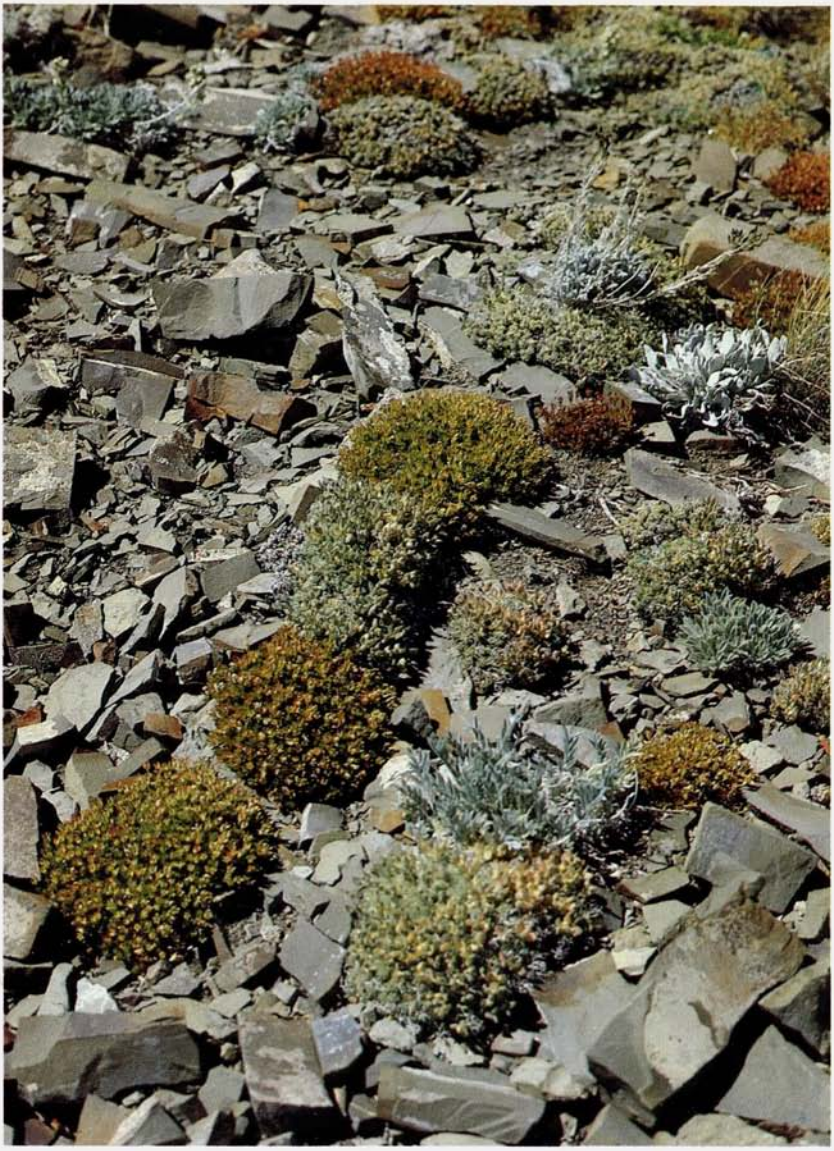
American Rock Garden Society



Bulletin

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THE BULLETIN

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CALENDAR OF COMING EVENTS

Second Interim International Rock Garden Plant Conference
Boulder and Denver, CO ..... June 28–July 2, 1986
Eastern Winter Study Weekend
(Hudson Valley) White Plains, NY ..... January 1987
Western Winter Study Weekend
(Northwest) Bellevue, WA ..... February 1987
Annual Meeting
(Connecticut) Hartford, CT ..... May 22–25, 1987
Western Winter Study Weekend
(Western) 1988
Annual Meeting
(Columbia–Willamette) 1988

Cover Photo: The Bunnery, natural cushion–plant garden south of Glacier National Park, Montana. (See page 77)
Photo: Sharon Sutton

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The Surface Sterilization (SS) Method of Seed Raising

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Three years ago a procedure was devised for raising seeds that led to a big increase in effectiveness. Both simple and easy, it can be adapted to the smallest or largest operations. It is called the surface sterilization (SS) method.

Every grower is familiar with the susceptibility of germinating seeds to attack by fungal diseases, particularly the infamous damping off. At the same time, many studies have shown that complete sterilization of the medium leads to poor growth. The question arose as to what would happen if the surface were sterilized to the depth of one cm while the medium below one cm was left unsterilized.

For efficiency, all steps are standardized. The pots are 2x2x2 inch plastic. The water–tight trays hold twenty–four pots. A half inch of peat moss is packed onto the bottom of each pot and the pot is filled with a mix of soil and compost. The *critical feature* is that just before sowing the seed, about 1 cm of boiling water is poured over the surface of the pot in two equal portions for the purpose of sterilizing the surface. The pots cool for about 10 minutes before the seed is sown. Large seeds are pressed in, otherwise no covering of the seed is used. The pots are immediately placed in polyethylene bags in groups of four and sealed with a wire twist–em. If space is available, the trays can be placed directly under the fluorescent lights, but it is more efficient to place the trays in room light, observe daily, and place under the lights as soon as germination is detected. The enclosing in polyethylene eliminates any need for watering until the bags are removed.

The treatment at this point diverges so that the procedure with each group must be described separately. For dry land plants such as the acantholimons, the pots are removed from the bags as soon as germination is detected which is often only a few days. The pots are placed 5 inches from the lights because these are high light intensity plants. The usual attention is given to watering thereafter. In this high light intensity, they develop six true leaves in a month and are ready for setting out after hardening off. The latter is accomplished by exposing the seedlings for a week to indirect outdoor light such as that on the north side of a building.

For such fast germinators, it might be asked why bother to place them in polyethylene bags. In the same way that molding of food is inhibited by covering the food, it is felt that the bagging procedure prevents fungal spores from falling on the surface and starting trouble.

At the other extreme are certain gentians and primulas which like lower light intensity (at least when seedlings), which are slower growing, and which like nearly 100% humidity. These are kept in the sealed bags for months at a distance of 12 inches from the lights. The bags are stretched every day or two so that they do not contact the leaves of the growing plants; however, it must be admitted that the polyethylene can completely interface with the water–soaked leaves for days with no apparent ill effects. This is attributed to the original surface sterilization and the sterile nature of the polyethylene. During all this time, no water is added—a great convenience in handling thousands of seedlings. After several true leaves have developed, the bag is opened at the top and the seedlings gradually accommodated to lower humidities before complete removal from the bags.

This brings us to seeds that exhibit delayed germination. The method allows these to remain in the bags throughout various cycles without watering; this is most helpful since the cycles may involve 2 years or more. Several different behaviors will be described using specific examples.

The simplest delayed germination is the type exhibited by *Primula kisoana.* The seed is sown when ripe in the fall and the bagged pots left outdoors until January. They are brought into 60 degrees (all temperatures are in degrees Fahrenheit) and they quickly sprout. The period of cold which is required to break dormancy is termed vernalization and is much misunderstood. It is sometimes imagined that freezing and thawing is required or that there is some physical action on the seed coat. In fact it is time required for certain chemical reactions to take place inside the seed. Studies at the Boyce Thompson Institute have shown that 3 months at 32–40 degrees is usually required. Time spent above or below this range is not effective and is time lost. It is apparent that the chemical reactions taking place are those of a rare (but well known) type that occur only in a limited temperature range. Incidentally, such phenomena involve complex multiple chemical reactions where there is a delicate balance between initiating and terminating steps. For this simple delayed germination, it would probably be more effective to place the bagged pots in the refrigerator at 35 degrees for 3 months, but the several months of fall weather usually suffice.

Many species exhibit more complex dormancies. *Lilium canadense* has the following behavior. The seed ripens and falls in October. The following spring it germinates, but no growth is produced above ground. The germination consists of the seed sending out a shoot which forms a tiny bulb and short root. This rests through summer, fall, and winter. The following spring, now 20 months later, a single leaf appears. This eventually dies down and the next leaf, somewhat larger, will not be produced until the plant goes through another cold cycle. No wonder it takes 5 to 10 years to get a flowering stem. About half of the eighty to ninety species of the genus *Lilium* exhibit this behavior.

Dicotyledons can show a behavior like that of *Lilium canadense. Actaea erythrocarpa* was observed to form a good root system after the first cold cycle, but did not send up the two cotylendons until the second cold cycle. In all of these cold cycles, it is a great help to be able to keep the seed pots in the polyethylene bags so that no water is ever added. Polyethylene is uniquely suited because it allows oxygen to diffuse in and carbon dioxide to diffuse out but will not transmit water. Incidentally, this is a matter of interfacial energies and not molecular size since water is actually the smallest of the three molecules.

The elimination of watering throughout these extensive cycles is not just a convenience. It is felt that continual watering has an unfavorable effect on soil porosity as well as building up mineral crusts.

These double dormancy cycles can be accelerated by a procedure well known to lily specialists. The bagged pots are alternately given 3 months at 60 degrees and 3 months of refrigeration at 32 to 35 degrees until

germination. In this way, 2 years can be condensed into less than 1 year.

An interesting variation was observed with *Lilium pardalinum.* The seed germinated at 35 degrees but did not develop a leaf until transferred to 60 degrees. There have been other reports that certain seeds germinate only below certain temperatures. Fortunately, this does not seem to occur with most alpines.

One special problem is illustrated with *Stellera chamaejasme.* The combination of the root growing straight down and needing a deep pot along with dormancy and somewhat erratic germination has led to the practice of removing the seedlings as they push above the soil. This is done as soon as detected and before the cotyledons have spread because the root will already be down an inch by then. They are spaced in a deep 12–inch pot immediately and given light 5 inches above the cotyledons as stellera is a dry land plant demanding high light intensity.

The most troublesome behavior arises with species that exhibit erratic germination. The simplest version is shown by *Primula pamirica* where about half of the seed germinates immediately and half exhibits dormacy. This was true of seed received from Khorag Botanical Gardens as well as our own absolutely fresh seed. The answer is to remove the seedlings from the immediate germination, dibble them into fresh pots (SS treated), and bag them. The original pots are then vernalized after which another strong crop of seedlings develops. These are left in their original pots as it is not worthwhile to make any provision for seeds showing double dormancy, and it is desirable from a horticultural viewpoint to breed out double dormancy. One dormancy is enough. Incidentally, *Primula pamirica,* as many other primulas, likes to stay in the bags for several months.

This leaves those species that have truly erratic germination such as most of the Ranunculaceae. It has been reported that the embryos in these seeds are not developed when the seed is shed and variable time and conditions are required for the embryo to develop to a readiness for germination. Throughout this time, the seed must be kept moist as it is growing inside, and we all know how fast Ranunculaceae seed loses viability on drying. Again it is a great convenience to have these pots in bags where they can be periodically inspected and seedlings removed as they appear. However, we feel that success with this group would be greater if the medium were dried out somewhat after the SS treatment and an extremely porous medium used. This will be tried.

The use of small pots is well enough as long as the bags are closed, but when removed from the bags, the small pots require more careful attention to watering. This is particularly true when the pots are placed 5 inches from the lights. There is a tendency to alternate between overwatering and underwatering. This tendency is combated by using polyethylene squirt bottles for

watering. It is easy to direct the small stream of water until about a half cm of water is added, and then quit. Generally this is required every second or third day.

Long standing in the bags does lead to growth of moss and liverwort. The answer is to frequently inspect the pots and to destroy any growths as soon as they start, either by removal with tweezers or by pushing under the soil with a nail. Sometimes a layer of sand is added after a year. Keeping the pots in complete darkness would eliminate such growths, but there is an advantage in keeping the pots in indirect north light. Inspection can be spaced at monthly intervals or longer since many seedlings, such as gentians and primulas, will grow adequately in the sealed bags in the north light for months.

There have been a few elements of humor in these experiences. Usually, if there had been no germination after three cold cycles, the pots were reused directly by pouring on the boiling water. This induced a long dormant Juno iris seed and a corydalis seed to germinate. The seed undoubtedly did not reach 212 degrees because of slight burial and its thickness, but it must have received a good thermal shock. The use of thermal shock to induce germination is well known. For example, 20 minutes at 140 degrees is a standard treatment for seed of the sensitive plant (*Mimosa pudica*) and warm water is often recommended for inducing germination of primulas. However, it is suspected that thermal shock may be more of a factor with old seed and the need for such treatments is reduced when fresh seed is used.

There have been studies of whether seed germinates better in light or dark. For example, dark conditions have been recommended for primula. The use of room light is obviously something of a compromise, and the excellent germination of a wide variety of surface sown primula seed indicates that room light is dark enough.

The practice of surface sowing in the SS method does lead to an additional chore. Some species, particularly primulas and gentians, produce a root that sometimes runs along the surface. This necessitates opening the bags, making a small hole with a nail, dibbling in the root, and tamping the medium against the root with the head of the nail. Some growers would say that the seeds should have been covered, but it is felt that the covering would increase fungal attack. In any event, this dibbling is a small price to pay for a pot solid with seedlings.

Seed that is enclosed in pulpy fruit needs to have the pulp removed and any remnants rotted off because the pulp usually contains inhibitors to germination. This is obviously an evolutionary development to insure that the seed does not germinate until passing through the gut of a bird or animal. Also such seed characteristically exhibit at least single dormancy. The above is true not only for the many shrubs and trees with fleshy fruits but also for

many herbaceous plants, lysichiton for example.

It is important to keep good hygiene in the pots and any fungus, rotten seed, or the rare sick seedling is removed at once with toothpick or tweezer. The SS treatment coupled with the high compost content does seem to encourage occasional growths of a cottony fungus. This may not be pathogenic to the seedlings, but it is removed as soon as detected. This raises the question as to why the SS method works so well because clearly the surface has not been completely sterilized. It may in fact be a selective killing of fungi which is more beneficial than a complete sterilization. The fact is that the SS method seems to work better than would be expected if it were simply a matter of surface sterilization. This is particularly true where germination is long delayed since there should have been time for the fungi to invade the surface. It can only be reiterated that the SS method has given good germination even for species exhibiting dormancy where the bag was sealed for 5 to 12 months.

Seedlings of many bulbs consist of a single cotyledon their first year. These need to be placed 5 inches or less from the lights in order to pour the maximum energy into the leaf without scorching. Such seedlings are prone to go dormant at any provocation such as root disturbance, lack of water, or low light. It is critical to keep them going as long as possible and at as high a rate of photosynthesis as possible to build up a sizable bulb.

Any discussion of seed raising cannot be left without emphasizing that a significant percentage of commercial seed obtained through seed exchanges is DOD (dead on delivery). This statement is in no way a criticism or complaint. We can only be thankful that most seed is viable considering the rarity, distances, and all that is involved. And DOD seed is small price for the high percentage of viable seed. However, it may be helpful to members to list some of the species whose seed is largely DOD because it stores so poorly. This would include all *Salix,* petiolarid primula, *Primula rosea, Lysichiton,* and probably most arums, *Gentiana asclepiadea, Gentiana triflora, Adonis, Corydalis,* and Ranunculaceae in general. There has also been difficulty in germinating Juno iris seed, but the cause is in doubt. *Iris bucharica* has given excellent stands of seedlings when open sown as soon as ripe, but records were not kept on the interval between planting and germination. There is still no substitute for getting seed directly from a friend who sends the seed as soon as ripe or even in the capsule just as the capsule is turning brown.

Plant Exploring in the USSR

Karel Polivka
Prague, Czechoslovakia

Part One: Spring on Tshormozak Pass, Tadjikistan, USSR

In the middle of Tadjikistan, about 90 km southeast of the city of Dushanbe between the Kafirnagan and Vakshsh rivers there is a range of relatively low mountains called the Sarkhku. Even during the Middle Ages an important caravan route crossed these mountains on the way from Afghanistan to Uzbekistan. The highest point on this route is at 1600 m elevation. Four nut trees provide a pleasant place to rest, welcome after the arduous climb. The pass derives its name from the phrase *Tshormozak* which means *four nut trees* in the Fars language.

I have visited this pass several times at different seasons and have found a wealth of interesting flowers there little known to cultivation in Europe. My most recent visit was in the last 2 weeks of April, 1984. After leaving Dushanbe, we crossed the Kafirnagan River some 50 km to the southeast. We traveled by bus through small villages of Tadjikistan where there are many vineyards and everything is green and filled with flowers in the spring.

The land rises quickly from there and mountain ridges stood before us, higher and ever higher toward the south. In crossing the pass, we made a long series of hairpin turns and stopped near a slope. We were surrounded by primordial nature. Climbing a path near a precipice, we were welcomed by a wealth of flowers such as *Bellevalia atroviolacea* with blossoms so dark blue they are almost black. Several places were so full of them that they resembled a dark carpet. One's attention was quickly diverted by *Anemone bucharica.* The form and color of its blossoms vary tremendously from red to pink and even purple when they grow near *A. tschernjaijevii* which is usually purple.

Among the fresh green grass we could see the red color of many flowers. In the middle of the slope we saw the flowers of *Corydalis popovii.* This species of *Corydalis* grows in the Hissar Pamir among shrubs on stony hillsides. It is a bulbous plant that can be grown in Europe in sunny, dry places. I was especially attracted by one plant with exceptionally large blooms which differed distinctively from neighboring plants in color as well.

The beautiful flowers of *Fritillaria eduardii*—lovelier even than *F. imperialis*—showed up in several places. This species varies in color from orange to golden yellow. It is closely related to the crown imperial; however, its blooms open more widely on sunny days and reach a height of only 25 cm.

On the ridges there was an abundance of *Crocus korolkowii*, an endemic of Northern Afghanistan and southern central Asia. It has a cluster of blossoms that are bright yellow on the inside and brown on the exterior. *Eminium albertii*, an aroid–like plant 12 cm tall, produced a dark red funnel nearby. Amidst the fresh grass it looked like a wraith or phantasm. It has a small bulb and can be grown in dry places in gardens in Eurcpe, growing strongly and even producing seed from which it can be propagated. There were also many plants of *Colchicum luteum* which blossoms in the spring. This unusual colchicum has vivid golden–yellow flowers but grows badly under European garden conditions where it suffers from summer humidity and rains. There were also a variety of other *Corydalis* species on that slope as well as *Tulipa praestans*, a bright red tulip that grows to 15 cm tall and is abundant in Tadjikistan. Among the many red flowers, one could also find yellow colored specimens. The banks everywhere were covered by flowers in many different colors. From the pass there was a beautiful view to the south; there were also snow–covered mountains visible to the north. The hills around us were like beautiful rock gardens filled with different flowers and colors.

Eminium albertii in author's garden Photo: Karel Polivka

Part Two: On the Khra–Tskaro Mountain: The Caucasus

Moving thousands of miles farther to the west to Georgia in the Caucasus, we arrived at the Khra–Takaro Mountain. At its foot there is a city called Bakuriani, well–known as a first class winter sports area. It is situated at 1600 m elevation while the height of the neighboring mountains rises to about 2800 m.

On the lower part of the mountain, there are hillsides covered with open forests gradually changing to vast growths of *Rhododendron caucasicum.* These thickets are only about 75 cm high and very dense. When their cream colored blooms open, the hillsides welcome the arrival of spring.

During our ascent we had to pass through this dense rhododendron belt, and from time to time it seemed to us as if the mountain wanted to protect its tender inhabitants. On the lower part of our ascent when passing through forests, we had to climb over fallen trunks of wooden giants. In the clearings an abundance of *Veratrum album* was blooming. This abundance is apparently due to the fact that there were no cattle to eat the plants since they were grazing on alpine meadows in the summer. We looked around; in the distance there were mountain ranges disappearing in bluish haze. In the lush growth of a clearing we saw *Lilium szovitsianum* growing about 20 cm tall with golden yellow blooms and a *Corydalis* species with cream blossoms already faded away. Along streams and creeks *Galanthus caucasicus* was blooming with flowers much bigger than the well–known *Galanthus nivalis.* In small meadows we saw groups of dark pink *Orchis incarnata* blossoming with individual plants of cream colored *O. pallida.*

The most interesting, the most abundant, and for us the most beautiful was the omnipresent *Scilla rosenii.* In some places it was so abundant that it seemed as if the hillsides were covered with small blue tarns. Actually, *S. rosenii* is the most beautiful of all scillas. It grows 16 cm tall and is sky–blue in color with blooms resembling *Erythronium dens-canis* in form. Rarely one could find completely white specimens. In Europe it grows very well and apparently it would grow in North America too. It produces a lot of seed and deserves larger recognition in cultivation.

Small rocks richly covered with mountain flowers showed above the turf. These plants, mostly *Androsace villosa*, bloom so abundantly that it seems as if the rocks welcome the Caucasian spring. *Androsace villosa* can even be found occasionally on the trunks of giant trees. In the vicinity of rocky streams we found *Anemone fasciculata* blooming abundantly, a creamy white in color. It is closely related to the European *A. narcissiflora.* Interesting to note is that we found quite a few individuals with pink blossoms. The flower also grows well in Europe, in humusy acid soil. Even from a great distance, it was possible to trace the banks of mountain streams bordered with a dense

growth of yellow *Caltha polypetala*, larger than the European *C. palustris.* Higher on the hillside were low plants and sky–blue blossoms of *Campanula tridentata.* In one place higher on the hillside there were corydalis blooming, blue in color, with subtle flowers 6 cm or so high like *Corydalis emanuelii.* it also resembled *C. cashmeriana,* well known in cultivaiton. By merit of its mountain origin, this Caucasian species grows well in our country becoming a garden prize of mountain flora fans.

Arnebia echioides was especially abundant. The yellow blooms have black spots which fade on older blooms. It is a sacred flower of the Muslims. The root is as large as a carrot and despite damage caused by transplanting, it has grown well.

The beauty of undisturbed nature was so fascinating to us that we could not stop taking pictures. Everyone wanted to preserve souvenirs of the splendor of this site.

We climbed still higher. Around us we could see talus slopes again, decorated with many flowers. In the shadow of an overhang the subtle *Woodsia alpina* grew well, its fronds about 10 cm long. Farther up the ridge, above the upper limit of the forest there were slopes covered with tundra interspersed with fell fields richly covered with cushion plants. *Primula elatior* bloomed there with large bright yellow flowers. As a vanguard, pioneer plants of *Rhododendron caucasicum* grew thickly, not yet ready to bloom. Their leaves were rich and green. It was evident that frequent rains and mists did them good. In the meadows we could see richly flowering *Fritillaria lutea*, not more than 14 cm high. It grows well in cultivation in our country.

The weather had been improving. The sun was stroking the rounded ridges of the Trialet Mountains. We made another stop to take pictures and to admire the beauties of Georgian nature. Around us there were islands of *Gentiana angulosa,* blossoming sky blue. Nearby were healthy plants of *G. pyrenaica* in glorious bloom—the dream of many alpine gardeners. On the slope we saw quantities of light violet *Primula algida* with very rare white specimens. In moist places *P. elatior* bloomed yellow. The most beautiful, however, was *P. amoena* with an extraordinary spectrum of bloom color from violet blue and cream to yellow and pink with many intermediate colors as well. The flower stems were about 14 cm tall. The plant grows well in humus and moist soil in Europe.

The plant and flower paradise close to the ridge top can hardly be described. In the splits and cracks of the rocks *Saxifraga kolenatiana* and *S. desoulavai* grew. The rosettes of these plants were thickly sprinkled with flower buds. *S. kolenatiana* belongs to the Aizoon section. Its leaves are a little larger and pointed in form, with conspicuous edges. *Saxifraga desoulavai* belongs to the Porophyllum section. On rocky terraces, yellow *Gagea* species bloomed surrounded by subtle *Muscari* species with dark, black–violet

blooms. Right beside those we saw *Salix herbacea,* several centimeters high, and *Dryas octopetala.*

There were only a few meters remaining until we reached the summit of Khra–Tskaro Mountain. On the other side just below the summit, *Colchicum szovitschii* had already finished blooming. The blossoms are pink in color and open in the spring. In Europe it grows well and starts blooming immediately after the snow has gone away.

The mountain ridges extended all around us like a stormy sea, disappearing into misty haze in the distance. We will never forget what we have seen and cannot find appropriate words to describe it. We sincerely yearn to come back again. This memory will stay with us till the end of our lives.

The Year *Kelseya uniflora* Germinated—It is about three years since I obtained viable seed of that pretty, long–sought–after species and excellent example of high mountain flora. The seed germinated the spring of sowing and four seedlings came up, reaching, by fall, the size of one tiny rosette so small that *Eritrichium nanum* looked a giant by comparison. Repotting them I noticed long primary roots that indicate a fissure plant, so I treated them as such, planting them in big clay pots with good drainage and porous, gritty soil. The second year each one added a few side rosettes (the strongest plant, ten) so closely adpressed that it was difficult to tell them apart. They now form bluish "thimbles" 15 mm in diameter. Now I would like to plant them into my rockery and, as I found no competent information on the cultivation of this plant, I send an S.O.S. to any knowledgeable reader with personal experience. I also want to thank the unknown donor as well as the Exchange people who treated the seed so that it did not lose its viability. They all should have a feeling of envoys well representing their country abroad.

– Jaroslav Kazbal, Slezska 98, 130 06 Praha 3, Czechoslovakia

Cornus Canadensis

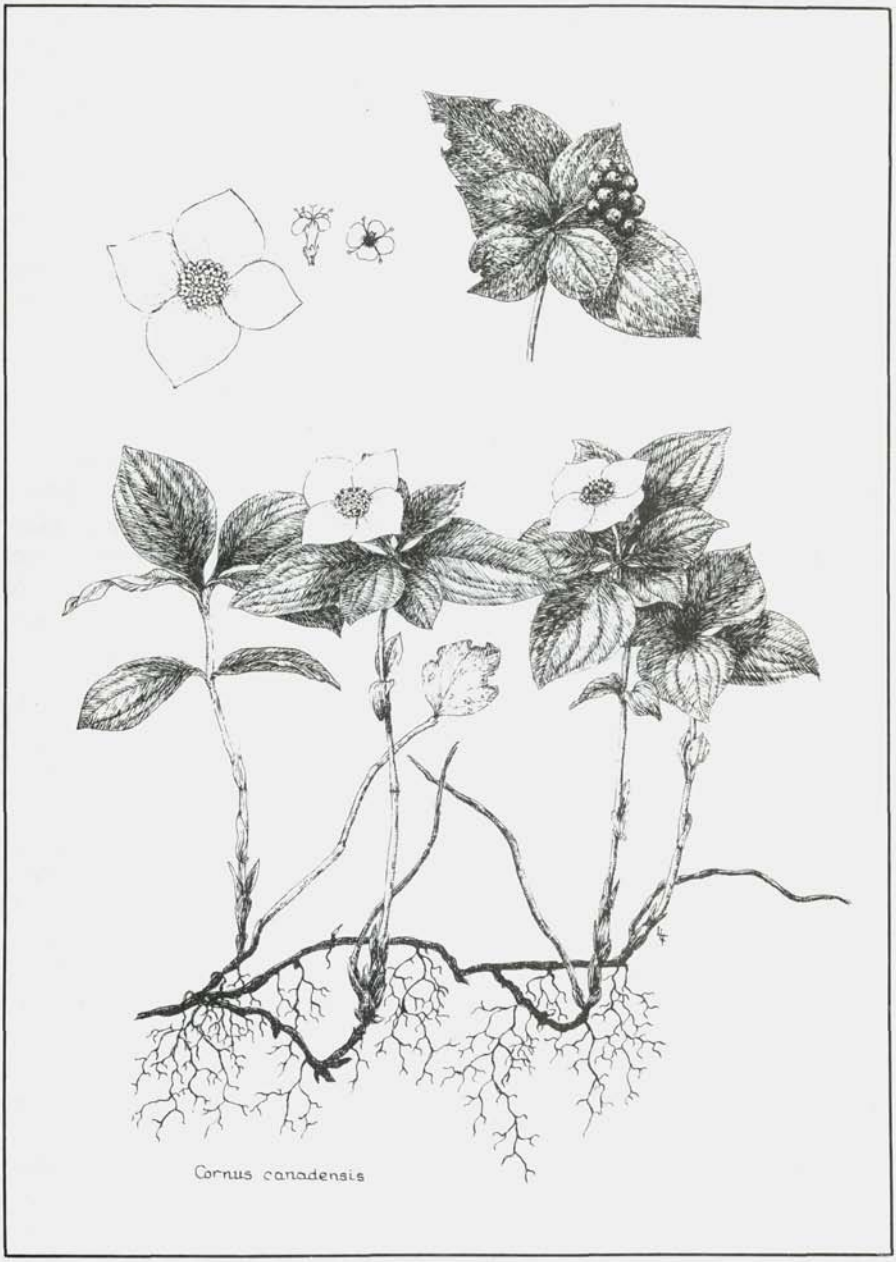
H. Lincoln Foster
Falls Village, Connecticut

The specific name *canadensis*, shared frequently by other native American plants, was used by early botanists to indicate that such plants are most at home in the northern parts of the American continent. This epithet is verified further by the observation that, though in nature *Cornus canadensis* is found from Greenland to Labrador, across the north to Alaska, and southward in the mountains to West Virginia and California, this plant flowers and fruits abundantly only in its northern haunts. It may be persuaded, by careful site selection, to grow in more southern lowland gardens, but here it never puts on such a display of flower. And even when it does flower, it sets fruit poorly or not at all.

This behavior may be solely controlled by temperature, but it is more likely a response to day length. I remember how struck I was seeing great beds of this dwarf cornel densely set with glistening clusters of red fruit growing in full sun as a roadside groundcover in the Gaspé and again seeing it heavily fruited, though not so dense, in deep, moist shade in New Hampshire. How different it looks in the few native patches I have found in the northwestern hills of Connecticut where bunchberry flowers sparsely and never develops good full clusters of berries. I used to wonder whether in the southern part of its range an insect pollinator was scarce or even absent, or possibly, whether some fungus destructive to the flower buds proliferated in warmer climates to diminish fruit set. These two factors may play a role, but I now incline to think that day length may be the controlling feature. Here is an area of investigation for some graduate student of botany at a university where there is equipment to control all aspects of the environment.

Yet, though this plant fails to perform in many of our gardens as superbly as it does in the northern wilds, it is still a most worthy candidate for inclusion.

Cornus canadensis forms a rapidly spreading groundcover by way of its forking underground rhizomes and from these ramifications rather sparce feeding roots wriggle down into the acid, duffy, moist soil it prefers. At periodic intervals from the upper surface of the rhizome arise the leaf–bearing stalks 4 to 8 inches tall. The opposite leaves, of sufficient substance to be evergreen when not tattered by an open winter and suffused in fall with shades of orange and cerise, tend to cluster in a whorl near the summit. Broadly flaring at the middle, the leaves narrow abruptly at both ends and are conspicuously veined. From the center of the leaf whorl grows a short flower stalk that carries what appears to be a solitary flower with four white petals and a yellow–



Cornus canadensis

Drawing: Laura Louise Foster

green center. Actually the center is a cluster of small four–petaled flowers that eventually produce the clump of red berries giving this plant one of its colloquial names: bunchberry. The four white petal–like structures are bracts just as in the flowering dogwood tree, the closely related arborescent species of *Cornus*.

Because of the similarity of the flowering and fruiting of the tree-like *Cornus florida* and herbaceous, ground hugging *C. canadensis*, one is curious about their evolutionary history. This curiosity is further piqued by the fact that in the lower reaches of the *C. canadensis* range in the West, there is a parallel tree–like species, *C. nuttallii*, though this usually sports six bracts around the cluster of flowers rather than four. Is there in the Orient now or in records of the past a ground covering species to make a balanced pair with the tree form, *C. kousa*? There is not now in Europe a tree–like companion for the herbaceous *C. suecica*, a near relative of *C. canadensis*.

One gets lured away easily into these speculations when one tries to capture the "feel" of the plant itself and remembers a tree or two of *C. florida* that presented problems in a controlled landscape because they persisted in sending out rather herbaceous stolons in a skirt all about the base of the trunk—wonderful fodder for deer, but never assuming tree–like stance. Is it even possible that we could cross–fertilize *C. canadensis* or *C. suecica* with *C. florida, C. nuttallii,* or *C. kousa* to hark back to some previous evolutionary forms? Probably not, too many genetic changes have taken place to allow such miscegenation.

To return from our wayward speculations, it is accurate to say that the flower clusters set off by the white bracts are truly handsome in *C. canadensis* and are sometimes even more exotic by having the bracts purple tipped or even roseate throughout in *C. canadensis* forma *purpurescens*, again duplicating the color patterns of *C. florida* with its commonly cultivated rubra form. The scarlet berries, huddled in a tight bunch, are certainly as notable as the flowers. Each fleshy berry contains a single plump nut–like seed, but with enough flesh around it to encourage eating.

That the fruit is indeed edible is attested to by some of its common names: crackerberry and puddingberry. Linnaeus, in his account in *Travels in Lapland*, reports that the Lapps made what he called a "dainty" from a mixture of the berries of *C. suecica* with whey boiled down until as thick as "flummery." This pudding is eaten with milk or cream, rather easier to mouth if the seeds have been strained out earlier in the process. Cow's milk and whey may be as satisfactory as the milk of reindeer that the Lapps depended upon. It might be wise also if using *C. canadensis* to add a dash of lemon juice or other flavoring to the mixture because its berries are rather insipid while those of the European *C. suecica* are in themselves pleasantly tart.

The current enthusiasm for the nutritional value of our native and

imported flora should not exclude, I think, the aesthetic virtues. *C. canadensis* does possess this latter quality in sufficient degree to prompt us to try to introduce it into a moist, acid corner of our garden for a long season of display. It is definitely not an easy plant to transfer from nature to the garden, but it may be propagated by careful separation of a subterranean rhizome from the plant, treating this as a cutting in a sand–peat frame or pot until it has made new roots. Seedling plants are even more readily established if you are willing to wait 2 years for the seeds to germinate after at least one spell of freezing.

Because the flower structure of this groundcover is somewhat different from that of the various other shrubby species of *Cornus*, some botanists have christened it with a separate genetic name: mouthfilling *Chamaepericlymenum*. There is plenty of sound authority, however, to warrant retaining the simpler nomenclature.

Cornus suecica is very similar to *C. canadensis* but is in appearance a leafier plant. It has a considerable number of larger opposite pairs of leaves on the upright stem below the terminal whorl. The blossoms are very like those of its New World cousin, though not so large. The creamy bracts are smaller and the cluster of flowers in the center is dark purple instead of pale yellow. Though considered primarily a European plant, *C. suecica* is circumpolar and comes across from Siberia into Alaska and there east across the Canadian arctic.

Edward K. Balls

Margaret Jordan
Cottingham, England

A great English plant collector who lived in California for nearly 30 years died in Yorkshire on 23 October, 1984.

E. K. Balls was born 9 August, 1892, and brought up in Southampton; he worked in retail drapery until 1914. A Quaker from age 16, he worked on war and famine relief with the Friends in France, Corsica, Macedonia, Italy, Serbia, and Russia until 1925. He married Natalia Nikolaevna Timonova in Russia in 1924.

In 1926 he began to grow alpines and build rock gardens for Clarence Elliott of Six Hill Alpine Nursery, Stevenage (father of Joe Elliott of Broadwell Nursery, Moreton in Marsh). An important garden which he built was for Lionel de Rothschild at Exbury, Hampshire (taking 8 months' work); others were

at Giggleswick School in Yorkshire and at the London Zoo to form an open-air reptiliary.

In 1932 Dr. Paul Giuseppi, Treasurer of the Alpine Garden Society, wanted a companion and help to finance a plant hunting trip to Persia. Clarence Elliott suggested EKB, who raised subscriptions at surprisingly short notice, and this was how his careeer as a collector began. Giuseppi was especially keen to find the legendary dionysias, of which they collected six species; plants still survive raised from seed of their *Dionysia curviflora.* They also found glorious irises such as some of the onocyclus group. EKB wrote vividly about this and his later journeys in the *Gardeners Chronicle*—the articles deserve reprinting in book form. He wrote about his irises in the *Yearbook* of the British Iris Society, and at greater length in the *Bulletin* of the New Zealand Iris Society.

Supported by such people as Sir Frederick Stern of Highdown; Lionel de Rothschild; E.B. Anderson; Lord Aberconway; Mrs. A.C.U. Berry of Portland, Oregon; Wallace Stevens in New Zealand; and Dr. Lemperg in Hatzendorf, Austria, EKB now decided to become a professional plant hunter spending his winters in lectures and articles. He went in 1933 to Turkey with William Balfour Gourlay of Edinburgh and Cambridge. They went again in 1934; among the best of their Turkish finds were *Orphanidesia gaultherioides* (now *Epigaea*), *Cyclamen intaminatum, Iris histrio aintabensis* and more of the onocyclus iris, *Geranium armenum (psilostemon), Draba polytricha, Campanula betulaefolia, Crocus scharojanii, Primula longipes,* and *P. auriculata.* By now EK was collecting herbarium specimens for such institutions as Kew and sometimes pressed as many as ten of each species; he was most diligent and enthusiastic, whatever the discomforts and dangers. He went back to Turkey in 1935 with Charles Bird, an ornithologist, but the authorities this time were obstructive, because, it turned out, they thought he was a spy—even supposed him to be Lawrence of Arabia! The 3 years in Turkey yielded the collector's numbers EKB 146-2416.

Next came Morocco in 1936 with Richard Seligman: *Narcissus watieri, Sarcocapnos baetica, Colchicum triphyllum* (A.M. at the R.H.S. in 1937); Greece in 1937 with Gourlay; *Salvia haematodes, Fritillaria graeca* ssp. *epirotica;* Mexico in 1938 with Gourlay and Mrs. Balls. *Rubus* x *tridel* 'Benendeu' was bred by Collingwood Ingram from *R. triloba* collected in Mexico by EKB, crossed with *R. deliciosus.* While still in Mexico the two men were asked to join Jack Hawkes in South America to collect wild potatoes for the Imperial Agriculture Bureau—some of their finds are still in use for breeding today. Collector's numbers in South America (horticultural material, which they could not ignore in addition to the 500 species and varieties of potato, and wild cotton, tobacco and tomato) reached the figure EKB 7506.

When war broke out EKB was lecturing in the USA and could not get

E.K. Balls (center) on Mexican expedition, 1938

home. Mrs. Balls joined him in 1941 and during the war he worked with several British Government agencies, then for UNRRA (1944–1947 in Yugoslavia and China). He had met Lester Rowntree in Mexico, and now took a share in her California Wild Flower Seed business. The business closed in 1949, and EKB was then offered work at the Rancho Santa Ana Botanic Garden, now in Claremont, California. His work there was partly to collect seeds and plants of the local flora, all over the state, and partly to design and build rock gardens and beds suitable for their cultivation. After EK's retirement in 1961, he and Mrs. Balls remained in California until they moved to Spain for a year (where EK did not put out the work of making a new garden to others, but, in his eighties, tackled it with a pickaxe!), finally to live with their daughter in Cottingham, East Yorkshire, from 1978. Mrs. Balls, a gifted painter, died on 13 November, 1983.

I had the good fortune to discover in September 1983 that EKB, whom I had thought already a part of horticultural history like Reginald Farrer or Frank Kingdon Ward, lived only a mile away. I knew him for the last year of his life; he remained lively and enthusiastic even then, until near the end. At 90 he gave a lecture on the wild flowers of California, and was deeply disappointed that a trip to the antipodes, to meet friends in Australia and New Zealand with whom he had corresponded for over 50 years, had to be cancelled when he was 92, owing to ill health. His friendship was a joy, his modesty and appreciation delightful, and his whole life based on loving service to mankind.

Dryland Bunneries: Persian Carpets of the West

Panayoti Kelaidis
Denver, Colorado

By June most years, the hot summer sun turns the prairies and grasslands of the West into a symphony of subtle neutral colors: silver and gray, brown and beige, straw white and dusky green. Even native westerners may be a little apologetic about this state of affairs. They will assure you that it's been unusually dry this year, that the weather has been abominably hot. Don't be fooled. It's like that every year when summer comes.

It is hardly surprising, therefore, that most visitors from lush green cities or maritime climates waste no time in escaping the drylands to climb up to mountains where snow lingers all summer and thunder showers keep the vegetation green and flowery. Even sophisticated rock gardeners may curse the sagelands for their heat, their emptiness, their vastness.

Much of the West consists of relatively flat terrain, covered (depending on precipitation) by various short grasses and tiny shrubs. These are interspersed, in their season, with a tremendous variety of wildflowers. Where this native landscape has not been overgrazed, bulldozed, or built over, it glows richly with herbaceous and subshrubby plants. For a brief period in mid-spring, and often again in the fall, the western drylands constitute one of the loveliest of wild flower gardens.

So great are the extremes of hot and cold, cloudburst and drought, that it is difficult to predict from year to year when the flatlands will bloom. Many years blooming is uneven. Some plants may fail to set seed several years in succession, but then one year the snow accumulates and spring comes gently for a change. The landscape unfolds hundreds of jewel-like wildflowers as far as the eye can see, as intricate and rich as a Persian carpet.

It's not easy to generalize about the dryland West. It stretches from Mexico almost to the Arctic Circle in Canada. It is intricately divided by hundreds of separate mountain ranges and by a wiremesh of rivers. Now, by the hand of man, farms, cities, mines, and millions of miles of barbed wire further partition the West.

What can be said, with a degree of certainty, is that almost any piece of undisturbed dryland from the east face of the Rocky Mountains to the Sierra Nevada and Cascades is sure to have at least one species of cushion *Phlox* in evidence. There are sure to be two species of *Penstemon* present, and two or more eriogonums which can vary from a few inches to several feet in height. Composites will be especially well represented, from the townsendias and erigerons of spring to asters and gutierrezia in the fall.

Eriogonum ovalifolium (p. 73)

Photo: Phil Pearson

Sphaeromeria capitata (p. 75)

Photo: Phil Pearson

Eriogonum species, Nevada (p. 70) Photo: Ted Kipping

Phlox bryoides (p. 74) Photo: Phil Pearson

Virtually every self–respecting bunnery is sure to have one of the innumerable permutations of *Hymenoxys acaulis* or *Haplopappus acaulis.* And this is only the beginning.

It is useless to generalize about the plants of this region, for just as each island or mountain in the region of the Mediterranean Sea has evolved its own special flora, so too have the basins and ranges throughout the West isolated plants and created a multitude of microhabitats for plant speciation.

So rich is the West in wildflowers that in a good year something of interest may be found at nearly any stop. And yet, every botanical explorer in the West soon notices that there are certain places that harbor a special concentration of unusual plants. Frequently these are low ridges at the bases of mountains and are colloquially referred to as "hogbacks" where strata are tilted somewhat. Often several rock substrates can be found in close proximity. Here, soil is shallowest and winds and sun are fiercest. Grasses no longer outcompete the little forbs, and a cushion flora dominates the scene. In his monograph on the genus *Astragalus* in America, Rupert Barneby describes one such habitat as "pseudo–alpine."

Though often five or more thousand feet below tree line, this sagebrush tundra frequently contains a few of the same species of cushion plants that might occur on the tops of nearby mountains. Thus, on the plains of Montana, *Douglasia montana* and *Eriogonum ovalifolium* can be found on both the eastern escarpment of the Rockies and the sagelands far below. In Wyoming, *Astragalus kentrophyta* ssp.*implexus* can occur on dry plains below 5000 feet and on alpine summits 10,000 feet in elevation. The same is true of *Hymenoxys acaulis* and *Eriogonum flavum* which have both desert and alpine subspecies. *Haplopappus acaulis* forms spiny mats on the exposed tundra of the Sierra Nevada in California. Very similar forms can be found throughout the Great Basin on various exposed hills all the way to the Rocky Mountains.

There are countless special places in the West where these cushion plants occur in such profusion and variety that one always remembers the way there and visits them time and time again over the years.

Since the climate of the high steppe in the West is so unpredictable and captious, it's no surprise that this landscape is vulnerable as well. Just as on the tundra, plants must struggle with the elements to survive in these bunneries, but unlike the tundra, the dryland cushions of the West are far more vulnerable to every kind of abuse. Range managers think only of maximizing forage, so large portions of the West are seeded to exotic grasses. This does little to enhance the native wildflowers. One or two years of overgrazing can eliminate many palatable wildflowers over whole regions. During the long dry season, few people notice the dry and dusty ancient cushions and regard the landscape as desolation. Motorcyclists find driving through these places irresistible and off–road vehicles create especially unsightly

devastation here. Mining (however crucial for our modern society) creates wasteland that only centuries will heal in such extreme climatic regions. Even so, with all these threats and so little appreciation, the drylands of the West are the treasure trove of knowledgeable rock gardeners. I can think of no area more deserving of the attention and protection of rock gardeners than the dryland bunneries of the West.

The Laramie Plains

Practically all the unforested portions of Albany County in Wyoming constitutes a giant bunnery. It has always struck me as ironic that the little university town of Laramie struggles to plant trees and lawns when the native prairie there contained more desirable cushion plants and wildflowers than many of us manage to maintain in our gardens.

At least three species of Orophaca *Astragalus* (the most dramatic and pulvinate of native peas) can be found in this broad valley. On certain spots along Highway 287 ancient specimens of *Astragalus tridactylicus* form silvery mats up to 3 feet across and must be decades old. For a few weeks in early spring these are smothered with vivid pink blossoms. Farther west I have seen smaller-leaved *A. sericoleucus* doing the same thing a few weeks later. Much easier to grow than these is *A. spatulatus* which belongs to a different section altogether: section Drabelliformis. This is frequently a much smaller plant that forms cushions usually much smaller than a dinner plate and as tight and silvery as *Raoulia australis.* For a few weeks in June the plants, hidden under pink or purple or pure white pea blossoms, are as floriferous as cushion phlox.

Almost any stop in this valley is sure to produce one of several phloxes. *Phlox muscoides,* with its miniscule leaves forming mosslike cushions is especially common. It rarely seems to bloom prolifically and often sends out long underground rhizomes popping up here and there many feet from the parent plant.

Phlox bryoides is a larger plant, but still fairly congested and desirable. It has silvery, overlapping leaves that resemble a little club moss much more than any bryum, to my eyes. These are so tightly packed that when they are in bloom not a leaf is apt to be discerned. The flowers are perhaps half the size of typical eastern creeping phloxes, but lovely nonetheless. As with most western phloxes, these are intensely and deliciously fragrant. Fifty miles south of the Laramie area, in Colorado, the plant is restricted to steep limestone cliffs—for all the world like dionysia—but here in Wyoming it grows practically anywhere: in pastures, on hilltops, even colonizing in ditches and old roads.

One particular hilltop in this valley has not only all the plants mentioned

thus far, but several dozen other cushion plants and miniatures as well. *Eriogonum ovalifolium* occurs in a white-flowered phase (this is practically its southeastern limit), and *E. flavum* var. *flavum* is everywhere. This is a surprisingly adaptable buckwheat with vivid yellow flowers on 5-inch stems blooming over a very long period in the summer. The gem of the genus is undeniably *E. acaule;* this is the tiniest of all the buckwheats, forming cushions up to a foot across composed of literally hundreds of miniscule rosettes of greenish gray-green leaves barely 1/16 of an inch long. The flowers vary from yellow to reddish shades. They are tiny things, half buried in the cushion for a few weeks in June, that turn these low mounds into burnished platters of color. A delightful plant, largely restricted to Wyoming, this is by no means common. Further north and west there are hogbacks where thousands of plants of this species do occur—some of the choicest cushion lands or bunneries of the West.

Sphaeromeria capitata is also known as *Tanacetum capitatum.* First found by Thomas Nuttall not too far north of here, this minute, mat-forming tansy is white-tomentose, resembling an especially desirable artemisia. In early summer, the clumps are literally covered with egg-yolk yellow lollipops of blossom. It has proven surprisingly adaptable to cultivation over the last few years. Its cousin *Sphaeromeria nuttallii* grows in choice bunneries much farther to the west, and is even tinier than this species.

Penstemons occur in variety. The specialty of this region is *Penstemon laricifolius* var. *exiliifolius,* perhaps half the size of *P. laricifolius,* with ivory-white bells and the perfect stature for trough gardens where it is far more likely to grow in cultivation than in the open garden. It is fiercely resentful of excess water. The plant is universal in meadows throughout the Laramie Plains and in the foothills beyond. *Penstemon eriantherus* has an especially dwarf form here and *P. virens* and *P. secundiflorus* are common along the fringes of the plains. Erigerons and townsendias occur in tremendous variety almost everywhere. Over a dozen species occur here—most being quite dwarf and floriferous. And yet the list of cushions never seems to end: *Paronychia sessiliflora* making tight wads on the roadside, starfish rosettes of several species of *Physaria* and *Lesquerella* that are almost as decorative in seed as they are in flower, many silvery-leaved *Senecio* species and the dark green congested mounds of *Arenaria hookeri.* This valley is a tremendous cornucopia of desirable cushion plants and alpines virtually none of which is secure and protected.

Eureka County, Nevada

Most cross country travelers find the Great Basin to be the least inspired part of the nation: so few towns, such arid gray landscapes! This should be

a signal to plantspeople that there are riches to be found here. And, indeed, there are perhaps more cushion plants found in this vast series of basins and ranges than on all the alpine tundra of North America.

On one rapid cross country trip recently, we happened to stop along a major highway in Eureka County. The tremendous variety of cushion plants on an impossibly white substrate indicated that this would be an interesting place to explore. The rock was a very sharp and pitted limestone that resembled tufa somewhat, but was whiter than any tufa we had ever seen. The first plant to attract our notice was a huge cushion of *Astragalus calycosus* var. *calycosus.* Almost as tight as the Orophaca astragalus from farther east, this form had furry, overlapping, pinnate foliage of a deep blue–green color. The flowers were tiny but of a two–toned lilac–purple that was irresistible to photograph. Nearby a much tighter cushion suddenly began to appear. At first the cruciferous seed pods reminded one of an impossibly tiny draba (what draba grows out here in the desert?), but after a moment's reflection, it dawned on us: *Lepidium nanum!* A rather good look–alike for *Draba bryoides* var. *imbricata.* Obviously requiring lots of heat and drought to retain its tight habit.

Astragalus kentrophyta occurs in a more lax, intensely spiny form nearby that can spread up to a yard across. What would it take to grow such a fine specimen in the garden? Suddenly, I notice that it is growing not on the white limestone, but on an abandoned roadbed—in pure asphalt!

Haplopappus acaulis here occurs in the tiniest form we have ever seen, rosettes barely a quarter of an inch across and flowers on stems only an inch or two high. A perfect trough plant if ever there was one. Erigerons, lesquerellas, and tiny bonsai–like *Artemisia* species, mostly of the *Artemisia arbuscula* persuasion. Another glory of this locality was *Penstemon janishiae,* recently segregated from the widespread *P. miser* and producing huge gaping amethyst flowers on stems a few inches tall.

After an hour or two of gathering seed, trying to key out the several species of *Phlox* here from vegetative characters, and puzzling over fascinating mounds of this or that, we realized that we were dangerously near to sunstroke. The bank thermometer in the nearest town about 100 miles away read 104° F. The cushion form protects from heat as well as cold apparently.

Through the years, it is possible to find hundreds of places as rich as these throughout the dry tablelands of the West. Let us hope the plants will endure and adapt to the increasing urbanization and development of the West as well as they have put up with the relentless and merciless elements.

Recollections of The Bunnery

(Cover Photo)

Just to the south of Glacier's peaks, facing northward to them and beyond toward the drainage to Hudson's Bay, a long, narrow and high segment of the continental divide pushes skyward and drops away steeply on both sides westward to the Flathead and eastward to the Little Badger, a fork of the Marias River, a Missouri tributary. It is a considerable feat just getting up there, a climb with no easy ways now, though a fair road was built when a relay station was installed. Plenty of snow, roadside slides, and ankle–deep mud can prove deterrents.

For some reason known only to mother nature, a particularly attractive bunnery lightens the slope above the road at near its highest point on the south face at just below 10,000 feet, an exposure that allows most of the snow to blow off. Whereas most such bunneries consist at best of one or two, maybe three species, this one boasts an unusual variety of such as eriogonums, phlox, penstemons, and composites.

incidentally, this area has an interesting "history." Some of us will remember the comic strip about a boxer named Joe Palooka. Joe's manager annually took him away to a Rocky Mountain summer camp called Palookaville. Though nobody ever said so, and workout was the order of the summer, it was here at the base of this mountain with fresh air and good trout fishing that Palookaville flourished. You won't find it on any map, though.

– BLD

The Bunnery, seen all too briefly and without bloom more than 12 years ago on a forced march to the top of the mountain, has never been entirely forgotten. Unfortunately it has never been entirely remembered either, and worse, it has never been revisited. The specific names of its occupants have long since been forgotten, not so the general effect of a diverse group of friends enjoying a well–deserved rest, full of health and satisfaction and burnished late–summer well being, with seed successfully set and dispersed, and elegant mounds of diminutive foliage prepared for winter in shiny rich green leather or warm red–orange suede or entirely encased in deep silvery gray, ladybug–decorated flannel. Splendid enough in leaf, think of this exceptional bunnery in bloom!

– SFS

A New Alpine Garden in the Rockies

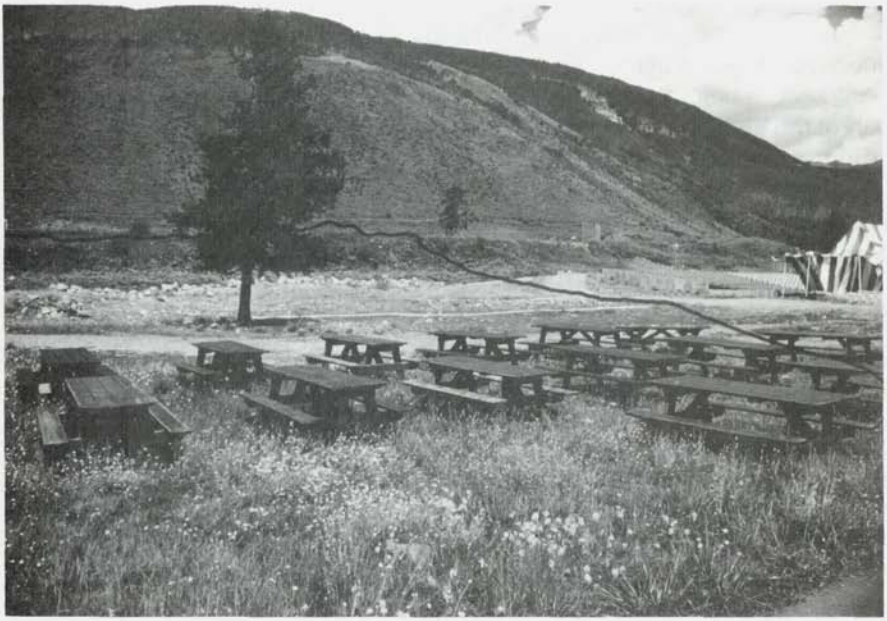
Martin Jones
Vail, Colorado

In the summer of 1983 it occurred to me that Vail would be a perfect place for the development of a public alpine garden: good altitude at 8200 feet, a year–round resort community, and an already strong emphasis on the use of flowers in local landscapes. The question then was where to locate such a garden in a small valley full of extremely valuable real estate. My first thought was to contact Don Simonton. I knew Don had a strong interest in our native plants as well as knowing the community as well as anyone. When I called, Don was not at home but his wife June was and she was very interested in the idea. She indicated that she knew of a perfect location. That she did. She proceeded to show me a spot in Gerald R. Ford Park which was undeveloped at that time. It was well protected, had a southern exposure, was not far from Gore Creek, and was within walking distance of the village core. There was also an amphitheater being planned for the park which we felt would complement the garden greatly. The site could not have been more perfect.

Shortly thereafter Don and June got together a small group of long–time Vail residents who are influential in the community. I gave them a slide presentation of the Rock Alpine Garden at the Denver Botanic Gardens to give them an idea of what an alpine garden was. This garden and its curator Panayoti Kelaidis were truly the inspiration for this ambitious endeavor. At the meeting we decided that we should present the idea to the people and government of Vail. I contacted Panayoti and scheduled a time at which he could address the community.

With the presentation of a proposed plan and an explanation of the concept of alpine gardening, the people at the meeting enthusiastically received the idea.

At about the same time the Town of Vail was beginning a planning process for the park lands within the town. The plan for Ford Park was the central issue. It is not easy to sell something to a concerned community with very little open space available. Especially when they're not quite sure what it is they're being asked to buy. Some people thought it would be an exact replica of an alpine tundra, others thought it would be a pile of rocks with wildflower seeds scattered about. It took 2 years of meetings and educating the public as well as the planning staff, the steering committee, the planners hired by the town, and the council itself before they understood the concept well enough to accept it. There were also other concerns. The softball players who had fields above the proposed garden site were sure we wanted to turn



Proposed site in Ford Park Photo: Martin Jones

one of their fields into a rock pile. They went so far as to circulate posters warning, "Don't let your summer end up on the rocks." It was not easy convincing them that we didn't intend to sacrifice one of their fields. Although I cannot honestly say that the thought didn't cross my mind. Other groups were interested in a swimming complex for the training of Olympic athletes, others just wanted green space.

The planners involved had their work cut out for them. One of the early plans showed the garden divided into four sections, some on 45 degree slopes. Once they understood the concept better, they had an idea why this would not work and the potential value this idea had to the community. After 2 years and many, many meetings a master plan was arrived at. It gave us a suitable garden in size (about 1.5 acres) and location as well as meeting the needs of other concerns. The plan was approved by the council and we were on our way.

At this point, approximately July of 1985, we began to officially organize The Friends of the Vail Alpine Garden. We called a meeting of people interested in the project. At this meeting we elected a board and set out to incorporate ourselves and get our tax exempt status from the Internal Revenue Service. With just a small group of volunteers this took us longer than we expected. We also had to modify the proposed budget and existing site plan plus many other details. It took us until mid–February before we

could begin our initial attempts at fund raising. We also had to satisfy the needs of the council to get their final approval of the garden as a separate entity from the rest of the proposed development. They wanted us to be financially secure before we started construction. This meant raising a significant part of the $800,000 proposed construction budget—a lot of work for a small group of dedicated volunteers.

During this whole process, the Denver Botanic Gardens watched closely. When we finally got approval of the master plan and established a legitimate organization, Merle Moore, the Director of the D.B.G. gave us not one, but two letters of support. We also received strong support from Panayoti Kelaidis. Then in February, Andrew Pierce accepted a position on our board of directors. Andrew is the Assistant Director of the D.B.G. His knowledge and experience have proven invaluable to the development of this project.

Now to give you some information on the garden itself. The garden is primarily dedicated to the display of North American Rocky Mountain alpine and subalpine plants, although other species will also be included. The design will emphasize large rock and water features with as much as 3000 tons of rock being placed and 3850 gallons per minute of water being moved through the two ponds and two streams. The entire garden, although having a 25 foot change in elevation, will be wheelchair accessible.

The garden itself was designed by the author with the invaluable input of Panayoti Kelaidis and Cliff Simonton. Cliff is the environmental coordinator for Beaver Creek Ski Resort. He was also invaluable in establishing the grades in the garden which were critical in determining the path system and the location of the water courses.

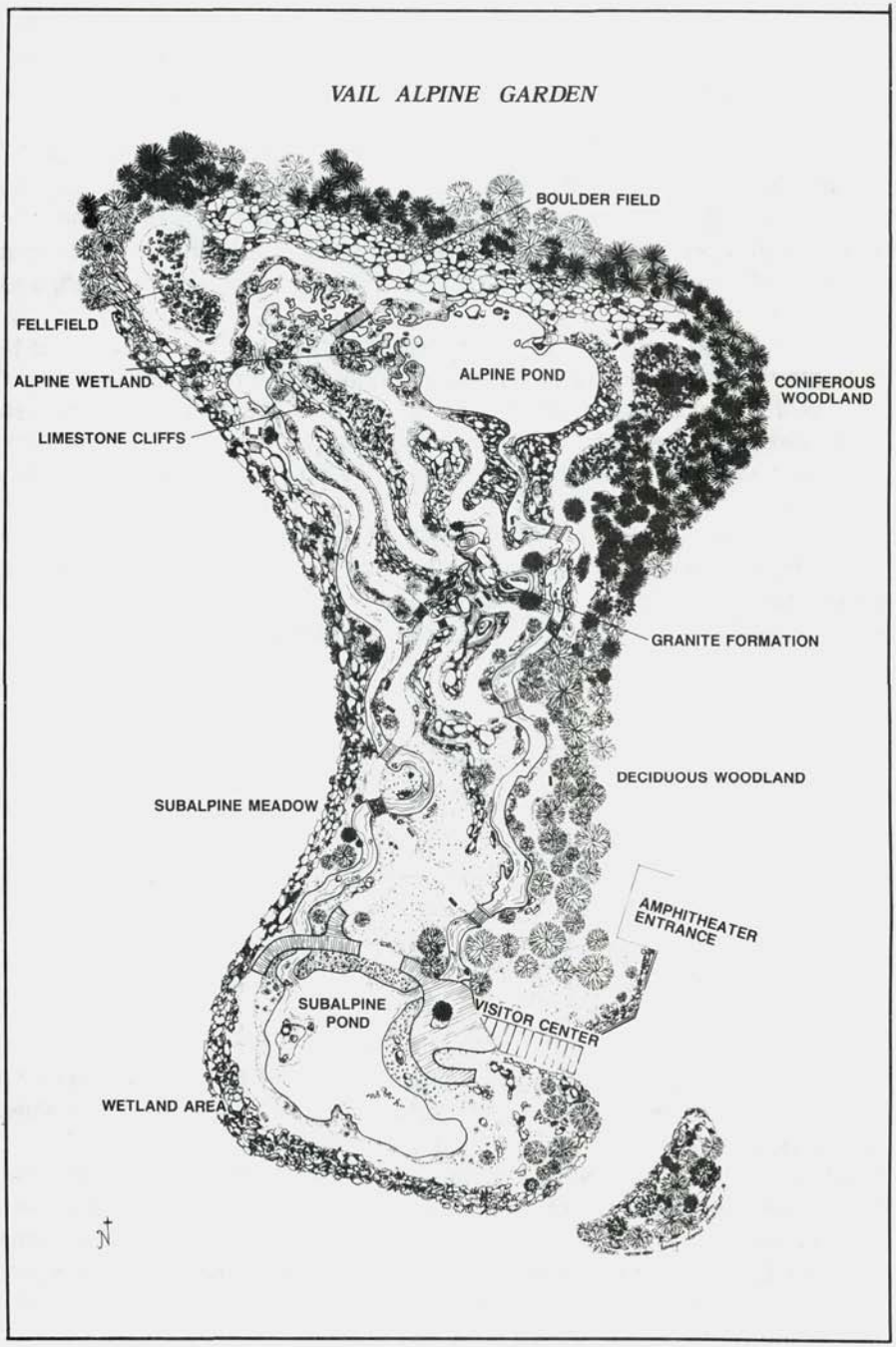
Our climate and elevation, we feel, will permit the development of a unique garden to enhance the knowledge of gardeners all over the world. The Vail Alpine Garden has the opportunity to make a significant contribution to the horticultural community and to society at large. It is the intention of the board to capitalize on this opportunity to the fullest.

Initial membership benefits are to include a quarterly bulletin, a seed exchange, guided tours in the surrounding mountains, and a membership pin and card. When the garden is completed, admission will be free to members. They will also have access to the library and data resource center.

The goals of the Vail Alpine Garden are to collect, preserve, cultivate, and display herbaceous plants, shrubs, and trees native to North America. The garden will also display alpine plants from many other parts of the world.

The garden staff will accumulate data on the growth, habits, adaptability, and specific needs of plants in the collection. The information will be stored on computer and available by mail.

The educational program of the garden will include access to the data base, a library, a slide library, quarterly bulletin, guided tours, seminars, and


VAIL ALPINE GARDEN
BOULDER FIELD
FELLFIELD
ALPINE WETLAND
LIMESTONE CLIFFS
ALPINE POND
CONIFEROUS WOODLAND
GRANITE FORMATION
DECIDUOUS WOODLAND
SUBALPINE MEADOW
AMPHITHEATER ENTRANCE
SUBALPINE POND
VISITOR CENTER
WETLAND AREA
N

classes.

The garden will make available seed and plants for introduction into commercial production and encourage their use by demonstrating their habits and cultivation techniques.

It is also our intent to provide a passive form of recreation and cultural activity for visitors to our mountain communities. Many people visiting the mountains, especially the elderly and handicapped, are unable to enjoy the splendor and complexity of our native alpine and subalpine environments because of access difficulty. The garden is designed to accommodate and educate all visitors.

We hope to work in conjunction with the Denver Botanic Gardens to promote the use of alpine gardening not only as a form of garden art but as a useful form of residential and commercial landscape design. We also look forward to the support of the ARGS and its membership in our endeavor and hope we may contribute significantly to alpine horticulture in North America.

We will have a display set up at Alpines '86. I'm sure we'll see many of you there. If you would like more information on the Vail Alpine Garden, please call Martin Jones (303-949-6672) or Hellen Fritch (303-476-0103) or write to the Vail Alpine Garden, 183 Gore Creek Drive, Vail, Colorado 81657.

Adonis Seed—The following thought–provoking information was sent to Laura Louise Foster by Virginia Howie of Millis, Massachusetts. A letter just received from Joseph Starek of Czechoslovakia says that the seed of *Adonis vernalis,* black and shiny, must first be shucked out of the green covering. Then Mr. Starek suggests renting a chicken or pigeon and feeding it the fresh seed. The recovered seed will germinate by the hundreds. This discovery came when he found mobs of seedlings under the bushes beneath a spot where pheasants roosted at night. Mr. Starek's friends tell him that using a solution of the bird droppings as a soak will produce the same results.

Excerpts from Early *Bulletin* Articles on the Rockies

(Past generations of gardeners and plantspersons also knew and loved the Rocky Mountains and their flora. Included here are some of their discoveries, impressions, favorites, and opinions.)

The Rocky Mountain and Great Basin Ranges: Excerpts
C.R. Worth, ARGS *Bulletin,* Vol. 18, No. 2, April, 1960

Sweeping down out of Canada, the Rocky Mountains rise abruptly from the Great Plains—not, as school geographies may have led us to believe, in one vast unbroken wall, but in a great number of short, almost parallel ranges, often separated by wide valleys, but here and there converging into a "knot."

In composition the ranges vary greatly. Along the "main range," that is, roughly, in the vicinity of the Continental Divide, metamorphic rock seems to predominate, while farther west sedimentary and igneous formations are the rule. Yet generalization is unsafe, for one may find granitic peaks rising out of a limestone base, at least one granitic range has a limestone summit, and frequently several types of formation lie in close proximity.

Perhaps because the Rocky Mountains are older than the other high ranges of the world and because their northern part was buried under the great glaciers of the last Ice Age, much of the alpine flora is remarkably widespread and relatively uniform. *Silene acaulis* extends as far south as northern Arizona; *Primula parryi* occurs from the Front Range of Colorado into eastern Nevada, and from Arizona into (reportedly) southern Montana. Colorado and Montana are perhaps richest and most varied in their alpine plants, while the much drier ranges of the Great Basin have but a limited number of species. Yet it is to these outlying peaks that one must go for some of the choicest plants of the region....

The wooded areas have few plants of interest, while the occasional meadow below timberline may provide a considerable number of species of interest to the botanist but of a size and coarseness to dampen the enthusiasm of a gardener. The occasional treeless (or nearly treeless) mountainsides are not to be ignored, for there phlox, townsendia and other delights are often found in abundance.

Especially in Wyoming and Nevada, even more rewarding than the heights to both gardener and botanist are the regions below timberline—slopes of hills, canyons, and especially the occasional lime knolls cropping out of an otherwise flat plain. Here are to be found the real treasures of the region, plants as minute, as specialized in growth, and as showy in bloom as those of alpine screes, and in much greater variety: phlox, townsendias,

oenotheras, astragali, minute penstemons, beckwithias, violas, eriogonums, calochorti, perhaps even *Eritrichium howardii* and *Sphaeralcea caespitosa.* As these flower in spring or early summer, the visitor late in the season may find little but the characteristic "buns" into which many species develop, or sere and seedless fragments of the herbaceous sorts; in a dry year even these may be absent.

With the excellent main highways now general throughout the region, several of which travel for miles near, or even above timberline, it would seem that the mountains would be much more accessible than they were only a few years ago. Yet, except in a few favored regions, this is not the case, in spite of the speed and ease with which one can now travel from one locality to another. For our modern cars cannot negotiate successfully many of the mountain roads which the Model T and the cars of the 1930's found no obstacle, and many of these roads are in far worse condition than they were a decade ago. It once was a simple matter to obtain horses to carry one where a car could not go; now they are rarely procurable, and one must resort to hikes of many miles through often waterless country, or to jeep travel. Finding an available jeep is often more difficult than renting a horse; even if one can be located, and its iron-nerved owner persuaded to take one on a breath-taking trip to the high places, the cost is usually prohibitive to one of moderate means. Nor can a high-mountain ride in one be recommended to persons affected by awesome slides and precipices along which the road is so narrow that half—or more—of the jeep's tires at times have contact with nothing but an apparently bottomless void. Plant-hunting was certainly simpler and far less nerve-racking in the good old days of the 1930's.

In writing these notes, I have often been appalled, less by the number of ranges about which I know nothing, than by the little I know about those with which I am most familiar. Only by repeated visits, season after season, in good years and bad, at frequent intervals throughout the period of growth, can one begin to become acquainted with the plants on a mountain. Even on those where I have been many times, often for extended visits, I still discover plants of real interest which I have never noted in the past. Yet many of our mountains have been visited only once or twice by botanists and collectors, and some are perhaps still virgin territory. While there is probably little likelihood of finding many new species, especially at high altitudes, in regions still but sketchily explored, range extensions and notably good (as well as more adaptable) forms are likely to be encountered almost anywhere. Our western mountains are still a worthy hunting-ground for the adventurous....

(The entire April, 1960 issue of the Bulletin was devoted to the Rocky Mountains.)

The Bunnery habitat, Montana (p. 77) Photo: Sharon Sutton

Oxyria digyna (p. 87) Photo: Sharon Sutton

Hymenoxys acaulis, Colorado (p. 73) Photo: Ted Kipping

Townsendia condensata (p. 83) Photo: Ted Kipping

Botanizing on Loveland Pass: Excerpts
Claire Norton, ARGS *Bulletin,*
Vol. 4, No. 5, September–October, 1946

Loveland Pass, since its opening not many years ago, has been a Mecca for the alpine botanist. It is readily accessible by auto, and once there, presents a varied and altogether delightful flora for study, a flora which has not yet given way markedly before the invasion of man.

A tunnel is now being built to carry Roosevelt Highway through the mountain under, rather than over, the Pass. What will then become of the road is debatable, but there is the possibility it will be abandoned ....

Then perhaps ... *Eritrichium argenteum* ... here at its loveliest in blue and in white, will nestle again in the rocks at the edge of the roadbed. Grasses of the tundra will spread year by year to cover the scars left by the great power shovels and bulldozers. In their wake will follow ... *Geum (Sieversia) turbinatum,* crowding down from the slopes above with thrifty clumps of fern–like foliage, lending the vividness of their leaves in the fall and the sunny yellow of their flowers during the all too short days of summer.

To vary the color scheme, and to waft its fragrance in this rarified atmosphere, *Smelowskia americana* ... will slip in among the tufts of grass.

The arenarias ... will grow in any nook and cranny where they can find a toehold, spreading out their tufts of shiny green foliage to form mats up to several inches across.

Where rocky debris makes the going hard ... *Phlox caespitosa* and *P. condensata,* yellow *Sedum stenopetalum* ... and deep rose ... *Silene acaulis* will make themselves at home. To contrast with these will come the Sky Pilots, *Polemonium viscosum,* choosing the higher rockier positions to display to advantage their striking blue trumpets....

Primula angustifolia will find again a northfacing station under over-hanging rocks, where wind blown soil particles come to lodge. Here, too, will grow ... *Saxifraga flagellaris,* and back in the deep fissures ... *S. cernuua, Cryptogramma acrostichoides,* and that true pioneer of the heights ... *Oxyria digyna....*

Left to their own devices, the embryo streams at the timberline will break their man–devised bonds to cut their way across the roadbed. From above and from below will come a variety of flowering gems with a taste for conditions that are moist, or even wet ... *Caltha leptosepala* ... *Trollius albiflorus* ... *Primula parryi* ... and the decorative sedges.

For these plants of the above–timberline world on Loveland Pass are versatile. They have come to be what they are and where they are because

of their adaptability to their environment. A road is not too great an obstacle for them to overcome.

The old road over Loveland Pass was after all not abandoned, but instead is maintained year round and sees moderate use. Perhaps some of Mrs. Norton's plants have found it to their liking and have returned to be enjoyed by visitors who know enough to take the high road.

High Hunting: Excerpts
Kathleen Marriage, ARGS *Bulletin,* Vol. 8, No. 6, November–December, 1950

Independence Pass, Colorado—"Up here in scree *Silene acaulis* was plentiful. A usual complaint is that in cultivation this is sulky about blooming. Perhaps it is a trifle stingy, but its closely–woven, round, green mats like big green pancakes are worth having in the alpine lawn, even if they never show a flower. In the highest outcrops of lichen–encrusted rock was ... *Eritrichium argenteum....*It is the delight and despair of rock gardeners.

"Everywhere on the heights *Viola bellidifolia* was full of bloom. This doesn't give a hoot for conditions—it keeps its tidy habit even when warm and well fed."

Two plants "belonging to Liliaceae we saw are petite enough for any rock garden:

"One is *Zygadenus elegans* with its racemes of creamy white, diminutive lilies rising from a tuft of narrow leaves. It makes a good vertical note in a symphony of flat mats and cushions. Hundreds of these decorated the grassy slopes, as we slithered down the west side of Independence Pass.

"The other is *Calochortus Gunnisonii,* an airy graceful thing that knocks the smugness off any rock garden; its lovely lavender cups lined with white are a joy. This is the only one of the list stubborn about growing and flowering. In the garden I plant forty bulbs and am lucky to get a dozen flowers. Why? On grassy slopes near Camp Aspen, they flower by the hundreds.

"The above plants, always excepting *Eritrichium argenteum,* are all reasonably easy to grow from seed. Their one common demand is a root medium that allows complete drainage so that their crowns may dry off in comfort before winter. A lean diet of scree, chip rock or coarse gravel suits most of them. They incline to look less attractive when over–fed. Don't we all?

"Though many of these plants grow in full sunshine in their mountain home, they appreciate a spot of shade and preferably a north slope at lower elevations. The ground at their toes is always cold."

European Notebook:

A Possibly Useful New Product

Paul Halladin
Geneva, Switzerland

Those of us who attempt to grow some of the more difficult alpines in pots have a variety of special problems. One of these problems is the necessity of very frequent, often daily, watering during the summer months. A relatively new product has been introduced in France and Switzerland that may provide a partial solution to this problem. It is a hydro–retainer called Grain d'Eau (pronounced gran–doe in French). Translated literally it means seed of water. The product is produced and distributed by a small company in Strasbourg, France, called Leon Beck and Co.

Grain d'Eau is a polyacrylamide crystal that looks like a coarse–grained brown sugar crystal in its dry state. It is not biodegradable but is sterile, non–toxic, and can withstand a temperature range of –30° to +130° C without breaking down. This product has the ability to absorb 200 times to 700 times its weight in water depending on the pH of the water; the best water absorption range is from pH 6.0 to 7.0. It is normally utilized by adding a small quantity (3 grams of the crystals to 3 liters of potting soil is recommended) to moist but not soaking wet potting soil and then thoroughly mixing until the crystals of Grain d'Eau are as evenly spread as possible throughout the soil. This mix is then used to pot up plants. The little crystals of Grain d'Eau will gradually absorb moisture from the rest of the potting material each time a plant is watered until it has reached its capacity. Each little grain swells up into a gelatinous mass or lump that acts as a miniature water reservoir. Assuming no further water is added to the mix, the water in this little reservoir is then gradually released at a pace much slower than the combination of evaporation and osmotic action that normally can cause the soil mix of a potted plant to dry out too fast.

The product is so new that most of the literature available is in French. My inquiries have not revealed the existence of any experiments by the scientific community. I came across the product last year in the potting shed of one of the leading growers of alpines in Europe. This nurseryman is using the product successfully to reduce losses from drying out during the time plants are shipped to customers. My own experience is limited to growing various alpines in a mix containing this product for the past few months. Alpines growing in such a mix were left unattended and unwatered for 5 days during a warm spell last summer without any noticeable deterioration.

However, a test or observation of such short duration may not be conclusive because there may be other factors to take into consideration.

A possible criticism raised by one professional contact was that this product may release its moisture content too slowly to be of much use to certain plants of very vigorous growth habit or those root–bound older plants in pots that require drenching every day to prevent flagging in hot weather. This same individual granted that this product would probably be most useful for those alpines that must be grown in porous mixes of excellent drainage and yet cannot tolerate total dryness. This is, of course, one of the categories of alpines with which we have the most difficulty.

In an experiment I performed for myself, I observed that a single crystal of this substance (smaller than a half grain of rice) absorbed more than a teaspoon of water in a few hours at a temperature of 68° F. It swelled up into a lump of gelatinous material about double the size of a shelled peanut. This lump of gelatin was then placed on a piece of aluminum foil in an enclosed dry room with a humidity of 15 to 20% and a temperature of 68° *to 73°* F. with no air movement until all the moisture content of the item had evaporated. It took 48 hours for the substance to revert back to its crystalline state. This material is not sticky to touch and does not adhere to pots although small bits of sand, peat moss, and organic matter may adhere lightly to its surface when incorporated into a potting mix. It is also odor free in both crystalline and gelatinous states.

Under actual potting conditions that may substantially reduce evaporation of moisture, other factors enter the picture such as pot size and composition (clay or plastic), temperature range over a period of days outdoors, wind conditions, type of soil mix, the presence of a gravel top dressing over the potting soil, exposure to full sun, and the type of surface the pot is resting on (concrete, bricks, stone, wood, sand, gravel, or dirt). Of course, plunging a pot in sand would also retard evaporation.

There are certain other questions that no one has been able to answer. Could the roots of some plants actually penetrate this substance in its gelatinous state? Could the roots of some plants adhere to the outside of this substance as the roots of some plants adhere to a clay pot? Can moisture be extracted from this substance or will this substance only release its moisture content at its own pace? How permanent is the product? How many cycles of hydration and dehydration can it take without deterioration? One known factor is the ability of the product to absorb water containing chemical plant nutrients in solution. It would be interesting to know if the product could absorb water containing nutrients in solution over many repeated cycles without affecting the ability to absorb and release water.

Perhaps the product might give some of us the opportunity to go away

from our home base for a few carefree days in the summer without having to make elaborate plans for watering care by outsiders.

Grain d'Eau can be obtained from Leon Beck (SA)
2 bis Rte D'Oberhausbergen
67037 Strasbourg,
France

Floral Fraud?—Ernestine Lamoureux of Kelowna, British Columbia, writes that *Lobelia cardinalis,* one of her favorite flowers and one heavily relied upon as a source of nectar for hummingbirds may well be a cheat. In *Bird Behavior* by Robert Burton (Knopf, 1985), she found that, "The interdependence of flowers and birds has led to cheating on both sides. The cardinal flower *Lobelia cardinalis* secretes no nectar but mimics other plants, so it is pollinated by birds visiting its flowers in the hope of finding a meal." Far West Gardens near Santa Fe, New Mexico, recommends *Penstemon pinifolius* for hummingbirds. Brian Minter of Minter Gardens near Chilliwack, British Columbia, recommends the honeysuckle fuchsia, *Fuchsia* 'Gartenmeister Bonstedt,' as the favorite flower of hummingbirds in his garden. Louise Blakey, in her book *Our Hummingbirds* has an extensive series of listings of plants for hummingbirds, among them *Fuchsia magellanica* and *F. lycioides, Zauschneria* species, *Trichostema lanatum,* agapanthus, *Agastache mexicana, Lithodora diffusa, Lonicera sempervirens* and *Penstemon ovatus,* all good, honest, trustworthy plants we hope. What are favorite hummingbird plants in your garden? It isn't always enough just to think of our plants, is it? Birds, insects, plants, and humans have lived in relative harmony, but through manipulation by the human element of that group, balance is dangerously shifting, with serious implications for our food supply as well as our gardens. Your pertinent thoughts on this and related topics are invited.

Anniversary Issue Correction

Francis H. Cabot
Cold Springs, New York

I'd like to correct an egregious error in the article on the origin and roots of alpine gardening in North America included in the Anniversary issue of the *Bulletin.*

In preparing the article I had come across a note in a 1912 or 1913 issue of the *Garden Magazine* citing the trip of C.F. Ball and Herbert Crowley in 1912 to Bulgaria and, because it was an American magazine, jumped to the conclusion that they might have been New York estate gardeners.

I sent a copy of the *Bulletin* to Dr. E. Charles Nelson, taxonomist at the National Botanic Gardens, Glasnevin, Dublin and author of *An Irish Flower Garden* and *An Irish Florilegium.* Dr. Nelson had been very helpful in providing information on Sir Frederick and Lady Phylis Moore, two of the original Honorary Directors of ARGS. Dr. Nelson's reply contained the following comments:

"I would like to suggest a minor correction—Sir Frederick would be best described (in this context) as the former Keeper of the Botanic Gardens at Glasnevin, Dublin. He retired in 1922, when Ireland (the southern part) gained its independence from the United Kingdom and the title of the Gardens changed from Royal to National.

"There is one other mistake, and for this you really deserve to have your knuckles rapped—C.F. Ball was Moore's Assistant Keeper and Herbert Crowley was a Kew gardener—never, in a month of Sundays, were they 'New York estate gardeners.' CFB's lantern slides of his Bulgarian trip are still here in my office and many of the photographs he took in Glasnevin also survive. He was killed at Gallipoli in 1915—what would have been the story of Glasnevin had that not happened we cannot tell; it was a tremendous tragedy. Ball is included in R. Desmond's *Dictionary of British and Irish Botanists.* I don't think they visited Pruhonitz—the journey is described in detail in the *Gardeners' Chronicle* and in the *Journal of the Royal Horticultural Society.* Ball will figure prominently in my forthcoming history of Glasnevin, and he is mentioned in *An Irish Florilegium* and *An Irish Flower Garden.* Also, I am not sure that the Royal gardener in Bulgaria was Delmard. Ball and Crowley were usually accompanied by Kellerer, and they went to Bulgaria as guests of The O'Mahony, an eccentric Irish plantsman who had established an orphanage in Sophia. These are really quite minor points although if there was a chance, please do give poor Frederick Ball his proper station in life (he was English, however, not Irish). *Escallonia* 'C.F. Ball' was named for him, and *Escallonia* 'Alice' for his young wife."

Having learned a proper lesson and with aching knuckles I suggest that ARGS readers who care about correcting inaccurate statements, strike out the first full paragraph in the second column on page 36 of the Anniversary *Bulletin.* Messrs. Ball and Crowley, while enterprising horticulturists and collectors, are a part of the horticultural history of the United Kingdom and Ireland rather than the United States. Those wishing to learn more about them can look forward to reading Dr. Nelson's books and his forthcoming history of Glasnevin.

Omnium-Gatherum

Color—As you can see we have a new cover and four pages of color inside. Lest you get spoiled right off, be aware that this is special-occasion color chiefly in honor of the Interim Conference in Colorado. It will, for the present, be a sometimes occurrence, not a regular one. The cost is an obvious factor, but also to be considered is the matter of scarcity of appropriate and excellent pictures. There are many superb photographers out there. If you have suitable accurately identified photographs, we'd like to have them submitted for consideration. If you can write an accompanying article, wonderful; if not, someone else will be inspired to do so.

Schedule—With our new printer, any lateness of Bulletins will doubtless be the fault of the editor or the Post Office. We did the Winter issue in record time, though it was late getting to you due to the changeover from the old printer. We are trying very hard to get caught up and this issue should be very nearly on time. Those of you in the East, please keep in mind that you are very far from the mailing point, as those of us in the West were for so many years, and that with the same mailing schedule you will get your Bulletins much later, as was always the case with us. It is a regrettable situation.

Letters—Blame for the lateness of the Bulletin has, with one exception, been erroneously directed at the Editor, it appears. Now if you wish to go after her for something she is really guilty of, which isn't as much fun, granted, try casting aspersions at her letter-answering efficiency. In that area she is undeniably a culprit. It is my fond hope never to have to mention this subject again.

Your ARGS BOOKSTORE

Kathie Lippitt, Manager, 6 Glen Terrace, Scotia, NY 12302

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