galanthus*, employ their petals as corona substitutes. *Hymenocallis'* petals and sepals will last, but one storm will suffice to damage the thin membrane. And insects may eat holes in it, too. But while weather events are on hold, the spider lily is a creature of elegant beauty, and it is the membrane that makes it especially beautiful. With some imagination, one can visualize both the spider and the web, but it is better to cast aside imagination and contemplate it in its own uniqueness.

A couple months later, it bears its seeds: green jelly beans! The thick, fleshy seed coat is an integral and inseparable component of the seed package. Its removal is terminal to the seed inside. The seed drops from the plant before it is mature. Then the green coat, lying on the surface in the sunlight, performs photosynthesis and further develops the seed. One may guess that premature disbursal serves dispersal. Also, the seed is kept moist and is less cold stressed at ground level. This way of delivering one's progeny, prematurely but with both provisions and the means of making them, was one of Norman Deno's most amazing discoveries in the course of his investigation of seed germination. Is

there any other plant that does this? Quite possibly, but none that I know of.

The specifiable trait that differentiates *H. coronaria* and *H. occidentalis* is the filament's point of attachment to the floral tube. (In *Narcissus*, this is one of the points of distinction among sections of the genus.) In *H. coronaria*, the filaments arise from the lobes; in *H. occidentalis*, from the sinuses, the points of constriction between the lobes. Both *H. coronaria* and *H. occidentalis* have comrade species on the coastal plain who share their way of attaching the filaments. If one judged from morphology alone it would appear that each is more closely allied to one of those two groups of species than to each other. In addition to definable attributes, they also differ in "general aspect," and it is often the qualities one cannot enumerate that really count.

I have not used the admittedly earlier epithet *H. caroliniana* (L.) Herbert, because so far I have not been able to determine to which entity the original specimen should be referred. A Linnean specimen is a sacrosanct object, more suited to veneration than scientific investigation.

Hymenocallis coronaria is a plant of rock river shoals. It also grows on the banks and on rock islands in the river. The soil is always alluvial sand, enriched by soluble nutrient minerals released from the bluffs above the river. It grows in partial shade, or else the "full" sun of a clearing, rather than the full sun of an open field. It expects to have its competition, such as alder seedlings, scoured out and away by seasonal floods. Where there are rocks, it has anchorage and stays put when flooded. Hopefully. It also occurs in wet woods, but its distribution is flood determined. Often you will see it actually out in the river, where it is shallow. To see it growing in the moving water is a special joy, but raises the question, "how did it get there?" Did a seed first swim and then sink, or was a bulb dislodged and then deposited?

It is best known along and above the Fall Line, the division between the piedmont and coastal plain, especially in Georgia, and also in Alabama. It occurs on the inner Gulf Coastal Plain, and enters Florida, but does not approach the coast. There is only one population in North Carolina, along the Catawba River at the foot of the Blue Ridge, not very far east of Asheville. "Its bulbs were nestled between rocks just below the water surface, with its strong roots twined firmly around the rocks." (Flory, 1978) Dr. Wherry collected it there; his plants were found to have 44 chromosomes. The same chromosome number was found in a Savannah River population. *Hymenocallis coronaria's* easternmost known occurrence is at the Savannah River bluffs in Aiken County, South Carolina. Nowadays, it would be hindered from establishing itself farther downstream by levees and flood controls, but the real reason it does not reach the Atlantic Coastal Plain is the absence of rocks.

The epicenter of *Hymenocallis occidentalis* is the Cumberland Plateau, which occupies central Kentucky and Tennessee, and northern Alabama. There you will find it on streambanks, hillsides, and meadows. The populations tend to be infrequent but large. From that stronghold, its range extends north and west to southern Indiana and Illinois, and Missouri, south to the inner Gulf Coastal Plain (the region where more field investigation is most needed), and east, so that it too has one population in North Carolina, on a rich hillside bordering a stream in Cherokee County. Its normal chromosome number is 54. Along with the differences in floral characteristics and

habitats, the different number of chromosomes confirms that *H. coronaria* and *H. occidentalis* are distinct entities.

One more species, *H. bidentata* Small, occurs only away from the coast, at the southern end of the Appalachians in Alabama. I know nothing about it other than that it exists, but I mean to investigate. Subsequent authors have assumed that it is a nonentity, but contemporary botanists, especially those who actually do field work (the truth is out there), are moving beyond the lumper reflexes that prevailed in the mid-century and gaining a fresh appreciation of John Kunkel Small. One of the motives is that now the most munificent research funders are environmental agencies and organizations, who are in the business of saving things, not consigning them to oblivion.

In the garden, the spider lily is a robust, vigorous plant. It expects to be well fed. It will increase, but rather more slowly than *Leucojum*, *Lycoris*, or *Narcissus*. With *Leucojum aestivum*, a moist site is a nice extra; it will persist just as well in mesic conditions with occasional dry spells. Moisture is not an option for *Hymenocallis*. In a normally mesic site, it will grow happily for several years, then, come a drought, disappear without notice. It does not express stress. In fact, it may flower after the fatal stress has occurred. The site need not be very wet, but it must never become dry. I recommend a deeply dug hole in the ground, lined with a plastic sheet, then filled with a mixture of soil, sand, peat, and leafmold, with mineral fertilizer added. (*Hymenocallis* is pH tolerant.) This should be sited in light, partial shade, and the shade source should be periodically pruned. Its roots should be pruned, too, if they find their way into the lined bed, which will without fail attract them. One who creates gardens as well as grows plants will find ways to translate these counsels into an attractive pondside scene; but if you want authenticity, make it a rocky, flowing body of water.

Like some other members of its family, *Hymenocallis* dislikes disturbance but recovers from it well. It can be left undisturbed to form large clumps, but I want to increase it. The

best time to lift and divide is early in spring, before it sends up its leaves. Plunge the bulbs in a bucket or tub of water, wash off the soil, then seesaw the bulbs and ease them apart, to avoid breaking the roots. It should be assumed that there is practically no time when the plant is completely dormant.

That is one reason why you won't find this bulbous subject in a bulb catalog or bulb book. (They will proffer definitely tender species from south of the border, ones that suffer dry storage.). The other is that, despite their hardiness and attractiveness, these *Hymenocallis* are little known, let alone grown, beyond their native regions. Certainly both *H. coronaria* and *H. occidentalis* are hardy in the Middle Atlantic States, and probably somewhat farther north. It is possible that they cannot adapt to the climates of England and the Pacific Northwest, but I think it more likely that gardeners there have not had the opportunity to observe them in their native habitats, or read the habitat descriptions of others, and extrapolate from these how to grow them. I have no idea how many gardeners successfully grow either species, or how many have tried and failed; I haven't received feedback. The way to fail is to assume that this bulb grows like any other and not seek to learn its needs. But when you seek, it will need to be with perseverance. The sources one normally consults are silent. It is amazing to check book after book, some of them otherwise comprehensive, and find no mention even that these plants exist. How could all those eminent authors have overlooked them? These are not nondescript bagatelles; they are bold and assertive. To see them is exhilarating and memorable, and the memory will be associated with enjoyable adventures. They are "plants that merit attention," and well reward it.

ACKNOWLEDGMENT. Special thanks are due to Patrick McMillan, who told me of the plants' distinctions and habitats, especially of the relationship of distribution and habitat maintenance to flooding, and referred me to the literature.

REFERENCES

Deno, Norman C. 1993. *Seed Germination Theory and Practice. Second Edition*. State College, Pennsylvania.

Flory, Walter S. 1975. "Chromosome Numbers for Several Species of *Hymenocallis*." *Plant Life* 31:56-63.

1976. "Distribution, Chromosome Numbers and Types of Various Species and Taxa of *Hymenocallis*." *The Nucleus* 19(3):204-227.

1978. "Known Distribution of *Hymenocallis* Salisbury in North and Middle America and the West Indies." *Plant Life* 34:47-59.

Godfrey, Robert K. and J. W. Wooten. 1979. *Aquatic and Wetland Plants of Southeastern United States: Monocotyledons*. The University of Georgia Press, Athens.

Small, J.K. 1933. *Manual of the Southeastern Flora*. New York.

Don Hackenberry is owner and proprietor of Appalachian Wildflower Nursery in Reedsville, Pennsylvania. He has grown, propagated, and distributed a wide array of native and exotic bulbs, herbaceous and woody plants—including spider lilies. Photo by the author.

Arie Peterse discusses *T. clusiana* with Carlos Van de Vech

photos, Brent Heath

Muscari armeniacum in field, Von Gentem, Carlos Van de Vech

Inspecting hybrid species tulips photos, Brent Heath

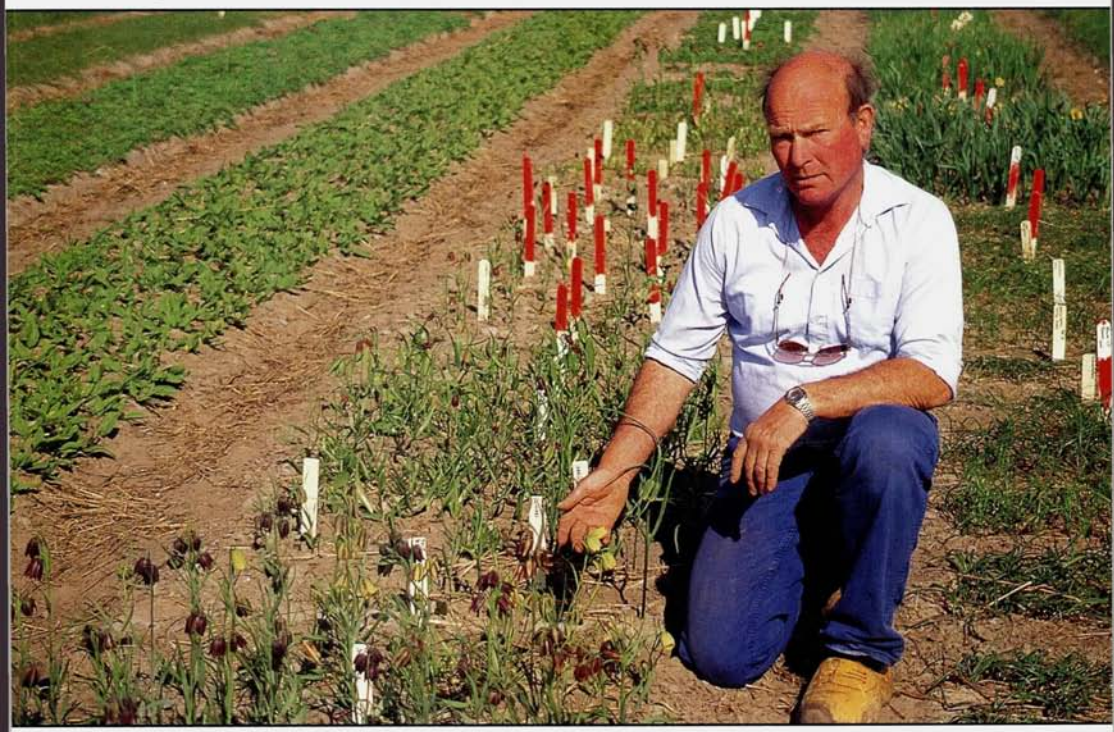
Win Van Lierop, rogueing species hybrid tulips (p. 119)

Willem Van Eeden checking *Erythronium* seedlings (p. 118) photos, Brent Heath

Mr. Kruyer and Brent Heath inspecting *Erythronium* 'Pagoda' (p. 282)

Tractor combining tulip flowers Brent Heath

Jap Zweris in *Fritillaria* trial field; *Erythronium* production on right (p. 118)



SPECIALTY BULBS

IN THE HOLLAND INDUSTRY

by Brent and Becky Heath

The specialty bulb industry in Holland is alive and well. Specialty bulbs include all sorts of bulbs other than the major bulb crops of tulips, daffodils, hyacinths, lilies, and gladiolus. Many are those minor bulbs that we rock gardeners are so crazy about. This industry has been fueled by the demand for these little bulbs, largely from European and American gardeners. Great Britain remains the largest market

This industry has flourished in spite of all of the negative publicity the little bulbs have gotten from the overzealous conservation groups, who assumed that most of the species bulbs were being collected in the wild. On the contrary, growers in Holland have spent countless time, effort, and money to learn how to successfully propagate these wonderful little beauties from seed, division, and micropropagation. Sales are excellent for bulbs that both naturalize and perennialize in our gardens. Below are some statistics on the number of hectares of various minor bulbs grown. There are 10,000 square meters to a hectare and 300 to 500 bulbs per square meter, so anywhere from three million to five million bulbs per hectare. You can see that quite a few small bulbs are produced in Holland annually.

Minor bulbs (including *Galanthus, Fritillaria, Anemone*, etc.)	150.4
Crocus chrysanthus hybrids	134.3
Species tulips	103.4
Muscari	101.2
Allium	81.1
Crocus species	59.4
Iris reticulata and hybrids	34.5
Scilla	33.8
Chionodoxa	18.8
Narcissus species	15.5
Hyacinthoides	10.1
Puschkinia	6.3

There are over 3500 bulb growers in Holland, and at present about one quarter grow some type of small bulbs. Some 20 or 30 specialize in small bulb production. Several of these growers stand out because of their hybridizing programs, innovative propagation methods, or work in bringing species or new cultivars into production.

The de Goede brothers, Wim and Cees, have learned to propagate many fritillaries, *Calochortus, Dichelostemma,*

Willem Van Eeden still grows bulbs in the old-fashioned way—but very well

and other species native to North America on their farm in Breezand, in the north province of Holland in an old lake bottom ten meters below sea level (see article, p. 120).

Willem Van Eeden is a wonderful, modest gentleman bulb grower (photo, p. 115), a hybridizer of the old school, who lives and grows his bulbs in the historic town of Noordwijk in southern Holland just inside the dunes. Willem comes from a long line of bulb growers and has spent his life collecting, hybridizing, and propagating unusual kinds of bulbs. He is the gentleman who has given us *Iris reticulata* hybrids 'Ernest', 'Ida', 'Gordon', 'Michael'. He has also produced and introduced several very showy selections of *Erythronium*. He has perhaps the largest commercial collection of specialty bulbs in Holland. He produces his bulbs in a half-hectare plot in the city of Noordwijk in a micro climate surrounded by buildings and in several larger fields just outside of town. Many of Willem's bulbs came from seed that were sent by friends around the world. For Willem, his bulbs are his life's labor and love.

Jap Zweris is a gentleman who after retiring as a grower of lilies, and the large daffodils and tulips, has concentrated on collecting and propagating rare and interesting bulbs of the world (photo, p. 116). His specialties seem to be his collection of *Erythronium dens-canis* and its hybrids, a myriad of *Fritillaria*, many types of *Muscari*, and species *Narcissus*, but his collection spans many more genera. Most exciting to me is his success in propagating species *Narcissus* such as *N. rupicola*, *N. scaberulus*, and *N. triandrus*. He often builds up stock of rare bulbs and then auctions them off to other growers to keep on growing and offer to the trade. He grows his bulbs in an area of North Holland called Zijpe, which was once an inlet from the North Sea.

Several other notable men of the small bulb industry whom I would like to mention include Cees Van Roon, the respected bulb expert from

Parting narcissus bulbs with ring armed with utility knife blades

Wim de Goede and Carlos Van de Veek in Fritillaria *propagation house*

the largest brokerage house of small bulbs. C. S. Weijers in Hillegom has spent his lifetime learning about these bulbs and keeping track of who grows what, when, why, and how. He generously shares this knowledge with those companies who patronize his firm. He is a virtual encyclopedia of the culture and handling of small bulbs.

Jan Bijl is another successful bulb grower, who in his retirement has bred alliums such as 'Globemaster' and collected and distributed countless more kinds of bulbs to other growers. He is instrumental in keeping the collection of historic bulbs at the *Hortus Bulborum* in Limmen, a wonderful bulb museum of varieties and cultivars seldom still found in the trade.

The five Van Lierop brothers have successfully built one of the largest and best bulb farms in Holland (photo, p. 114), with a diversity of genera of bulbs including incredible selections of species tulips and species tulip hybrids, a more vigorous form of *Allium moly* named 'Jeannine', *Chionodoxa, Muscari latifolium,* and others—all of which they produce by the millions.

This is just a sampling of the most significant growers I have encountered, who through their efforts in hybridizing and perfection of propagation methods have influenced our world of bulbs suitable for the rock garden and have been responsible for the availability of the little garden jewels. We have these gentlemen and the rest of the bulb industry to thank for their dedication in providing the material for our gardens. So many hours of pleasurable recreation and countless smiles are generated in turn by all the beauty that the team of hybridizer, grower, and gardener provide.

Brent and Becky Heath are proprietors of The Daffodil Mart and enthusiastic growers of and searchers for bulbs. Photos by Brent Heath.

From California
to a Holland Bulb Grower

by W. H. de Goede

Here is my story about growing and selecting wild bulb species from America, and in particular from California. In 1983 I travelled for the first time to America, in search of the red *Fritillaria recurva* (photo, p. 91). I had no idea how big California was, nor of the treasures that awaited me, and without help I think I would not have found anything. I was lucky to make the acquaintance of Wayne Roderick, an American botanist who lives in California and knows almost every plant, tree, and bulb growing in the state. From that time on the search was not so difficult.

After my first trip in 1983, I came home with about five or six species of *Fritillaria* and five species of *Erythronium*. We lost almost all. After the second trip in 1984 we knew what we had done wrong, and so we treated the bulbs in a completely different way and almost all survived. I made two more trips, one in 1985 and another in 1987.

Now we are growing the following selection of American species: 18 species of *Fritillaria*, 4 of Brodiaea (sometimes classified as *Dichelostemma*), 31 *Calochortus*, and 1 *Odontostomum*.

From the beginning we said we would try to grow the American bulbs, but they would have to be grown in an open field outside. Another reason we wanted to try to grow them was to obtain breeder's rights to varieties which we might think were of commercial interest. That means, when we grow a species, from whatever genus, we must evaluate whether it will be good enough for commercial production. We try to select good forms and to test how they grow, increase, whether the bulb can be forced well, if it is good as a pot plant, useful as a cut flower, etc.

Then we have other problems. First we must find a way to grow it, discover whether it is hardy or not, whether it is commercially productive enough. Then we must promote the new species or selection, which means obtaining good photographs, and building up interest in it so that retailers and wholesalers will carry it in their catalogs. This takes much time and energy.

At the moment we are able to offer *Fritillaria* 'Goldilocks', a select form of *Fritillaria glauca*; *F. biflora* 'Martha Roderick'; *F. pudica* 'Fragrance'; *F. eastwoodiae*;

Dichelostemma ida-maia; Triteleiea ixioides 'Starlight'; *Calochortus* 'Golden Orb', a select form of *C. luteus*. All the other species we grow we offer in very small quantities to the wholesale or retail market.

We think there will be a large market for *Calochortus* especially the mariposa types. We can grow them very well, and it looks as though with a special treatment we can bring them to flower the whole year through. That is very important for the cut flower market and means big sales. I believe that in the next five years, we will be able to supply more than 16 different species or selections of species of *Calochortus*, wonderful plants from America.

I hope I made clear that the names of the special bulbs you read in this article and many more will be offered in the future in catalogs in your country. They are not collected from the wild in California but rather have been grown in Breezand in the Netherlands.

Breezand is the largest bulb growing area in Holland. It is also the newest and the best area for growing flower bulbs. The de Goede brothers, Wim and Cees, have 30 hectares of regular bulbs (*Anemone blanda, Fritillaria meleagris*, species tulips, and a few types of standard tulips and daffodils). On a hectare and a half they grow the specialty bulbs discussed above.

The de Goedes have a state-of-the-art warehouse with the best equipment for treating and handling all of the unusual bulbs they grow. They are among the best growers in Holland, producing some of the finest quality bulbs.

They are second-generation growers; their father started the nursery in 1918. Their sons plan to carry on the business into another generation. Three more of Wim's brothers are in the flower bulb business in Washington State.

[one hectare=10,000 sq. meters=2.47 acres]

Kniphofia 'Little Maid'
by
Susan Whittesley

KNIPHOFIA NOTES

by Panayoti Kelaidis

There is a certain subspecies of alpine gardener who grows only saxifrages and androsaces, condescending occasionally to grow one of the *smaller* primulas, perhaps, or the occasional respectable bulb, like a *bona fide* alpine crocus, say. I suspect that if you read past the title of this article you are not this sort of rock gardener, since no hardy plant is less conventionally alpine in appearance than torch lilies.

And yet towering *Meconopsis* and rhubarbs in the Himalayas, various thistles and giant gentians in the Alps and Rockies grow far above treeline. Nowhere is tundra more amazingly diverse and exuberant than in the high Drakensberg and neighboring mountains of South Africa. Here *Dierama robustum* can tower to over two meters, *Phygelius* and *Geranium robustum* form shrubby masses to a meter, unknown and wonderful perennials like *Gomphostigma virgata* in the Loganaceae spire like a *Lysimachia ephemerum* on steroids. What to make of giant *Moraea alticola* and nearby several species of helichrysum and euryops also growing well over a meter among the dense mats of more conventional looking alpines?

And everywhere you look, new species of *Kniphofia* appear in every imaginable variation of foliage and habit:—including tiny rock dwellers that could insinuate themselves into most respectable rock gardens without too many visitors smirking. And yet other species tower higher than you would dream possible or form huge, almost succulent mounds along streams and in seeps. Fastidious gardeners insist on relegating these to desert or succulent gardens, their boggy homes and alpine credentials notwithstanding.

When I first started gardening as a child, tritomas (as we then called them) were the only African plants even occasionally grown in continental American gardens. I remember planting four or five "species" grown from European botanic gardens. They all looked suspiciously similar to one another: indeed they looked pretty much like *Kniphofia uvaria* (so called) sold by nurseries all around Denver. I now suspect that most of what is grown and sold in the United States has very little *K. uvaria* in it and represents one or more species of silvery-leaved, drought-tolerant plants allied

to *Kniphofia ensifolia*. They are so wildly successful on our hottest banks—blooming prodigally for a month or more in early summer—I am not apt to ever eliminate them altogether. And yet, as I grow more and more authentic species from wild-collected seed, I realize that you can no more say you have grown *Kniphofia* based on the cultivated hybrids than you can say you've sampled the genus *Iris* after you've grown a few tall bearded cultivars.

The *Kniphofia* you are perhaps most apt to encounter in the high Drakensberg is *Kniphofia caulescens* (photo, p. 128). From a distance it may remind you of one of the old garden hybrids, but the more you see this, and once you grow it, you will find it to be utterly distinctive. For one thing, the leaves are a wonderful, bright blue color with an almost glaucous texture I haven't seen in the more familiar types. There seems to be quite a bit of subtle variation in the flowers, but all have particularly showy exerted anthers. The form I am growing now has white flowers that age to a rich crimson, although yellow tints seemed common in nature. I am told that old plants develop a trunk with time, like some sort of *Cordyline*. In nature, it often formed immense colonies—particularly in the Cape Drackensberg around Naude's Nek (photo, p. 127) or Sani Pass. I saw plants that matched these closely both on the cliffs at Mount-aux-Sources, and on top of Platberg well to the north of the Natal Drakensberg—a range of many hundreds of miles.

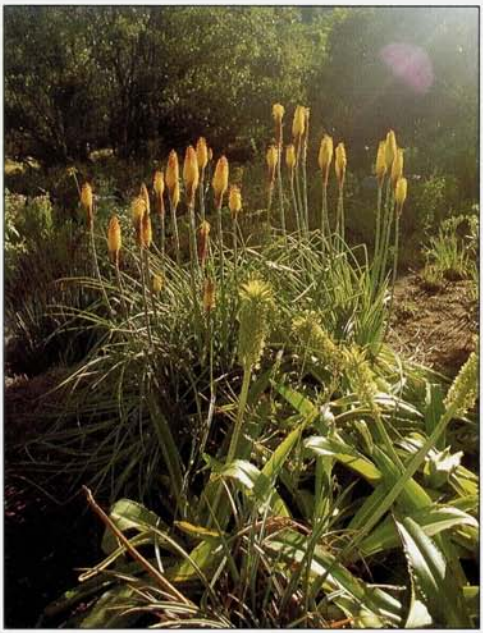
Occasionally growing near *K. caulescens*, although blooming much earlier, is perhaps the most distinctive and dramatic foliage plant in the genus. *Kniphofia northiae* must be placed with care in your garden, for this sumptuous plant can form rosettes that cover an area 5' across. The shape of a cluster of plants looks much more like a yucca than a torch lily, perhaps even more like a gargantuan tillandsia. The flowers quickly dispel this illusion: they form a huge cone of soft orange and yellow tubular flowers 2' or more long on mature specimens. This species appears to adapt readily to a wide range of garden conditions—although in nature it seemed to always grow at the highest elevations, on steep, wet slopes, often next to running water. It must be one of the first of the genus to bloom in spring, since the flowers were long past in early January in the wild—I suspect they will bloom in early May the Northern Hemisphere. Few plants make such a dramatic statement in the garden.

A wonderful assortment of kniphofias grew on the high ridges around Rhodes in the Cape Drakensberg Mountains. Three in particular impressed me with their tiny size and brilliant flowers.

Kniphofia triangularis is one of the few true species of kniphofias that has actually been available over the years. The form in cultivation—with trim cones of brilliant, tangerine flowers—looks most like plants I saw in the Natal Drakensberg midlands. On Naude's Nek I saw a brilliant, bi-colored *K. triangularis* var. *triangularis* with flowers opening a brilliant coral-red, aging a cooler shade of yellow. I encountered a closely related miniature kniphofia on Blue Mountain Pass in Lesotho, but this one had bright crimson and pure white flowers: *Kniphofia thodei* would be an outstanding acquisition if we can obtain starts: is anyone growing it?

Not many miles away, a steep east facing slope was covered with an incredible quantity of the tiniest kniphofia I saw on my travels: *Kniphofia hirsuta* (photo, p. 128) forms a lax, flat, silvery rosette less than a foot across that really is covered with hairs!

Kniphofia rufa (p. 129)



Kniphofia at Kirstenbosch Botanic Gardens

Kniphofia acraea (p. 129)

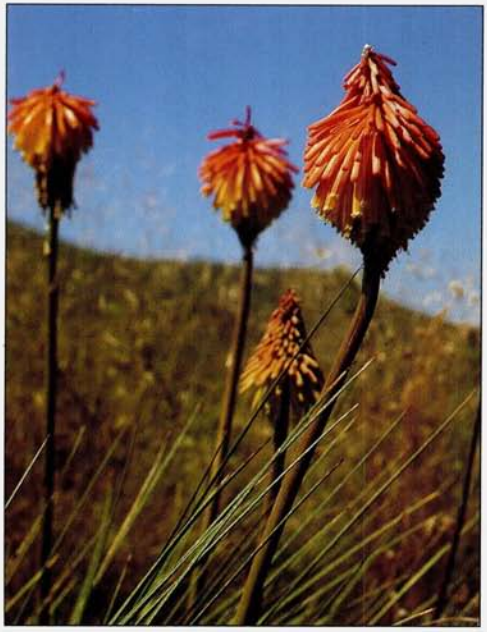
Kniphofia porphyrantha on Platberg

Sani Top, South Africa

Panayoti Kelaidis

Kniphofia at Injesuti (p. 129)
Ernest O'Byrne

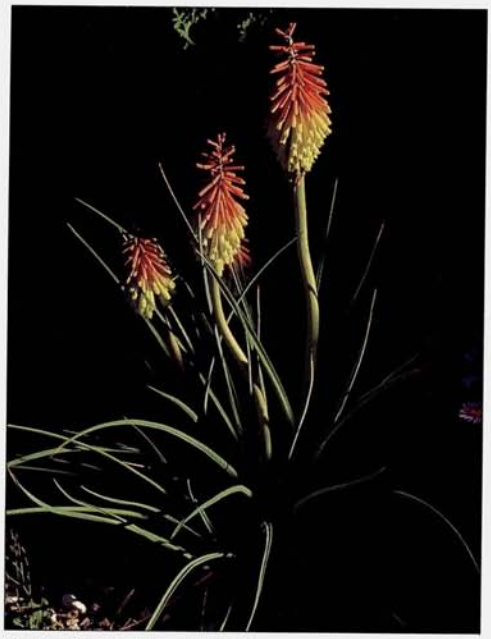
Kniphofia stricta (p. 129)



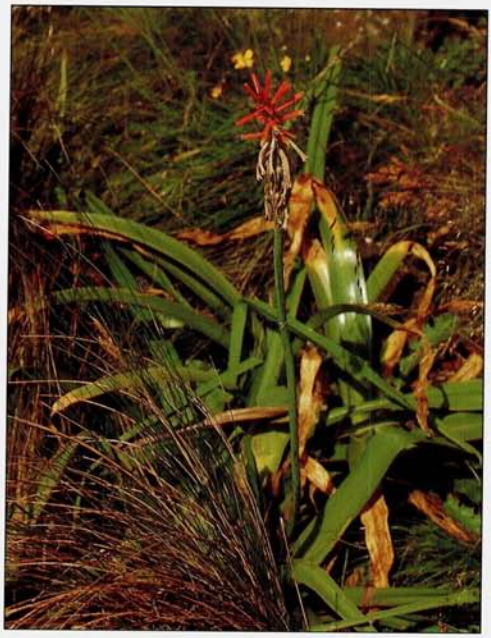
Kniphofia caulescens on Naude's Nek (p. 124)

Kniphofia porphyrantha (p. 129)

Kniphofia sp. at Injesuti (p. 129)
Ernest O'Byrne

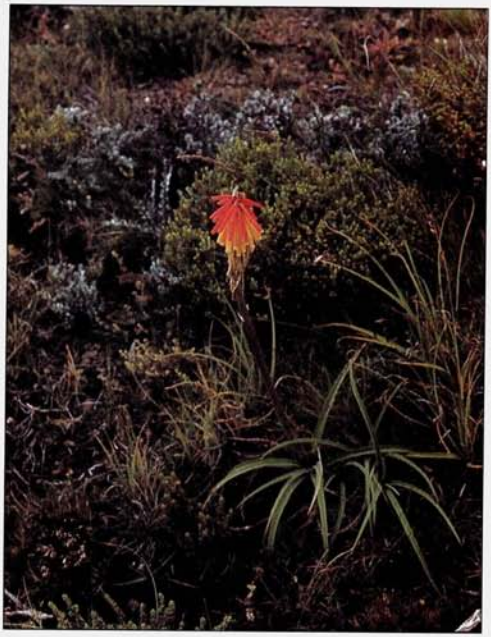


Kniphofia stricta (p. 129)

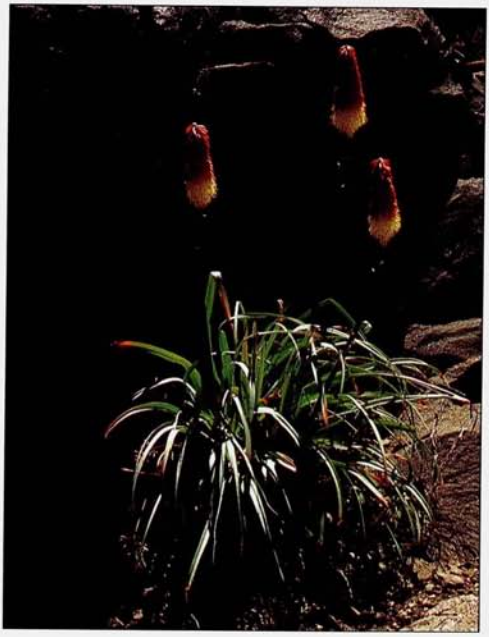


Kniphofia ritualis (p. 129)

Kniphofia hirsuta (p. 124)



Kniphofia caulescens (p. 124)



The stems are usually under a foot tall, with bright, two-toned flowers of crimson and creamy yellow. This is sure to become a popular plant for larger scale rock gardens in time: it's really quite a stunner.

A few miles away, another hillside had myriad clumps of a narrow-leaved, bristly rosettes with relatively short stems. Here the flowers were a peculiar blend of lime, chartreuse, and muted orange, irresistably subtle (photo, p. 126, 128). This high alpine form of the widespread *Kniphofia stricta* is a wonderful, long-blooming plant in the garden. Lower elevation forms can have much brighter cones of hot orange that are nevertheless attractive.

Here and there throughout the eastern foothills of the Drakensberg you are very likely to find variable representatives of a group of species with some of the most distinctive flower forms in the genus. Rather than forming the characteristic cone-shaped inflorescence, the species allied to *K. laxiflora, K. ichopensis,* and *K. rufa* make very lax heads with flowers clearly separated from one another. These vary tremendously in size, habit, and color—cool greenish forms are common, as are more typical yellows and oranges. *Kniphofia rufa* (photo, p. 125) is a rather mysterious entity that can occur in a bright orange form, as I found it on the Little Berg south of Underberg, growing on a cool slope with *Helichrysum adenocarpum* and bright purple *Dierama latifolia.*

One of the most amazing kniphofias I have ever seen photographed is the pure white- and coral-flowered form of *K. rufa,* possibly a form of *K. ichopensis,* found by Ernie and Marietta O'Byrne on a hike they made above Injesuti in the Natal Drakensberg with David and Donna Hale in January of 1996 (photos, pp. 126, 127).

Another strange kniphofia I encountered not far from the Chain Ladder above Sentinel was *Kniphofia ritualis* (photo, p. 128). This forms very broad-leaved, shiny rosettes, with a sparser than normal head of orange flowers that fade to a dull shade of chartreuse. I have grown two other plants that were identified as this species but have narrower leaves and somewhat more congested heads of bloom—so there may be greater variability in this species, or I may have yet another taxon in my collection!

Growing much more commonly along this same trail, another miniature kniphofia captured my imagination. *Kniphofia porphyrantha* (photo, p. 127) forms very dense, low tufts of foliage, with flowers on stems often less than a foot high. They seemed to be uniformally bright, primrose yellow in color on Sentinel. The heads were also very squat compared to other species. A much longer-flowered, more crimson-colored plant was also identified as *K. porphyrantha,* growing in the woodland chasms leading to the summit of Platberg, near Harrismith. It was utterly distinct to my eyes—perhaps this is a variable taxon, or it changes dramatically as it blooms.

Another *Kniphofia* that is very unlike any in cultivation is *Kniphofia acraea* (photo, p. 125). This grows a hundred or more miles south of the Drakensberg on the summits of the Swarzhoek Mountains, north and slightly west of Cradock in the East Cape. Here, at nearly 8,000' the meadows look very much like the high Drakensberg, and winter temperatures are bitterly cold for months on end. At summer's end, a medium-sized kniphofia fills the meadow with cool, ivory-colored pokers. A lovely orange species with very different habit which occurred occasionally with it I never identified (possibly it was *K. stricta*),

but this dreamy white species is one that I continue to think of. When I finally obtained a copy of L.E. Codd's monograph on the genus, I was surprised to find it was a rather narrow endemic, restricted to this rather small range of mountains.

This discussion by no means exhausts the theme of kniphofias in South Africa: a few hours spent reading and skimming through Codd's monograph are sure to leave most gardeners in a trance. The genus is so much more variable than we'd dreamed. When will we finally grow the true *K. galpinii,* which looks delightful in its own right! Or test more of the huge, coastal species, so many of which have been hardy in far colder climates, like *K. littoralis.* Other particularly alluring species include *Kniphofia multiflora,* with attenuated spires that resemble those of *Eremurus* or *Urginea.* The flowering portion of the stem can be 80 cm long!

Possibly the most peculiar species in the genus is *Kniphofia typhoides,* likewise with long, somewhat tapering flower stems. In this species the flowers are dark purple, nearly black. Any of these giant kniphofias would certainly make a marvelous specimen plant in a perennial border or wild garden. But in larger rock gardens as well, or placed in a strategic spot in the home landscape, they provide colors and textures unimaginable in Northern Hemisphere perennials.

Lest this article be construed as yet another uncritical encomium of South African flora, let me be put on record that there are at least two really ugly kniphofias (that much I can vouch for personally, that is. There may be more!). Quite commonly, both on Bastard Voetpad and on Naude's Nek, you may see a skinny, pale, chartreusy thingum a foot or two tall with a crook in its neck. You may finally pause long enough to examine one and realize that (my heavens!), it's a kniphofia! This is *Kniphofia parviflora,* the ugly duckling of the genus. Or perhaps that honor may go to *Kniphofia brachystachya?* There may be other forms of this, but once, near Katberg, I found a colony of these with flowers the precise shade of the mud wherein they grew—halfway between gray and brown. They were so alluringly uncolorful, I regret I've never had seed of it. I confess, I'm growing *K. parviflora* already—so it may be that I'm fatally smitten after all.

Nevertheless, the genus is to a large extent alpine or at least montane. These flowers are among the brightest, most striking garden plants, and often easy to grow into the bargain. It would take a purist indeed to resist their call.

References:

L.E. Codd. 1986. "The South African Species of Kniphofia." *Bothalia* Vol 9, parts 3 & 4. Pretoria.

Source:

By far the best source for *Kniphofia* seed is Silverhill Seeds, who advertise in this bulletin.

Panayoti Kelaidis gardens in Denver, Colorado. Recent plant passions include plants of South Africa, particularly helichrysums, or anything succulent or pulvinate.

THE USEFUL BULB FRAME

by Jane McGary

I became attracted to bulbous plants when I started forcing Dutch bulbs for winter color in my cabin near Fairbanks, Alaska. I chilled the pans under my bed (where they sometimes froze solid) and flowered them under grow-lights. The profound pleasure their flowers gave me and my friends during the subarctic winters made me resolve to grow many flowering bulbs when I moved to the temperate climate of the Cascade foothills east of Portland, Oregon.

Commercially available species and hybrid bulbs did well in the garden, but reference books and seedlists led me farther afield, to plants from cold desert or warm temperate regions that would not flourish in western Oregon's cold, wet winters. British books advised growing these in a bulb frame, but I had only a vague intuitive notion of what that was. The concept was sharply clarified with the publication of Martyn Rix's *Random House Book of Bulbs*. The introduction includes a detailed description, with photo, of how to construct a bulb frame. I had an area graded and put up two 4'x 40' (1.3 m x 12 m) frames. (The larger and more massive the frame, the more temperature moderation it offers.)

I followed Rix's suggestions closely, using railroad ties for the base, which rises about 18" (45 cm) above ground level. The ties were secured with scraps of wood nailed across them on the inside and leveled with more scraps. To exclude burrowing rodents, I lined the bottom with galvanized aviary wire (similar to chicken wire but with a smaller mesh), stapling it to the ties at the base.

The bottom layer of fill is about 3" of round river gravel, which was necessary because the frames are in a low-lying area subject to surface flooding during heavy rains. The remainder of the fill consists of different mixtures in five sections of the frames: (1) a very gritty, sandy compost with plenty of dolomite lime added; (2) a similar mixture with more loam; (3) a rich peaty mixture with no lime; (4) a mixture of sand, crushed pumice, loam, peat, and aged manure, similar to my general potting soil; and (5) clay loam with added gravel. In some newer frames, planned exclusively for plunging pots as described below, the upper fill is simply coarse builder's sand.

The frame covers, constructed by a local greenhouse builder, are cedar A-frames with fully adjustable hinged lights on both sides. The glazing is acrylic, expensive but sturdy, which admits about 95% as much sunlight as glass does. British writers usually recommend Access frames for bulb frames. These aluminum frames are now available in the United States, but visiting British gardeners have advised me that Access frames can be catastrophically damaged by high wind or snow loads.

Most of the year, I leave all the lights open 12-24" to ensure good air circulation while shedding rain. During storms I lower those on the windward side but leave the leeward side open a few inches to prevent moisture buildup. On fine days when the plants are in full growth, I usually open the southern sides completely.

Last year I put up another frame of the same size but with less elaborate glazing. Its lights are fiberglass in lightweight wooden frames and can be removed completely. This frame will be devoted to less sensitive species that do well exposed to the weather here, covered only during very cold weather or the infrequent summer rains. This will also be a good place to germinate seeds that enjoy exposure to winter rain.

Why grow bulbs in a frame rather than in an alpine house? First, frames are much cheaper and easier to erect and maintain. A frame is unlikely to fly away in a windstorm—an all-too-common fate of greenhouses in this area. Frames are less obtrusive visually, so they fit in better with landscape aesthetics or subdivision covenants. Insects are not as much of a problem in the frames as in a greenhouse, because natural predators are more likely to be present. Finally, humidity is likely to be lower in an exposed frame, an important consideration for bulbs and alpines, which need good air circulation to prevent fungal diseases. The best argument to the contrary, of course, is that an alpine house is more comfortable for the gardener.

Most visitors assume that the purpose of the frames is to keep plants warm in winter, but this is only secondary. Nonetheless, it can be important; winter lows here average 15°F (about -10°C), with little snow cover—too cold for many Southern Hemisphere and Mediterranean bulbs. During cold snaps the frame lights are shut completely. More severe cold here is accompanied by vicious east winds, but usually preceded by a snowfall, so the snow serves as insulation. If there is no snow, I lay insulating material—fiberglass batts or sheets of newspaper, for instance—directly over the plants inside the frames. I do not heat my frames, but in colder regions this could be done with soil heating cables or hot-water pipes.

The primary purpose of a bulb frame, in fact, is to control the moisture regime. Many plants have evolved the strategy of spending the dry seasons in dormancy as a bulb, corm, or enlarged rhizome. If such plants are moist during their dormant seasons, they are likely to decline and die, usually from bacterial or fungal rots. In this area July, August, and much of September are often rainless, but not always. In addition, many bulbous plants have evolved with cold, dry winters—something Oregon can never offer.

It used to be recommended that bulbs grown in the alpine house be given "a good baking" in summer. It is now recognized that this can do more harm than good. In the wild, dryland bulbs often grow at considerable depths where they are neither hot nor completely dry; moreover, grasses and

other vegetation may shade the soil during the early-growing bulbs' dormant period. The frame offers sufficient depth and soil mass to maintain a reasonably cool temperature and a trace of ground moisture, augmented by night condensation (summer nights here cool sharply) and a light sprinkling when necessary. Growers in really hot climates might want to add shade cloth, although I have not found this necessary. I do situate particularly shade-loving species against the south side of the frame, where the rise of the side wall affords extra coolness. In addition, I have a small auxiliary plunge frame for woodland bulbs in another part of the property, shaded by trees to the south.

Some of my frames, or sections of them, are reserved for plants that need some water in summer, and others for those that naturally experience no summer rainfall. I water the former about once a week in summer and keep the soil moist in winter; during very hot weather, however, I omit watering to avoid promoting disease. The dry frame is watered thoroughly in late September or early October—depending on when the ambient temperature cools off—and during the period of peak growth (February through May). During the summer I sprinkle its surface lightly from time to time to prevent the potted bulbs from becoming desiccated, but the soil is never soaked. I've been watering by hand, but it would be possible to run a water line along the peaks of the frames, with spray emitters every 8' or so.

My initial plan was to plant my bulbs directly into the various composts with which I had filled the frames. This worked for a year or so, but I rapidly acquired so many different species and varieties that keeping them separate became a problem. I have now adopted a system of growing most bulbs in deep clay pots, plunged nearly to their rims in the fill. This technique has many advantages. The potting soil can be customized, and the irrigation schedule can be

micromanaged. Very small seedling bulbs can be accommodated without fear of their going astray. A great many species can be grown in a small space without losing track of any of them (my 480 square feet of frame host about 500 species). Finally, specimens can easily be removed for exhibition or propagation.

I use standard deep clay pots of European manufacture in 4", 6", and 10" sizes, purchased wholesale. The pots have grimly permanent aluminum labels embossed with an industrial Dymo tool and affixed with 16-gauge galvanized wire. I use two basic kinds of potting soil based on coarse sand, gritty forest loam, and crushed horticultural pumice; one mix has more loam and a little peat added. I add a small amount of crushed dolomitic lime to counteract the acidity of the loam and sand.

British authors suggest using aquatic pots of plastic mesh for bulbs. This year I finally found some with mesh bottoms as well as sides in a store specializing in supplies for hydroponic gardening. I bought some large square ones to house crocuses being grown for increase, and some small round ones to plunge in my vole-infested garden. The smallest round size drops neatly into the hole made by a bulb-planting tool. Burrowing rodents have shoved one or two of these above ground level, but so far they have not invaded them. Another useful product is a heavy plastic mesh used in connection with excavations. I lined trenches in an uncovered raised bed with strips of this, with good results so far.

The local voles and deer mice have not so far invaded the frames. Chipmunks often dig in pots nearer the house, but the frames are so far from any trees that any chipmunk or squirrel venturing into them would rapidly become Malamute food. Seriously predatory dogs are a valuable adjunct to the rural garden. Feral cats probably help control smaller rodents in the frame area, though cats are not popular with either the dogs or their bird-loving owner. Birds, often accused of ravaging frame-grown plants in Europe, have never been a problem here; on the contrary, a few small birds have died after apparently flying into the raised lights.

The peaks of flowering in the frame are February to May and October and November, but there is something in bloom almost every day of the year.

During flowering the important tasks, besides dragging visitors out for a tour, include removal of dead foliage and petals (to prevent mold and rot), insect control, fertilizing, and planning for repotting. I place special labels on plants that appear crowded, so I will know which ones to repot when they go dormant.

Fertilizing bulbs grown in pots is extremely important. I add a good measure of bone meal to the potting soil to start with. This provides nutrients to the roots, which in most bulbous species grow for several months before anything appears above ground. While the plants are visible in spring (or fall), I feed them every two weeks with a half-strength solution of low-nitrogen, soluble fertilizer (Peters Root-and-Bloom), which I keep mixed in a garbage can nearby. Note that some dryland bulbs flower after their growth period ends, so the appearance of leaves, not flowers, is the signal to feed them.

Repotting takes place in late July. The old potting soil makes a good amendment for the rock garden. I pot seedling bulbs of the current year as soon as they have gone dormant. Dump the compost from the seed pot on top of the growing pot after you have installed the small bulblets; it often contains more viable seed which will germinate the following year. I don't always top-dress the pots with grit, but it is probably a good idea.

A few species are still grown directly in appropriate sections of fill rather than in pots. Some are excessively large, such as *Crinum* species or *Fritillaria persica;* others are reported in the literature to prefer an unrestricted root-run, including *Tecophilaea cyanocrocus* and *Iris winogradowii* and its hybrids. I have also grown *Tecophilaea* in a pot, but the frame-grown specimens are healthier-looking and much more free-flowering.

The only pests that frequent the frame are slugs and aphids. You must keep slug bait in the frame all year, because the slugs can remain active in this sheltered site even in cold weather. The best treatment I know of for aphids on potted plants is granular systemic insecticide (Cole's or Dexol), which is sold for use on house plants. Unlike sprays, it does not harm even delicate seedlings.

Books suggest that *Botrytis* and other bacterial and fungal diseases are serious problems in bulb frames, but I haven't had much trouble with them. I remove spent blooms from large-flowered plants such as colchicums and irises and cut off foliage that shows signs of rot. I sometimes dust bulbs with sulfur before replanting them, especially if moist tissue has been exposed during division. A good rule to follow is that most bulbous plants don't want to be hot and wet at the same time; this means watering in the evening or on cloudy days. The liberal use of crushed pumice helps prevent bulb and root rot.

Weeds love the frame, and it is best to keep the surrounding space free of vegetation with herbicide or nursery groundcloth. Windblown weed seeds are a great problem on this site surrounded by Christmas-tree farms and abandoned pasture, but they might not trouble gardeners in residential areas. Weeding must be done with great delicacy; a fondue fork is a useful tool, both here and in alpine pots. If stoloniferous weeds such as thistle invade, they can be sprayed with herbicide after all the bulbs have gone dormant. Some bulbs themselves can become weed problems: I have only recently managed to eradicate a *Nothoscordum* purchased as a "desirable garden plant." Other over-enthusiastic but less disgusting seeders

include romuleas, many alliums, and members of the *Brodiaea-Triteleia-Dichelostemma* complex.

Visitors often chastise me for growing plants in the bulb frame that are "perfectly hardy." There are good reasons for doing so. These plants may bloom during the rainy season, so we can enjoy their flowers best under cover. More seriously, the variable, open winters here often coax spring bulbs into growth as early as January, exposing them to fatal damage during sudden freezes, which can occur as late as mid-March. This is a particular problem with crocuses. Finally, many bulbs are so difficult and expensive to obtain that it seems foolish to consign them to hazards of predation and climate. Named *Galanthus* and *Colchicum* varieties, which can cost as much as $10 apiece, increase vigorously and safely in the frame.

For many plants, the bulb frame is only a temporary home. Here young seedlings can build up size for a few years in optimal conditions, clearly identified and isolated. Newly acquired items enjoy a recovery period before facing the rigors of the open garden. Thus, although this technique cannot truly be called *gardening*, it is an invaluable adjunct to it.

Propagation is one of the best uses for the bulb frame. Almost everything increases faster here than in the open. The plunged-pot system offers secure identification and ready access, so offsets can easily be removed for garden use, sale, or trading. Furthermore, seed set tends to be better in the frame than in the open, because flowers are not damaged by rain and snow, and fertilization takes place more readily at higher temperatures. If you want to prevent hybridizing, you can exclude insects with screens and hand-pollinate the flowers.

The purist would grow only bulbous monocots in a bulb frame, perhaps making exceptions for such oddities as the tuberous Berberidaceae *Leontice* and *Bongardia*, or *Pelargonium endlicherianum*, the only hardy representative of its genus. It is difficult, however, to refuse room to nonbulbous plants with exacting dormancy requirements. Some examples in my summer-dry frame are the winter-flowering Californian *Dodecatheon clevelandii*, Central Asian *Ostrowskya magnifica* (Campanulaceae), and *Lomatium minus*, a rare purple-flowered umbellifer endemic to Oregon's Columbia Plateau. *Delphinium nudicaule*, a dwarf, scarlet-flowered, half-hardy species, appeared from a stray seed and made itself at home; several members of this genus from the southwestern United States spend the summer as dormant rhizomes.

If you have room in your frame (a situation not likely to last for long), you can grow winter-flowering and half-hardy bulbs for cut flowers. Tazetta narcissus and florist's anemones are good during the holiday season, as is *Iris unguicularis*. My frame also produces freesias in spring and some Cape bulbs in summer for arrangements.

Whether you are an avid collector, a competitive exhibitor, a commercial grower, or just a lover of early flowers, a bulb frame—however small—will expand your gardening horizons. It is time for it to become a standard feature of the North American gardener's repertory.

Jane McGary has an extensive rock garden in the hills above Portland in Estacada, Oregon. She grows a wide variety of plants, many from seed. She is currently serving as the manager of the Intake Chapter for the Seed Exchange. Photos by the author.

TRILLIUM TRICKS:

How to Germinate a Recalcitrant Seed

by John F. Gyer

Trilliums have the reputation of being difficult to germinate and very slow to grow. Lela V. Barton working with *Trillium grandiflorum* at the Boyce Thompson Institute in the 1940s published germination experiments that established the concept of "double dormancy" in *Trillium* seed. Simply interpreted, double dormancy means that one cold winter is needed to induce initial germination and root growth, followed by another winter to trigger the growth of the photosynthetic cotyledon. Barton's work suggests that nearly 22 months are needed to go from ripe seed to growing seedling.

Several years ago when my wife Janet and I began volunteer work in the garden at Winterthur, I became suspicious that double dormancy was not a fixed trait of *Trillium*. I noticed clusters of *Trillium reliquum* seedlings that had cotyledon-leaved seedlings *and* second-year plants. The clustered seedlings had obviously sprouted from single berries that had fallen from the large mother plants. If the seeds were doubly dormant, each cluster should have plants all at the same growth stage. I felt that these plants were telling something interesting and useful about their early development. The Garden Department at Winterthur gave permission to do experiments to find out what the seedlings had to say.

Trilliums are strongly protandrous, that is the pollen is ripe and shed nearly as soon as the flower opens, but stigmas do not become receptive until later. For *Trillium grandiflorum* stigma receptivity lags about a week behind pollen availability. Hand pollination of nine species at Winterthur indicates that trilliums are self fertile, if pollination timing compensates for their protandry.

Reports of self-sterility in *Trillium* probably result from either poor pollination timing or lack of proper pollinating insects. At Winterthur, several of the sessile-flowered trilliums regularly fail to set seed without manual assistance.

Trillium seed is produced in berries that collapse quickly when the seed is ripe. Ants carry off seed from the collapsing berries, even while the berries remain on the plant. A gardener must be vigilant to get to the seed before these natural distributors have scattered it throughout the garden.

Because I wanted substantial numbers of seeds for germination experiments, I needed to know if the seed was ripe before the ants were signaled into action. I thought there should be some obvious change in the growth rate of the berry which would signal seed ripeness. To test this I measured the volume rate of berry growth from pollination until berry fall. The results are best seen in Figure 1 for *Trillium grandiflorum*. I found an initial very slow growth phase of about two to two and a half weeks. This was followed by an essentially constant growth rate until the berries fell off. The pattern of prolonged slow growth followed by a nearly constant growth rate was repeated in all the species measured. There was no clear indication of when seed ripened.

Trillium decumbens has the most unusual berry growth pattern of all the species. It flowers very early, right after *Trillium nivale*. After pollination there is no significant berry growth until the leaves die off in mid-May, a delay of about four weeks. The berry, now on a short, naked stalk, slowly grows to maturity in September. During growth it is supported only by food reserves stored in the rhizome.

The *Trillium* pattern of slow berry growth followed by much faster growth is intriguing. In many, if not most, plants the pollen tube growth and fertilization take place rapidly. This creates a lag between pollination and ovary growth of only a few days. Auray Blain in an unpublished Ph.D. thesis done at McGill University suggests a reason for the ovary growth lag in *Trillium*. In Blain's work on *Trillium grandiflorum* and *Trillium erectum*, pollen required about two weeks to grow from the stigma into the ovules and fertilize them. Slow pollen tube growth can account for the initial slow berry growth phase. Slow pollen tube growth also implies that not all ovules are fertilized at the same time. It is possible that a spread of fertilization times results in seeds of significantly different ages within a single berry. Such a spread of seed age may account for the mixed age *Trillium reliquum* seedling clusters I saw at Winterthur.

Because berry growth did not signal seed ripeness, I collected berries at known times after hand pollination and tried to germinate the seeds they contained. All seeds collected before about 35 days post-pollination promptly rotted. This is not surprising. *Trillium* endosperm is helobial, that is, the first endosperm cell division produces a small cell and a large one. The progeny of the small cell helps cap the end of the seed, where food from the mother plant enters. Changes in the seed cap that restrict food flow to the endosperm are an important ripening process. In ripe seed the seed cap helps protect the endosperm from rot during its long germination period. The large cell continues to divide, but its progeny does not form cell walls until it has filled the young seed with its full complement of endosperm nuclei. Cell wall formation apparently does not start in the storage endosperm of *Trillium grandiflorum* until 30 to 35 days post-pollination. Once the storage endosperm begins to solidify at about 40 days post-pollination, the seeds can germinate, but the plants are weak and not viable. The interesting thing is that the seeds show no dormancy. Germination of these very young seeds happens at room temperature in about 60 days with no cold period.

Limited experience with *Paris quadrifolia*, a European species closely related to *Trillium*, suggests that its young seeds also germinate promptly at room temperature, but older seeds are dormant.

Table 1

SEED AGE EFFECTS

T.grandiflorum, Winterthur, 1996 data

Taken by John F. Gyer

SEED AGE *	H_2O %	WEIGHT (mg) SEED	WEIGHT (mg) ARIL	EMBRYO LENGTH (mm)	GERMINATION at 70°F (%)
32	---	4.0 **	---	---	0
39	---	5.8 **	---	---	0
46	67	8.2	0.9	0.15	>80
53	57	9.7	2.1	0.20	67 ***
60	---	10.7	2.9	0.25	48
66	51	10.6	5.9	0.25	35

* Days after hand pollination

** Weight of SEED + ARIL, Seeds at these ages all ROTTED

*** Calculated from a 30 seed dissection of a wild population 50 to 55 days of age

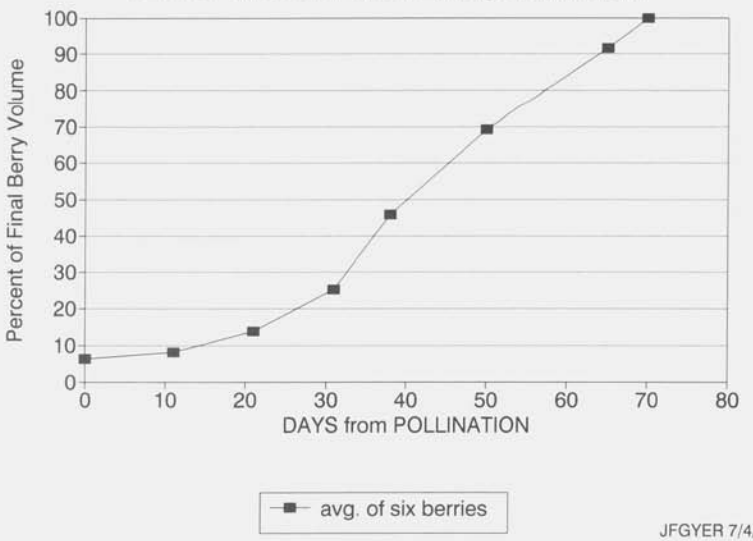
Trillium seed has a large appendage called an aril (photo 1). The aril is an enlargement of the funiculus, essentially an umbilical cord that connects the seed to the placenta of the berry. Although the seed endosperm contains little or no starch, the outer cell layers of the aril and the placenta are filled with starch. They stain blue-black with iodine, as the photograph shows. When the berry ripens, this starch ferments and releases volatile chemicals that attract ants and other insects which attack the berry and disperse the seed.

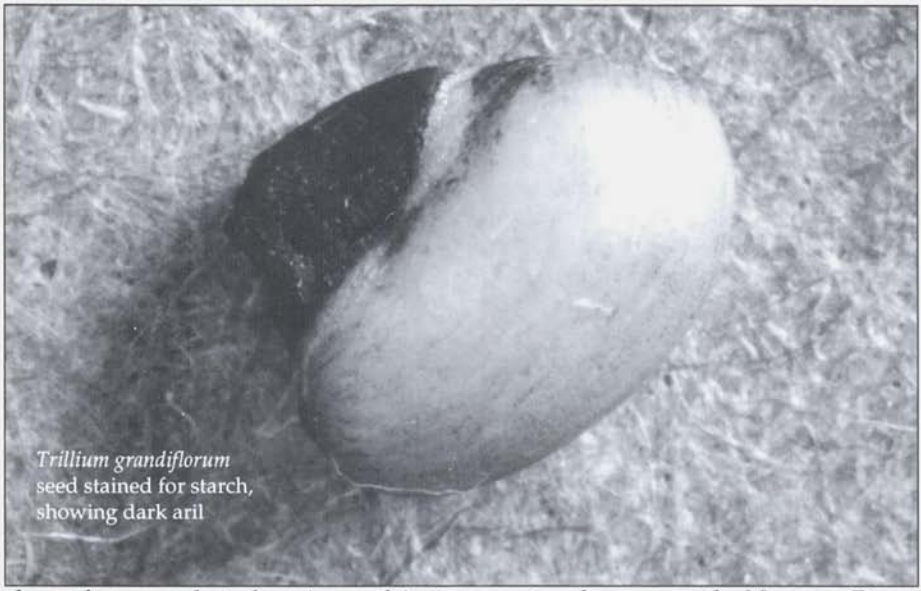
Table 1 shows how *Trillium grandiflorum* seed changes as its post-pollination age increases. The seed reaches nearly its full, mature weight between 45 and 50 days post-pollination. At this time the seed cap begins to close off food transport into the seed from the funiculus. The plant continues to deliver food at the same rate, but, since it cannot all enter the seed, some is stored in the aril. As a result the aril volume and the overall berry volume continue to increase. Aril growth eliminates any berry growth rate change that could signal seed maturity.

Trillium grandiflorum seed germination at room temperature decreases with post-pollination age, but even at full maturity 15% to 30% percent germinate in about 60 days. Of the seeds harvested 45 to 55 days after pollination 60% to 80% have visible germination in about 60 days. These prompt germinators will sprout cotyledons the spring after the seeds are produced. Young trillium seeds are not doubly dormant. In fact double dormancy is probably not an accurate description of *Trillium* seed germination.

A combination of experiments and observations suggest that, after the onset of dormancy in fully ripe seed,

Figure 1
BERRY GROWTH RATE, T.grandiflorum





Trillium grandiflorum
seed stained for starch,
showing dark aril

the embryo needs to be triggered into growth by temperature, stimulation from the environment, or both. Prior to dormancy onset, the minute embryo is metabolically active and able to grow to germination in 40 to 60 days at room temperature. Experiments that suggest that mature embryos could be triggered into growth were done at Dr. Sherry Kitto's laboratory at the University of Delaware. Embryos, which measure about 0.2 x 0.3 mm for all species examined, were removed from *Trillium grandiflorum* seeds that were about 60 days old. The embryos were plated onto half strength MS agar medium supplemented with 3% sucrose. About a third of the embryos grew to germination size in 60 days. This percentage is about the same as the room temperature germination of seeds from that population. The embryo experiment suggests that most mature seeds contain dormant embryos. A parallel experiment included 1 part per million GA-3 in the growth medium. About 60 per cent of those embryos grew to germination size in 60 days. GA-3 triggered dormant embryo growth. Norman Deno in his book, *Seed Germination—Theory and Practice*, suggests that gibberellin produced by natural soil microflora may stimulate germination. In the case of *Trillium* such environmental stimulants could trigger embryo growth.

Low temperature causes segments of the large trillium chromosomes to swell. Under the microscope the swollen segments give the chromosomes a distinctive banded appearance that was studied extensively in early cytological research. This swelling phenomenon may relate to the observation that moist, low temperature rest (about 3 months at 40°F) can trigger embryo growth. However, a single low-temperature treatment is not always effective (see Deno, p 224, second edition, 1993). In my experiments, embryo growth at about 40°F is slow or nonexistent. I have kept some *T. grandiflorum* seeds under refrigeration for more than a year before they were warmed and germinated at room temperature. Endosperm softened during cold storage, but there was no noticeable embryo growth.

The endosperm of most *Trillium* seeds that germinate in the ground or in non-sterile experimental conditions shows a distinct brownish stain between the cells at the cap end of the seed. This suggests that a fungal or bacterial infection has occurred. Such an infection may release stimulants that trigger embryo growth. Often, however, these endosperm infections can overwhelm the seed's defenses and produce rot.

Rots are most common under very moist conditions at warm temperatures. One source of severe rot is the aril. In nature it is quickly removed by ants or beetles. In germination experiments it is often allowed to decompose in the ground or the confined conditions of moist paper towels. The organisms that feed on its highly nutritious tissue can easily enter the seed and begin to destroy the endosperm. In my experiments I remove much of the aril's food reserves and surface sterilize the seed with a short (about five minute) soak in 3% hydrogen peroxide. The seeds are put in barely moist towels at room temperature (70°F) for four to six days. After this rest they are rubbed gently against a screen under running water to remove most of the remaining aril tissue and rinsed with peroxide for surface sterilization. If the seed is reasonably mature, and the peroxide soaks are brief, there is little rot during germination.

The initial stages of trillium seed germination take place at warm temperatures and are not outwardly visible. Germination begins when the tiny embryo begins to dissolve the endosperm. The stored food released from the endosperm is taken up through the growing cotyledon. Some is deposited in the embryonic rhizome as starch. The rest is used for growth. When the embryo, mostly cotyledon at this stage, reaches about 2 mm, the root/rhizome structure emerges, and germination is visible. This early embryo growth takes between 40 and 60 days under good conditions.

Trillium grandiflorum seed in berry, showing effect of hand pollination on seed set

Once there is visible germination, the endosperm food reserves are used to grow a root that can be as long as 3-4", if warm temperatures are maintained. Excessive root growth will exhaust the reserves of the remaining endosperm and weaken the seedling. Low temperature stops root growth and seems to shift the seedling's hormone balance toward the growth of the seed leaf. About 60 days at soil temperatures above 55°F produce enough root for a strong plant, and enough endosperm reserve remains for good cotyledon growth.

For *Trillium grandiflorum* both embryo and root growth can take place the same summer that the seed ripens. Seed taken about 50 to 55 days post-pollination is easily germinated by removing the aril with peroxide and allowing the seed to rest under just-moist conditions for about 60 days at no more than 70°F. During this rest I check the seed packets occasionally for moisture and rot. If I find problems, the seeds are rubbed against a screen under running water and rinsed in peroxide before they are repacked. Dissections show that 50% to 75% of the *Trillium grandiflorum* seeds harvested 45 to 55 days post-pollination have growing embryos after this treatment.

The germinating seeds are broadcast onto a sand and humus mixture and covered with about 1/2" to 3/4" of a granular material such as Axis or Turface. These materials retain moisture without packing, and they seem to reduce frost heaving during the winter. Beds are kept shaded and moist to keep the soil from overheating and allow rhizome and root development before soil temperature drops in the fall. In New Jersey seeds are harvested the last of June and planted into their beds about the first of September, in time for a 60-day root growth period before early November, when soil becomes too cool for growth. Cotyledons appear in the spring when soil temperatures reach about 55°F. Although germination rates can reach 90%, a more realistic expectation is about 50%. Most seeds that have remained dormant will germinate during the summer and form cotyledons the next spring.

The germination procedure developed for *Trillium grandiflorum* also works for other species, provided the seeds ripen early enough for 60 days of embryo growth *and* 60 days of root growth before cold weather. The very early species *T. nivale* and *T. pusillum* germinate very well after one winter. The sessile trilliums generally mature some time in August in New Jersey's climate. Although young seeds have active embryos, there is often not enough time for both germination and good root growth in outdoor beds before winter. Seeds of species allied with *T. erectum* mature around late July or early August. Although there is time for embryo and root growth, these species have not responded well to the *T. grandiflorum* germination procedure. The embryos of these seeds may have to be triggered into growth by GA-3.

In his youth, John Gyer spent vacations rock climbing in Wyoming but soon realized that the mountains were filled with plants he had never seen on his family farm in the Finger Lakes Region of New York State. He exchanged pitons for a camera and later contributed an article on the Bighorn Mountains to the *Bulletin* and to *Rock Garden Plants of North America*. He and his wife Janet joined the Delaware Valley Chapter of NARGS in 1970 and garden in Clarksboro, New Jersey. As their property aged the garden changed from open slope to forest, and their interest to woodland gardening. Photos by the author.

HYDROGEN PEROXIDE TRILLIUM SEED TREATMENT

by John F. Gyer

PURPOSE:

Remove the aril and disinfect seed so that seed rot during germination is minimized.

PROCEDURE:

Remove seed from berry. Soak seed in 3% hydrogen peroxide (drugstore strength) for 5 to 10 minutes. Active bubble formation disrupts aril cells, and their contents will cloud the peroxide solution. A drop of liquid detergent in the soak solution helps assure that the peroxide wets the entire seed surface.

Rinse seed under running water while GENTLY rubbing it against a fine sieve.

Wet a paper towel, and squeeze out excess water. The towel will be just damp. Fold the treated seed into the towel, and store for a few days in a plastic bag at room temperature. In 4 to 6 days the remaining aril tissue will be softened. Also any leakage of cell contents from the seed will be apparent, usually as a brownish stain.

Repeat the above soak and rinse procedure to remove remaining aril tissue and disinfect the seed.

Let the seed rest in a moist towel for at least a day before any further treatments such as GA3 or low temperature. This short rest assures that residual peroxide that has diffused into the seed will be decomposed. Otherwise the peroxide might interfere with germination-inducing treatments.

DISCUSSION:

In my experience with large volume germinations, arils must be removed if severe seed rot is to be avoided. In nature this is done by ants or beetles. The peroxide soak was suggested to me by Josef Halda, who uses 30% peroxide solutions. This concentration is acceptable for mature seed, but it causes a significant temperature rise, and it is too active for immature seed. The 3% solution is readily available, cheaper, and safer.

Peroxide disinfects the seed surface without damaging the seed surface. Hypochlorite bleach will disinfect the seed, but, because it is alkaline, it solubilizes the waxy seed coat. This leaves the seed more prone to fungal attack during germination. Also hypochlorite bleach does little to remove the aril.

con't. from p. 88—

but next shipping season I did, indeed, receive my packets. They all had the right numbers, but the wrong seeds. The conscientious order-filler obviously hadn't been told that the numbering system changed; I was supplied with 20 different packets of *Dipcadi*. And that brings me to the next item.

The genus of 50 odd species has a principal distribution in the Western Mediterranean with some outliers—depending on your taxonomist—in South Africa. It is a fine genus for anyone getting bored with the Fellowship of Fritillaria Fanciers. Imagine a one-sixth segment of a hyacinth bloom, colour it in green over a yellow ground—and there you have it. The flowering season is mid-June here, when the fritillaries have gone over. In my earlier days I grew it to flowering size in two years, and then, after photographing it, gave in to my composting urge. Now I am more careful, especially I since I have learned of *Dipcadi serotinum* var. *lividum*, which has a red tip. I do not yet possess this beauty; a mini-tornado destroyed my seed pots that fateful year, and I have not managed to snag it in seed exchanges since.

Early June is the usual flowering time of one of my very favourite bulbs. So easy to grow from the plentifully available seed, so satisfying, so generally neglected—don't let another year go by without growing *Albuca humilis* (photo, p. 89)! This comes from South Africa, but here it is a 100% outdoors-bulb (vegetative equivalent of the outdoorsman). In our garden so far this is the only hardy *Albuca*, but I have great hopes of recent South African collections. Foliage is somewhat grassy and not overly obtrusive. The flower stems are only about 15cm tall and split into a loose umbel with upward-facing, white flowers. The petals have a dark green central stripe on the outside, while the tips shade into yellow. The outer petals are more widely open than the inner ones, the flowers are reminiscent of upturned snowdrops. The fragrance is exquisite. *Albuca humilis* wants to be baked in full sun; in semi-shade it does nothing.

Of California's 6,000 species, maybe 10-20% are bulbous. Admittedly, a substantial number are excessively chauvinistic, but there are still quite a few willing emigrants. Among the non-oniony onions one of the most charming and reliable is *Bloomeria crocea*. Very common in grasslands and edges of woods, it can be found at widely varying elevations. June is the flowering time in cultivation. The flower stems will be some 20-30cm high, and the umbel will consist of up to three dozen flowers. The flowers are individually 1-2cm across, medium yellow, and with a central brown stripe on the outside. The flowers open in succession, no more than about six being in bloom at any one time, so that the flowering season is very long. One of the great features is that the flowers stay open in the evenings. Not terribly quick from seed, it took five years in my garden. There are taxonomic differences distinguishing this from the related *Triteleia ixioides* ssp. *ixioides*. There are also horticultural differences. In general, you can have yellow stars from California with lots of variables in height, colour, markings, flower shape, and floriferousness.

Many favourites have been omitted—I hope they don't take offense at the slight and take revenge by either disappearing or taking over our garden.

Andrew Osyany is an avid gardener and traveler in search of plants. He gardens in Shelburne, Canada,and invites you to Toronto for the NARGS Winter Rendezvous, in January 1998.

SEED EXCHANGE 1997

How the Seed Exchange Works

Donors send seed to the Intake Chapter. Here the seed is cataloged on a computer database, which is used to produce the Seed List. Each donor is assigned a Donor Number and is sent a postcard notifying him or her of the Donor Number. After the deadline, or last date for acceptance of seed (October 31, 1997), the seed is sent to the Packaging Chapter. The packaged seeds are then sent to the Order-Filling Chapter, which receives the order forms from the members and sends the seed out. Orders are filled during January and February, after which the surplus seed is sent to NARGS chapters for distribution to their members.

Advantages of Participating

Donors receive 35 packets of seed, while non-donors receive only 25. Furthermore, orders from donors are filled before those from non-donors.

Collecting Seed

Collect seed in your garden and in the wild. Do not collect seed in areas where this is forbidden. Clean the seed by removing it from capsules, discarding the debris and chaff. If the seed is enclosed in a fleshy fruit, remove as much moist material as possible.

Packaging Seed for Donation

Please use paper or glassine (not plastic/polythene) envelope no larger than 5x10cm (2x4"). Suitable envelopes may be purchased from the NARGS Bookstore. Very clearly write the botanical name, collection site (if wild), and your name on each envelope. Be sure that the seed envelope does not leak. Very small seeed should be wrapped in a piece of waxed paper or foil before being placed in the envelope. If any seed is unusually moist, enclose it separately in plastic to prevent the moisture from ruining the rest of the seeds. If seed must be refrigerated to retain viability, send it in close to the deadline. We cannot practically provide special storage of seed after mid-September.

Fill out the Seed Donation form (see below). Place the seed envelopes in the same order as they are listed on the form and put rubber bands around each group of 5 to 10 envelopes. Please do not tape the envelopes together, because it is difficult to separate them without damaging them. Place seed envelopes, Donation Form, and a mailing label with your own name and return address in a sturdy, padded mailing envelope or box. Do not put loose seed packets inside excessively large envelopes.

Sending the Seed

Mail your donation to the address on the donation form as early as possible. DO NOT SEND SEED TO ANY OTHER ADDRESS. Overseas and Canadian donations should be mailed by October 15, 1997, and USA by October 20. No item can be added to the catalog after October 31.

Seed Donation Form

If you do not have a blank form, please enclose a clearly written or typed list of the seeds you are sending. You do not need to fill out all the parts of the form. Only the botanical name (and wild collection site, if any) are necessary. The remaining spaces (class, height, flower color) should be used only if the item is (a) new to or rare in cultivation in the Northern Hemisphere, or (b) an unusual size or color in its species. The column 'Authority/Reference' should be used if you believe the item is new to cultivation and has not previously been listed in the Seed Exchange; a very brief citation such as "Fl. USSR" or "Smith 1997" is adequate. If you are submitting an item under a very recently revised name, it is also helpful to cite the source.

What to Send

The most frequently ordered items in the Seed Exchange are small, highly ornamental alpine plants, especially those that are collected in the wild. Very unusual items, especially from temperate climates, are also much desired. There is also continuing demand for easily grown garden standards, such as dwarf *Aquilegia* and *Campanula* species. Recently there has been considerable interest in the genera *Arisaema* and *Corydalis*. Seed of rarely cultivated bulbous plants is desired. American members in particular are encouraged, indeed begged, to collect more seed of specifically alpine plants in the wild.

What Not to Send

Although the Seed Exchange is charged to include "plants suitable for rock gardens," in practice it offers opportunities to obtain unusual plants of many kinds. Donors should be aware, however, that certain items are not desirable; some of these will be discarded when received, and others will have to be discarded after orders are filled. In general, the following kinds of plants should not be sent to the Seed Exchange: Common trees and large shrubs, unless wild collected; Annuals, unless rare in cultivation; Plants taller than 1 m and requiring frost-free culture; Horticultural hybrids of common garden genera such as *Hemerocallis, Iris, Hosta;* Wild-collected seed of Federally listed Endangered Species or CITES listed species; Aquatic plants; Food plants of little ornamental value; Seed of any species of *Lathyrus* from outside the USA (agriculturally quarantined); And, of course, WEEDS.

The US Department of Agriculture and various state departments issue lists of plants classified as noxious weeds, the seed of which may not be distributed in this country because these species are harmful to natural plant communities or to agriculture. These noxious weeds include some plants frequently grown as ornamentals.

Send Seed Donations and Correspondence Regarding Donations and Catalog to:

NARGS Seed Exchange
PO Box 7803, Estacada, OR 97023

Send General Comments and Administrative Correspondence to:

Carole Wilder, Seed Exchange Director
221 West 9th St., Hastings, MN 55033

Book Reviews

The Alpine Flora of the Rocky Mountains, Volume I, The Middle Rockies, by Richard W. Scott, 1996. University of Utah Press: Salt Lake City, Utah (Tel.: (800) 773-6672). 768 pp., 620 illus., 611 maps; hard cover, $110. ISBN 0-87480-482-5.

The University of Utah just released in February 1997 Volume I of Richard W. Scott's planned three-part series *Alpine Flora of the Rockies*. I have been eagerly awaiting its arrival for over a year. A professor of biology at Central Wyoming College at Riverton, Wyoming, Mr. Scott has been studying alpine plants in the Rockies for over 20 years. He has undertaken a huge project. Volume I contains information on 609 species, 55 subspecies, and 314 varieties of alpine plants located above timberline (8,000' in Montana to 10,800' in Utah). The area covered includes parts of Montana, Idaho, Wyoming, and Utah, comprising alpine areas in 12 mountain ranges from the Beartooth and Bighorns on the north to the Wasatch, Uinta, and Medicine Bow on the South. There is a 30-page alpine and geologic primer followed by over 770 pages discussing each species. There are separate glossaries for alpine and botanical terms. Other appendices include a brief description of authors of accepted species, chromosome numbers of alpine plants, and a very good bibliography.

The book itself combines the features of an easy-to-understand flora and key and a distribution atlas. Each species is described in detail, located on a separate map by dots, and there is an illustration for each. The illustrations are from previously published material, supplemented by a few new drawings. Although useful, the illustrations are of varying detail and quality, and the artist for each is not identified.

While the distribution maps contain all known collections of the species within the area of study at any elevation, the description tells only where the plant can be found in alpine areas, and then only in very sweeping terms. Specific locations are not discussed. No elevation range is given for individual species. The book includes many plants I would normally expect to find in montane or subalpine environments, such as *Pyrola* and *Arnica*, which have been found in favorable alpine areas on occasion. Some of the species included challenge my concept of the definition of an alpine plant, e.g., nine of the thirteen *Salix* listed grow to more than 3' high.

The book seems more useful for keying out an unknown plant at an alpine site than to help you locate a particular species. However, the book is large (8 1/2" by 11"), and weighs around 5 lbs., and would be a burden to carry in your backpack—although I'm sure I will try.

Richard Scott is a self-proclaimed lumper and does not recognize many species proposed by others, choosing to reduce them to subspecies and varieties. He does list all synonyms for the species, sometimes as many as 20, and there are

two great indices for all plant names mentioned in the book, one for common names and another for scientific names.

The book contains a wealth of information, gathered together for the alpine plant enthusiast. It is reasonably priced at about 12 cents a page, a bargain for all the work that went into it. If you have a strong interest in alpine plants from the Rockies, consider this series.

—William H. King

Errata

#@!**%$#@!!!

Winter 1997 Issue Vol. 55(1). p. 54. *Petrocallis hispanica* should be *P. pyrenaica.*

NARGS Coming Events

Annual Meeting:

Minnesota Mini-Mountains Megamall Minneapolis

May 16-18, 1997

Includes talks by Marion Jarvie, Josef Halda, Harvey Wrightman, Cole Burrell. Garden Tours, Plant Sales, Book Sales.

Registrar: Marcel Jouseau

43 N. Chatsworth St., St, Paul, MN 55104

Meeting Location: Sheraton Airport Inn

Eastern Study Weekend: Toronto, last weekend of January

Western Study Weekend: Vancouver, last weekend of February

N·A·R·G·S BOOKSTORE

BOOKS—Our prices, as listed here, are approximately 80% of listed retail price at other stores. This is only a partial list of titles stocked; complete list accompanies the Summer Quarterly, or by request

Recent Additions to the Book List:

The Alpine Flora of the Rocky Mountains, Vol I, The Middle Rockies, by R.W. Scott - NEW $88.00
Auriculas, by B. Hyatt - NEW PAPERBACK EDITION $16.00
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N·A·R·G·S BOOKSTORE

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Woody Plants in the Rock Garden, by Northwestern Chapter, NARGS	$5.00

* denotes hard cover

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Ernie O'Byrne, North American Rock Garden Society Bookstore
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