ROCK GARDEN

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COVER: *Primula veris*
by Lori Chips, Norwalk, Connecticut

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ROCK GARDEN QUARTERLY

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FEATURES

DEPARTMENTS

Zigadenus elegans

THE CARDINAL DIVIDE

AN ALBERTA ALPINE RESTORATION

by Donna Balzer

"This is a charming area; unfortunately, it has been badly damaged by trail bikes and four-wheel-drive vehicles," wrote Patrick Seymour in *Rocky Mountain Alpines* in 1986. Seymour, now retired as Director of the Devonian Botanic Gardens at the University of Alberta, was at once amazed by the number of interesting species on the Cardinal Divide and dismayed by the damage being done to the fragile tundra. At the peak of the alpine season, he found the ground a carpet of blue *Campanula lasiocarpa*. Here grew as well *Phyllodoce, Cassiope, Dryas octopetala*, a host of *Salix* species, *Campanula uniflora*, eight species of *Arnica, Petasites, Erigeron humilis* and *E. lanatus, Eriogonum androsaceum, Anemone richardsonii* and *A. lithophila, Pedicularis, Castilleja, Gentianella amarella, Parnassia, Zigadenus*, numerous *Draba* species, *Silene acaulis, Minuartia obtusiloba, Papaver kluanense, Androsace chamaejasme*, and *Saxifraga oppositifolia*—just to mention a few.

Hikers, bikers and outdoors enthusiasts of all kinds are naturally drawn to any area where one can drive right to the tundra. In a situation unique in Canada's mountains, the Cardinal Divide is not included in our National Parks, even though it is within the alpine ecosystem. A true tundra experience free of the camping and use restrictions mandated by Parks Canada is a dream come true for many, and many people visit. The easy, unregulated, casual approach to use was both the appeal and—ultimately—the destruction of the Cardinal Divide, as an ever-widening, braided path was travelled heavily by off-road vehicles, and more and more alpine plants were killed. The area was being ruined by its own combination of attractions—the enthralling beauty of the mountains and the convenience of easy accessibility.

The tide of plant destruction turned on 3 September 1995, when plants left over from the Cheviot Coal mine test project near the Divide were donated to the Alberta Native Plant Council (ANPC). Planting and formalized trail development to restore the destroyed area became a reality.

"We barely got 300 plants in the ground the first year," said Dr. David Walker, who works professionally with large-scale plant restoration projects in the mountains and prairies. Dr.

Walker already had charge of the reclamation test sites at the mine, and got involved in the Cardinal Divide project naturally. He has continued as a volunteer consultant, planner, and donor of equipment to the Cardinal Divide site. "Volunteers were hacking and digging (into the hard and compacted alpine soil in the off trail areas) the first year," explained Walker. "We broke a lot of fingernails...."

By the second year Walker arranged to make the job easier by finding funding to hire student help for planting and by renting power equipment. "An electrical generator and heavy-duty power drills are used now instead of hand tools and strong backs," continued Walker, who noted that student help sped up the planting process incredibly. Six thousand plants have been grown and planted over the past four years.

Seymour first went to the Divide over 30 years ago—"I got a new car in '64, and the first thing I did was drive up there," he said. He continues to visit almost every year. Asked if the new project held any hope for the future, he replied, "I think so—as long as we can keep the traffic off." Signs now prohibit off-road vehicles. "The traffic," admits Seymour, "has ironically encouraged some species...." Clumps of *Androsace chamaejasme* are bigger and better than ever, seeming to thrive in the damaged areas.

Members of the ANPC make sure the appropriate plants are not placed in a haphazard fashion but are grouped by natural association, duplicating natural relationships seen on the site.

Because all seed for the planting comes from the area—which is more than 600 km northwest of Calgary, Alberta—all the seed needed for the following year is collected during the summer planting weekend. Members of the ANPC collect and label seed, and it is cleaned and returned later to Walker, who passes it along for propagation to commercial growers. Walker specifies the containers—a shorter version of the commonly used forestry seedling system known as Spencer Lemaire root trainers. With the shallow, rocky, alpine soil in mind, Walker stays away from longer, more traditional size tree-seedling root-trainers in favor of the "stubbies," which he has to special-order from Scotland!

The young alpine plants are root-stabilized in the containers and may be either one or two years old at delivery. Money is donated by the Cheviot Coal Mine for plant propagation and student labor. The goal is to put the plants in the ground at the end of the growing season. Because of the northern latitude and high altitude (the site is almost directly east of the town of Jasper at 2,000 m elevation), it was no surprise that August 21-23 was chosen as the weekend for both seed collecting and planting in 1998.

During the weekend temperatures dipped to 0°C overnight, with heavy frost. The plants are not watered or maintained in any way once they are in the ground, not even at the time of planting, so it is necessary to make sure they are already going into dormancy and well hardened off when they are planted.

The intent over the long term is to decrease the width of the braided trails. The first step each year is to set rocks along the chosen path, to outline an ever-smaller area where walking and hiking will be encouraged. The ANPC volunteers then set out the plants in appropriate groupings outside the new, narrower trail, planting and encouraging revegetation in the highly compacted, soil-eroded areas adjacent to retained paths. Students from the local area then use the pow-

erful, generator-powered drills to make a hole for each plant. They try to make the hole just the right depth for the plant plug, because plants won't grow if the crown is not set properly at grade level.

Walker has directed the planting crews to drill the holes at approximately a 45° angle instead of vertically down into the ground, so that frost heaving of the new plants is minimized during the first season. He gives the crews diagrams of this ideal planting technique at the beginning of the first day of planting. He has found in his experiments and many large-scale restoration projects that alpines planted in the traditional vertical position will gather water around their root balls and pop out of the ground as it freezes and thaws. Of course, plants planted this late in the season have little time for root growth, and thus are not anchored in the soil through the first winter. The drill bit size is matched to the diameter of the root-trainer, so that there is no need for extra soil to fill the holes created when the plants are installed.

Plants chosen for the site vary from year to year, because seed of all the species is not available every year. "Two years ago the ground was a carpet of purple when the purple lousewort (*Pedicularis lanata*) flowered, even though it has been previously listed as a rare plant for the area and had hardly been recorded there before," explained Walker.

Seed collection is largely left up to volunteers, under the direction of the ANPC. Seed of alpines, including native grasses and woody plants of the region, have been collected, grown, and planted back on the same site for four years. The first 800 meters of trails on both sides of the access road were planted in the first years of restoration. Even though this measures only 20% of the area to be restored, it represents at least half the work, because planting techniques have now been so streamlined, and the areas closest to the road were most heavily damaged.

Alison Dinwoodie, a retired professor from the University of Alberta, is generally regarded as the primary motivating force behind the restoration work on the Cardinal Divide. She is also the reason the Cardinal Divide area has received as much attention as it has in the past few years. As the natural area steward (a volunteer role she plays on behalf of the Alpine Club of Canada), she was horrified by the damage and made it her mission to bring the area's plight to the attention of alpine enthusiasts everywhere. "Write to Ty Lund [Alberta's Environment Minister] and ask him to keep off-highway vehicles off the alpines," requests Dinwoodie. She frequently lectures to interested groups about the site and the reclamation work. Dinwoodie's dream is slowly becoming a reality, thanks to donations of expertise and time by business, such as David Walker and Associates and the Cheviot Mine Project, many keen volunteers of the ANPC, local employees of the mine, and interested volunteers from the nearby town.

If local people continue to participate and to gain pride from working with volunteers from across Alberta, the project will be a success. The view from the top of the ridge doesn't seem heartening yet—four years has hardly been sufficient to restore the pristine beauty of the areas near the road. The alpine growing season is so short, recovery so slow, and destruction has been going on for some time. A close look at recently planted areas brings us more cheer; small clumps of grass grow from gravelly the soils and *Silene acaulis* blooms enthusiastically between rocks along the trail.

In this little-known area far from the well-publicized tourist destinations of Banff and Jasper National Parks, businesses and individuals are doing their best to restore what has been damaged. Spokespeople are mustering financial and political support to ensure the program can continue.

"If I had known there was an area this beautiful outside a park I would have come here years ago," enthused project volunteer Frank Rusconi, who drives from Edmonton to volunteer every year and plans to help for many years to come. This small, local restoration, with potential implications for similar actions throughout the world, has certainly caught this horticulturist's interest, and, like Rusconi, I'll be back for more.

OVERVIEW OF THE PROJECT:

Restoration of the alpine habitat damaged from continuous vehicle pressure in the past has been ongoing for four years.

Trails are being defined and narrowed as footpaths and their edges are being marked with rock borders. Almost a kilometer of trail has been restored, but another 4 kilometers need work. Walker estimates that this will require at least another four years of replanting.

Professional botanists and reclamation experts have joined forces in volunteering with groups such as the Alberta Native Plant Council and the Alpine Club of Canada.

The Province of Alberta recently (October 1998) redesignated the area as a protected area, creating the Whitehorse Wildland Park. This adds 27,000 acres to Alberta's protected areas network. This new park enlarges and reclassifies the existing Cardinal Divide and Cadomin Cave Natural Areas. Here's hoping the new designation, plus signs, will keep the ATVs off the site as well.

If you go:

Drive west from Edmonton or east from Jasper to the town of Hinton. Go 50 km. south past the town of Cadomin along the forestry trunk road. The Cardinal Divide is on the road just after the Mountain Park campsite.

Places to stay include serviced and rustic campgrounds and a single, very small motel (the Cadomin Motel & Cafe, PO Box 21, Cadomin, Alberta, Canada, T0E 0E0. Fax/Phone 1-780-692-3663).

If you would like to support this project or receive more information contact: Alberta Native Plant Council, Alpine Club of Canada, Edmonton Section, Box 52099, Garneau Postal Outlet, Edmonton, Alberta, Canada T6G 2T5. If you would like to volunteer (third weekend in August) write: Alberta Native Plant Council (address above), Att: Elisabeth Beaubien or Patsy Cotterill.

If you would like to receive a copy of the Cardinal River Plants Checklist write: Natural and Protected Area Section, Alberta Forestry Lands and Wildlife, 4th Floor, 9915–108 Street, Edmonton, Alberta, Canada T5K 2C9.

Donna Balzer lives in Calgary, Alberta. She is a garden consultant, broadcaster, and author. Her newest book, *Prairie Rock Gardens* (Red Deer College Press) is due in spring 1999. Drawing by Elizabeth L. F. Allen. Photos by Dr. David Walker.

KANANASKIS COUNTRY

ALPINES AFTER BANFF

by Todd Boland

When someone mentions Alberta and the Rockies to a rock gardener or mountain wildflower enthusiast, the first area that comes to mind would be Banff National Park. Without doubt, Lake Louise, Moraine Lake, and the townsite of Banff are the mecca of most tourists to Alberta. With the area's spectacular scenery and abundance of plants and animals, it is not surprising that Banff is so popular. However, just next door is an area not so well known that yet offers many attractions, called Kananaskis Country.

Kananaskis Country, about 60 miles west-southwest of Calgary, was established in 1978 as a multi-use recreational area and protects representative and unique areas of natural and cultural significance within the province of Alberta. This region encompasses about 1,600 square miles on the eastern slopes of the Rocky Mountains. The area contains diverse terrain ranging from rolling foothills and montane forest to the ice and rock of high alpine regions. Kananaskis Country embraces four provincial parks—Bow Valley, Bragg Creek, Elbow Falls, and Peter Lougheed.

Kananaskis Country is at the crossroads of several vegetational zones within Alberta. The eastern portion is predominantly foothills. Here, the lowest elevations (under 3,280') are occupied by grasslands, while the upper slopes (to 4,000') are a mix of lodgepole pine, white spruce, and aspen. The northern and southern ends are mostly montane forest (4,000–5,900'), a mix of open aspen and lodgepole pine, or dense coniferous forest of Douglas fir and limber pine. Western regions of Kananaskis Country fall within the subalpine (5,900–7,450') and alpine zones (above 7,450'). The subalpine zone is characterized by lodgepole pine in the valleys and a mix of Englemann spruce, subalpine fir, and alpine larch along the slopes. The alpine areas above treeline are home to alpine meadows and low willow-birch thickets.

The easiest way to traverse these vegetation zones is to drive along the Kananaskis Trail (Highway 40). This highway travels most of the length of the region and crosses grasslands before beginning the climb into montane forest. By the time you reach Highwood Pass, you have entered

subalpine forest. Parking at the Pass, you can climb the Ptarmigan Cirque Trail to spectacular alpine meadows (photo, p. 12).

From a rock gardener's point of view, there are three main areas of botanical interest. In the grassy foothills the plants are not technically alpines, but they are of small enough stature to allow their inclusion into most rock gardens. In May and June spring wildflowers are at their peak. The harbingers of spring in this area are the prairie crocus, *Pulsatilla patens*. These beautiful plants deserve a place in all rock gardens. The flowers, in a wide range of purple and mauve shades begin to appear in late April or early May. Almost as early are *Potentilla concinna* (photo, p. 10), with its striking silver leaves, and *Phlox hoodii*, with numerous white flowers atop moss-like foliage. As spring advances, the diversity of blooms increases. Members of the pea family are among the most significant plants. Outshining them all is the golden bean, *Thermopsis rhombifolia*, with brilliant yellow flowers. Unfortunately, this showy plant is fairly weedy in the garden and should be carefully watched. A brief stroll will reveal seven species of *Astragalus*, three species of *Hedysarum*, the yellow pea vine (*Lathyrus ochroleucus*), and seven species of *Oxytropis*. The most spectacular of these is the showy locoweed, *O. splendens*, with hairy, silver foliage and indigo-purple flowers (photo, p. 11). Unfortunately, many of these legumes are difficult to please in rock gardens of the East.

Other useful, spring-blooming rock garden plants from this area include *Geum triflorum, Ranunculus glaberrimus, Anemone multifida, Dodecatheon conjugens*, and *Lithospermum ruderale*. The spring season ends with the blooming of the lovely *Penstemon nitidus* (photo, p. 11). Its glaucous, blue foliage and azure flowers make it choice.

By midsummer, the foothill grasslands are ablaze with composites. Most are too large to be suitable for the rock garden but could make nice additions to the perennial border or wildflower garden. Significant species are *Gaillardia aristata, Solidago missouriensis, Heterotheca villosa*, and species of *Erigeron, Senecio*, and *Aster*. *Linum lewisii, Delphinium bicolor, Zigadenus elegans, Z. venenosus*, and *Campanula rotundifolia* are also abundant.

Leaving the foothills, you enter the montane forest and eventually the subalpine forest. Many beautiful wildflowers grow in the shade of the coniferous trees or in sunny glades. Again, these flowers are not true alpines, but many are ideal for woodland gardens or shady areas of the rockery. As is typical of woodland plants, they are generally spring-blooming. Most noticeable of these forest flowers is the heart-leaved *Arnica cordifolia*. The large, yellow daisies seem to glow in the shade of the forests. Although small-flowered, the blooms of *Aquilegia flavescens* and *A. brevistyla* are very dainty and attractive. The western wakerobin, *Trillium ovatum*, offers blossoms at first white but soon fading to pink. Damp areas are home to several violets including *Viola adunca, V. canadensis*, and *V. nephrophylla*. Rounding out the display are the nodding blue bells of *Mertensia paniculata*, the red and yellow brushes of *Castilleja miniata* and *C. lutescens*, and the yellow lady's-slipper, *Cypripedium calceolus*. Although much too tall for the rock garden, the deep blue spikes of *Delphinium glaucum* and the shapely, purple daisies of *Erigeron peregrinus* deserve a place in any perennial border.

In clearings in the subalpine forest and on the tundra meadows above the treeline true alpines abound. This area of the Canadian Rockies is often snow-

Along the Kananaskis Highway (pp. 7–13)

photos, Todd Boland

Potentilla concinna (p. 10)

Anemone parviflora (p. 13)

Penstemon nitidus (p. 8)

Oxytropis splendens (p. 8) photos, Todd Boland

12 Natural rock garden on Ptarmigan Cirque trail, Peter Lougheed Provincial Park, Alberta. (p. 8) photo, Todd Boland

covered well into June, and snowbeds may lie late into July. In fact, the Highwood Valley area of the Kananaskis Trail is closed to traffic until June 15, a factor to keep in mind when visiting the area. However, don't think you will have missed the show; the alpines here do not peak until early July.

Adjacent to the parking lot at Highwood Pass is a trail through a subalpine meadow. Small snowbeds are often present here in early July. The most significant members of this plant community are the purple-flowered *Phyllodoce empetriformis* growing side-by-side with the cream-colored urns of *P. glanduliflora* and snow-white bells of *Cassiope mertensiana.* Adjacent to the melting snowbeds are the blooms of *Pulsatilla occidentalis* and the snow buttercup, *Ranunculus eschscholtzii.* Other lovely alpines include *Anemone parviflora* (photo, p. 10), *Smelowskia calycina, Myosotis alpestris,* and *Androsace chamaejasme.*

From Highwood Pass the more adventurous alpine enthusiast can hike the Ptarmigan Cirque Trail, 3.6 miles long and climbing from 7,200' to nearly 8,000'. The looped trail takes two to three hours to complete; much longer if you are admiring the multitude of alpines! Self-guided brochures are available at the trailhead. The trail leads through a forest of alpine larch, Engelmann spruce, and subalpine fir. Farther along, you encounter clearings created by avalanches, filled with all sorts of alpine and subalpine plants. Rocky outcrops are home to *Penstemon procerus, Erigeron peregrinus, E. compositus, Heuchera cylindrica, Myosotis alpestris, Anemone multifida,* and *Potentilla diversifolia.*

Eventually, the forest gives way to alpine meadows. Damp seepage areas are home to thousands of yellow glacier lilies (*Erythronium grandiflorum*) and white globeflower (*Trollius laxus*). The alpine meadows are snow-covered for over nine months of the year, so the plants here flower quickly after the last snows melt. Early July is the peak season. Many alpines encountered near Highwood Pass also thrive here. Rocky outcrops form natural rock gardens with a kaleidoscope of colors; deep blue and purples of *Veronica alpina, Penstemon procerus,* and *Oxytropis podocarpa;* pinks and purples of *Astragalus alpinus, Saxifraga oppositifolia, Arabis lyallii,* and *Silene acaulis;* bright yellows of *Potentilla nivea, Erigeron aureus* (photo, p. 43), *Haplopappus lyallii, Solidago multiradiata, Saxifraga aizoides,* and *Ranunculus pygmaeus;* and startling whites of *Anemone drummondii, Draba lonchocarpa, Saxifraga bronchialis, Erigeron humilis,* and *Dryas octopetala.* You may experience alpine overload!

Kananaskis Country has much to offer; the relative lack of development leaves one with a feel for the original, wild Canadian Rocky Mountains. Wildlife abounds, the scenery is second to none, and the alpines are spectacular. The next time you visit Alberta, by all means make a trip to Banff, but also try to make time for a visit to the unspoiled beauty of Kananaskis Country.

Todd Boland gardens on the opposite side of the continent from Banff in St. John's, Newfoundland. He spends 3–4 weeks each year in the Clagary-Banff area, which he considers to be his home away from home. He has visited the HighwoodPass-Ptarmigan Pass area four times, photographing the wide array of alpines that grow there. In his St. John's garden, he particularly enjoys *Primula, Campanula,* and *Penstemon,* but also has a modest collection of dwarf *Rhododendron, Pieris,* and other ericaceous shrubs.


Hedysarum alpinum

ALBERTA ALPINES

THROUGH THE SEASONS

by Rodney Shaver and Llyn Strelau

Gardening in Calgary *is* a challenge. Yet some of the very conditions that provide this challenge are the reasons that alpine and rock garden plants are the best and most logical choice for gardeners in this area. Sure, we can grow a wide variety of annuals and herbaceous perennials. We can even vine-ripen tomatoes in a good season—but in a more typical year the alpines are the reliable stars. We have abundant sun, adequate rain in the summer (or access to watering), freshening breezes (well okay, sometimes gale-force winds), and cool nights. Our low winter precipitation ensures little problem with winter rotting, although this also means that there is no reliable or persistent winter snow cover. Our frequent chinook winds can raise the temperature by 30° Celsius in a matter of hours. The chinook can melt what snow we have accumulated and expose plants to the burning of the intense winter sun and to dehydration. Chinook temperatures can fool plants into premature spring growth. (See chart for temperature and precipitation).

To protect our rock gardens from these undesirable effects we first tried straw and evergreen boughs. The first year of that treatment was also the last. Picking the remnants of straw out of alpine buns in the spring is not our idea of a pleasant or efficient way to spend our time. Since then we have been using a thin, insulating, plastic blanket called *MicroFoam* that we lay down on top of the first good snowfall (sometimes this comes as late as the end of December). The snow trapped under the blanket stays put until mid-March or early April when the plants can look after themselves without misinterpreting the precarious weather changes. The precocious drabas are sometimes in early bloom when we finally pull the cover off. The blankets are easy to work with, and spring clean-up is a breeze. We have reused the same blankets for three years now and should get at least another two years of use before they need to be replaced.

Alpines have another unexpected advantage over larger plants in Calgary. We live in "hail alley...a corridor stretching across west-central Alberta that is North America's most volatile hail zone. In an average year, about 40 major hailstorms roar down the foothills and pummel the alley, which includes Calgary..." (*Canadian Geographic*, July/Aug 1998, p. 68). It is a case of "the bigger

they come, the harder they fall." After one of these episodes delphiniums and lilies may look like they have been put through a food processor, but most alpines will emerge from up to 6" of pea-to-golf-ball-size hail with only a few bruises.

FROM CALGARY INTERNATIONAL AIRPORT, ALBERTA
Elevation: 1077m. Data averaged over the years: 1881 to 1990

Total Annual Precipitation: 398.8 mm
Total Annual Sunshine: 2394.6 hours

Our soil pH averages 7.8–8.5 (higher in newer areas where subsoil is at the surface), and tap water is 7.5. This alkalinity makes it very difficult to grow any acid-loving plants. No matter how much peat, compost, or chemicals are thrown at the soil, it quickly reverts to very alkaline conditions.

We are blessed with very few insect problems compared with more temperate areas of North America. Our low summer humidity and lack of deep winter snow cover make our climate a challenge for many insects to survive. We do have small slugs (introduced) that wreak havoc, and aphids, which can cause problems some years. The introduced gray squirrel can make a mess of the new growth of bulbs in the early spring or nibble the tender new sempervivum rosettes, as though they were mini-artichokes. In parts of the city there are problems with rabbits and deer. The most frustrating problem may be the birds! Some species like to pick alpine buns apart in the spring, using the soft foliage to line their nests. Magpies and grackles, ever collectors of the shiny and the bright, will scatter or steal plant labels if they are visible.

We have both been avid gardeners for more than 15 years, but it has been only in the last five or six years that the 'alpine bug' has bitten us. In 1995 our first rock garden was rather forcibly inspired by a gardening friend's imminent retirement to the West Coast. She knew she would be moving, but not precisely when. To avoid losing any alpine treasures in an unseasonable relocation, she decided that we should build a rock garden to house her plants until she had a new garden to put them in. We opted for a crevice-style rock garden (photo, p. 21). We had two loads of one-inch-thick flagstone (local Rundle Shale, an attractive, dark gray, sedimentary rock) left over from pathway construction. We began with a mounded berm of soil excavated from the site of the bog garden we had built that spring. Over a mere two days our friend dismantled her garden and delivered the plants. We built up slabs of rock with a gritty compost of 10 mm and smaller crushed shale mixed with the native soil. As the crevices were created, we tucked her plants into their new home and top-dressed with more of the crushed shale. The rock garden turned into a sensuously slumped and tilted berm fondly called 'the sleeping giant'. The berm wraps around the base of an old apple tree, with crevices facing north and west and a scree slope facing south, giving us several different exposures.

When we saw the incredible beauty of the bloom the following spring, we knew we were hooked! This time we started at the west end with four, large, angular boulders, the heaviest weighing over one ton. Using these as a foundation, we built a companion piece to our first crevice garden that mirrors it, with

the bog between the two. This second crevice garden has the opposite orientation, with the crevices facing the hot, southern sun. By 1997 our growing collection of purchased, swapped, and seed-grown plants had grown to the point that we needed still more room. We built a third crevice garden to cover the 130 cm-tall knee-wall of our attached lean-to greenhouse. The south-facing section of this garden is the hottest and driest location and is a good environment for cacti and other alpines requiring full sun and well-drained soil. Where it wraps around the eastern end of the greenhouse, we have a perfect spot for saxifrages and alpine primroses.

It is difficult to list our favorite plants. Looking over our photographs and plant database, it seems that each month we can find many now indispensable plants in bloom. Here are some of the plants that we have in the garden. We will discuss them in the order that they bloom for us in Calgary.

April

The first flowers in spring are borne by *Hepatica transsilvanica*. Planted in the woodland garden, its buds push up through the snow and bloom in the first week of April. When we see the large, blue, anemone-like flowers, we know that spring is here—even though several more snowstorms may try to persuade us otherwise. The blooms of other species, *Hepatica nobilis, H. acutiloba* and *H. americana* and their many forms quickly follow. Collecting *Hepatica* has become a passion, and we have blue, white, pink, and red, plus a couple of double forms.

In the rock gardens, drabas provide cheerful color in early spring. These vibrant yellow buns would be overshadowed if they bloomed later in the year, but they are much appreciated first thing each spring. In very hot, dry summers drabas go partially dormant for us, but once the cool of late summer comes they revive and may even rebloom. The tight, complex, bun-forming species are attractive even out of flower. Among others we are growing:*Draba bruniifolia* var. *rigida, D. olympica, D.* aff. *mollissima, D. cuspidata, D. ossetica* var. *racemosa* (one of the few with white flowers), *D. ventosa, D. aizoides,* and *D. caespitosa. Aethionema oppositifolium* is equally early, and its sweet, honey scent is delightful. *Douglasia montana,* a hot pink form that we received from a gardening friend, puts on a nice show in spring. Very few seedlings appear, and looking for seed is like looking for the proverbial needle in the haystack, but it is slowly spreading around. *Saxifraga oppositifolia* (photo, p. 24) likes our cool spring but sulks during the hot, dry summers. We find that it does best with morning sun and afternoon shade. The form found in our mountains is not as large-flowered as some of the European varieties, but it is just as floriferous. One local grower has a small obsession with this species and now has about 20 different varieties, all showing an amazing amount of variation in flower color and form.

May

Who wouldn't love a gentian? The range of blues is stunning, from the deep blues of the small *Gentiana verna* ssp. *angulosa* to the celestial hues of the almost artificial-looking trumpets of the *G. acaulis* group. Our stock of *G. acaulis* is probably actually *Gentiana angustifolia,* rather than true *G. acaulis,* since it flourishes in our alkaline conditions. The friend who gave it to us had it self-sow all through her rock garden, and even into her lawn, until it formed carpets of blue every spring. Our alkaline soil and water makes it very difficult to grow other, more

acid-loving, fall gentians well. *Gentiana* aff. *acaulis, G. algida, G. bavarica* (photo, p. 24), *G. brachyphylla, G. dinarica, G. kurroo, G. loderi, G. paradoxa,* and *G. septemfida* are all successful, however.

Geraniums are not just for the perennial border. The smaller species and their varieties are wonderful tucked into crevices or at the base of larger rocks. The tuberous *G. pylzowianum* is quite delightful as it creeps along with its finely cut, 3 cm-wide leaves and medium-pink flowers that are large for such a diminutive plant. *Geranium orientalitibeticum* is a bit taller, and the creamy-spotted variegation on the leaves is attractive even without its large, white-eyed, pink flowers. *Geranium cinereum* 'Ballerina' grows to a better scale in a crevice than it does in the open garden. The foliage stays much tighter, and the darker-veined, pink flowers bloom from May 'til frost. *Geranium malviflorum* is a bulbous species that blooms in the spring, goes dormant for the summer and produces leaves in the fall. Again, it is compact with large flowers and likes good drainage. *Geranium sanguineum* var. *prostratum,* and its forms with deeply cut leaves and intensely colored flowers, are used around the edge of the rock garden and along pathways.

Vitaliana primuliflora with its acid-yellow flowers makes a bold statement when combined with the hot-pink *Douglasia montana* and blue *Gentiana verna.*

Corydalis magadanica is a tiny, tuberous plant that we received from Dr. Sasha Berkutenko three years ago. The curious flowers are a creamy white and last for several weeks in early spring. We have two plants in a tight crevice. One goes dormant at least three weeks before the other one, which was quite alarming the first year! It was a pleasant surprise to find it appearing again the following spring. This goes to show that you should never give up on plants too soon! Having had good luck with *C. solida* and *C. ambigua,* we are looking forward to growing more of these fascinating little plants.

Calgary seems to be an ideal place to grow *Lewisia.* Generally, our dry winters keep them from rotting while dormant, although *Lewisia tweedyi,* even when planted in a near-vertical crevice, can rot during a very wet spring. Sometimes a piece of the root remains alive to regenerate once it dries out. *Lewisia pygmaea* can become somewhat weedy in its seeding around, but it is easy to pull out the extra volunteers. It blooms off and on through the summer. *Lewisia rediviva* is stunning in a crevice with its huge flowers. It, too, has self sown, and we have both dark and light pink forms. *Lewisia nevadensis* and *L. columbiana* ssp. *rupicola* and ssp. *wallowensis* grow well in a climate quite unlike their native home. We are very excited with some of the *Lewisia* hybrids. Their compact size, lots of good-size flowers over a long season, and vigor have made them favorites. *Lewisia* x 'Little Plum' has narrow, flat leaves with upright flower stems each holding a cluster of plum-colored flowers. *Lewisia* x 'Pinkie' is similar with a pleasing, soft pink flower. *Lewisia* x 'Flora's Delight' has smaller flowers but many of them in a spray. *Lewisia cotyledon* crosses are represented in our garden in several color forms; the Ashwood hybrids are particularly pretty and very floriferous.

The alpine penstemons reach peak bloom here in May and continue throughout June, varying in bloom period depending on the species. *Penstemon pinifolius* is near the top of our favorite plant list. Its delicate-looking, needle-like foliage survives our unpredictable winters without any damage, and it seems willing to grow best in the most difficult and exposed locations. Both the bright red of the species and the soft yellow of 'Mersea Yellow' have their primary flush here in

June and follow with a generous smattering of bloom right until frost. *Penstemon davidsonii* var. *menziesii* and its form 'Microphyllus' are wonderful ground- and rock-hugging shrubs. The huge flowers on such tiny plants always amaze visitors. *Penstemon* x 'Pink Holly' is a beautiful pink variety that, like *P. fruticosus*, is wintergreen and prefers good snow cover for the winter. Fortunately, they seem to regenerate from the crown even after a bad winter. *Penstemon nitidus*, our prairie native, blooms and self-sows happily in dry, sunny scree.

Lepidium ostleri (photo, p. 23) and *L. nanum* are two little gems, forming hard, dark green buns that are attractive even when not covered by a mass of white-to-cream blossoms.

We bought three plants of *Clematis columbiana* var. *tenuiloba* three years ago. We assume that they were seedlings, because although the flowers are nearly identical in all three, there are definite differences in their growth habits. The best form is less than 6" tall very short internodal growth and masses of full-size, rich blue, pendant bells. The other two are both taller and rangier. They all seem to be very vigorous in growth, and if they weren't so attractive, they could be accused of being invasive. They are planted at the base of two of our crevice gardens and have sent runners down and under large rocks to pop up in crevices several feet away. The more modest *Clematis hirsutissima* has feathery foliage and solitary, leathery, drooping bells.

June

Dianthus pavonius is one of the many dianthus that we grow and love. We enjoy the many surprises we get from the self-sown seedlings that appear between the flagstones of our pathways. *Ptilotrichum spinosum* 'Roseum' is a 6" sub-shrub that looks wonderful with its light gray-green hummocks of foliage against the dark gray of our Rundle Shale scree. The paler flower color of the species is not as exciting as the deeper, hot pink variety, but the full range of color of a swarm of self-sown seedlings forms a beautiful tapestry.

Many aquilegias are a bit large for the rock gardens, but the more compact ones are lovely. These small plants have finely cut foliage, and some have very blue-gray leaves, which contrast wonderfully with our dark gray shale. *Aquilegia scopulorum*, *A. jonesii* x *A. saximontana*, *A. glandulosa*, *A. laramiensis* have all found homes in our crevices. We have tried and killed enough *A. jonesii* that it is one plant that we won't inflict ourselves on again. Yet some of the other Calgary gardeners have had very good luck in their conditions.

Jurinella moschus ssp. *moschus* from Palendokan (photo, p. 22), a monocarpic plant, caused an immense amount of comment this spring. The perfectly symmetrical rosette has a trifid-like presence as the leaves rapidly expand in the spring to reveal in the center a huge, stemless, lavender, thistle-like flower. After the central flower was spent, many side growths from around the base took over, perhaps ruining the symmetry of the plant, but giving a long season of bloom.

When we first bought *Cytisus hirsutus* var. *demissus* (photo, p. 24) with its softly hairy leaves, we doubted that it would be hardy in Calgary. We were pleasantly surprised when the next spring it was covered with bright, golden yellow flowers. This form has been slow to spread but makes a nice carpet crawling among the rocks.

Dodecatheon alpinum is only one of many shooting stars that share the garden.

Most of them are in our bog or a north-facing scree. We usually have to make sure to give it a little extra water in the spring to get it to flower well.

We are trying several *Daphne* species. *Daphne arbuscula* from the Muran Hills has held its own in a quiet corner of a north scree, while *D. cneorum* fills another nook with its rich fragrance.

Ranunculus parnassifolius (photo, p. 23), in its pure white form, now has many stems every year. It has started to sow around the mother plant, so we look forward to a good colony.

Oenothera caespitosa var. *marginata* blooms all summer from June to hard frost in September. It is somewhat out of scale in the rock garden, but the sight of 30 or 40 pristine, white, fragrant flowers opening in the evening is hard to resist.

Aethionema grandiflorum has very fragrant pink flowers atop glaucous, blue foliage. Growing in some dry crevices, we have been pruning the plants back to the newer, more compact growth later in summer to encourage denser-flowering plants next year. *Aethionema schistosum* has extremely blue foliage that is a lovely contrast to our dark rock.

Acantholimon species do quite well for us. They are growing in the most sunny and hot exposures and only exhibit problems if we have a prolonged wet spell. *Acantholimon reflexosum* has very stiff, prickly, blue foliage, and the large, silvery bracts remain after the pink flowers fall. *Acantholimon hohenackeri* and *A. litwinovii* also have blue foliage, while *Acantholimon* species from Ercias Dag is a shinier green, spiky dome. All are doing well for us.

July–October

By July most of the alpines are past their peak of bloom. Several species of *Calochortus* will still bloom, and some of the later penstemons are coming into their own. *Callirhoe involucrata* is just getting into full swing, with its eye-catching, wine-colored flowers on trailing stems. The summer colors of the sempervivums are pretty, and the rock garden is all about patterns and texture. As the cool nights begin toward the end of August, some of the alpines may decide to rebloom. It is also the time when the *Saxifraga oppositifolia* plants begin to look a little greener and may even put on a little bit of fresh growth. Some of the plants that will keep blooming for us until frost are *Oenothera caespitosa, Erodium carvifolium, Geranium* 'Ballerina', and *Penstemon pinifolius.*

Beginning in September and October, the nights can be very cool, and some of the fall bulbs start to bloom. We have had very good luck with the earlier colchicums, such as *C. bornmuelleri*, since it has started to bloom in early September most years. We have tried *Crocus sativus* and C. *speciosus*, but they bloom too late in the season to enjoy them in all but the warmest autumns. *Leucojum autumnale* was a new acquisition this spring, and it put on a respectable show for such a tiny plant.

As we head back into another winter, and the garden is put to bed, our dreams turn to the coming spring. There are so many more plants to try and holes to fill where other plants didn't quite make it. We are very interested in pushing the boundaries of what we can grow in Calgary. We have begun collecting various dwarf conifers in the genera *Picea, Tsuga, Chamaecyparis*, as well as some dwarf evergreen *Cotoneaster* and *Buxus*. Most of these need to be protected from winter sun and chinooks but seem to be cold-temperature hardy. Another

Rundle Wood Gardens, first crevice garden, with *Veronica prostrata, Geranium* x 'Ballerina', *Lewisia tweedyi, Ptilotrichum spinosum, Potentilla, Penstemon davidsonii,* and *Phlox* 'Schneewittchen' (p. 16)

Clematis hirsutissima (p. 19)

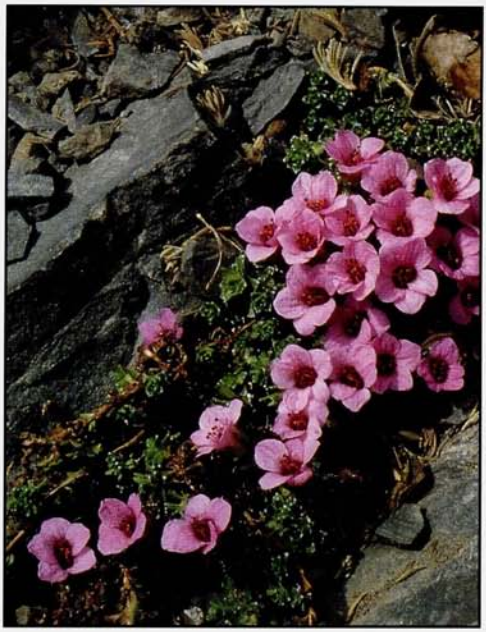
Jasione crispa

Jurinella moschus ssp. *moschus* (p. 19) photos, Rundle Wood Gardens

Ranunculus parnassifolius (p. 20)

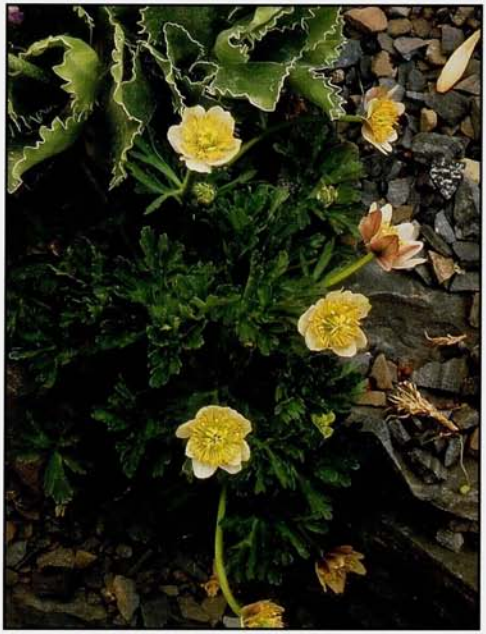
Lepidium ostleri (p. 19)

Gentiana bavarica (p. 18)



Saxifraga oppositifolia (pp. 17, 30)

Hegemone micrantha



Cytisus hirsutus ssp. *demissus* (p. 19)
photos, Rundle Wood Gardens

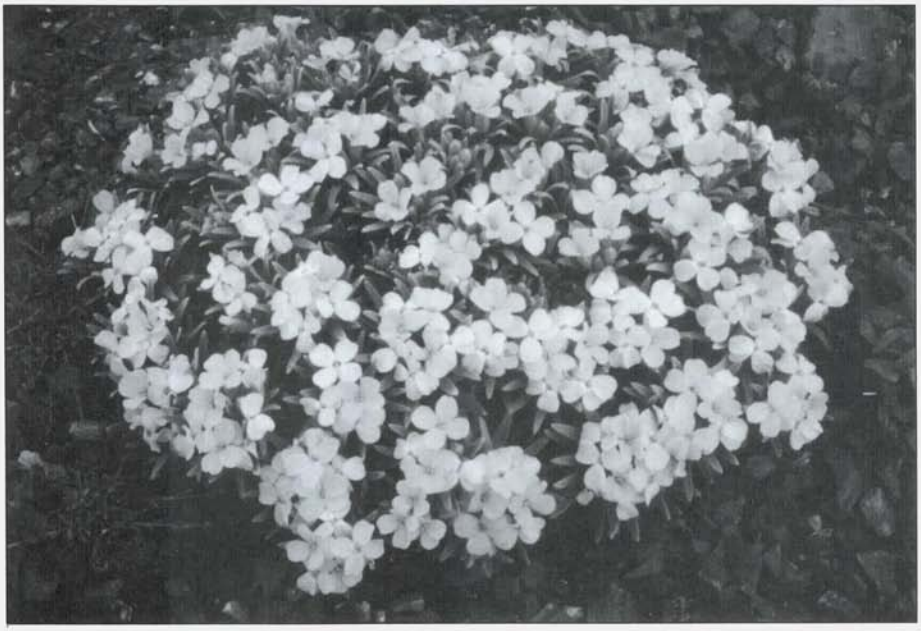
group of plants that we are testing for hardiness is the *Cactaceae.* We are presently growing various forms of *Echinocereus reichenbachii, Opuntia basilaris, O. clavata, O. fragilis, O. humifusa, O. imbricata,* and *O. polyacantha* with no problems. Also, the South American cactus *Maihuenia poeppigii* has made it through one winter with no special care.

Except for covering them with the foam blankets to help keep a good winter snow cover, we don't coddle our plants outside. Although we live in a nominal Zone 3a climate, we are successfully growing plants that are rated up to zone 6 or warmer—which goes to show that most of the plants haven't read any of the books! And we aren't going to tell them to either.

Three years after we began that first rock garden, the friend who inspired its building is revelling in her wonderful new garden in Victoria, British Columbia, restocked with pieces of her treasured plants that survived our stewardship. We were fortunate to have few losses (perhaps more a testament to the hardiness of alpine plants than our emerging skills!). We still swap plants with this gardener and with many more around the alpine world, as we continue to discover the fascinating world of rock and alpine gardening.

Llyn Strelau is a Calgary jewelry designer who enjoys the gems of the plant world as much as those of the mineral variety. He fondly remembers spring hillsides covered in *Anemone patens* and *Thermopsis* in his childhood home in central Saskatchewan. Rodney Shaver spent many hours as a child enjoying the woodland flowers of southern Ontario. Rodney and Lynn started gardening in Calgary 20 years ago. They now garden a one-quarter-acre city lot. Rodney owns a small, home-based nursery providing a unique collection of hardy perennials for Calgary, including species clematis, dwarf conifers, woodland, plants, rock, and alpine plants. Photo by authors.

Degenia velebetica



Above, the Paulson garden. Below, *Paraquilegia microphylla* growing there. Photos, Sheila Paulson.

An Alpine Garden
in Calgary

by Sheila Paulson

After attending my first NARGS Study Weekend in the late 1980s, a weekend of fantastic speakers and programs, I became addicted to alpine plants. That spring, with great enthusiasm, I looked around my garden to see where the alpine bed was going to be placed. It really wasn't too difficult to decide—along the northern fence an unused vegetable and raspberry patch had become overgrown and weedy and begged for revitalization. This area was about 60' long and 20-25' wide, with raised beds long ago constructed from railroad ties and 4" x 4" timbers.

Before I describe building my new garden, let me tell you about Calgary weather. We are 80 miles east of the Canadian Rockies at an elevation of about 3500' and are nominally classified as USDA Zone 3. Temperatures range from -40°F to 90°F, with a generally dry environment both summer and winter. Frost can penetrate into the ground as far as 8'. Snow cover is light, with seldom more than a foot or two accumulating—although in recent winters snow has far exceeded that. Our major weather problem is the chinook, a warm wind from the West in winter that can raise the temperature 40–60°F in a few hours and last several days. The wind removes any snow by sublimation, and the soil is dried. Chinooks raise Cain with perennials and shrubs that may think spring has come in January. Hence my love for alpines, particularly those indigenous to the Rockies...they have seen these wild temperature swings before and can usually tough out the conditions!

Now on to building my garden along that wooden fence on the north edge of the yard. After scouring as many books on alpine gardens as I could get my hands on, I opted for a design illustrated in an Alpine Gardening Society Guide, "Alpine Gardening, A Beginners Guide," by W.F.W. Harding. The photograph in the center of the book was what I would strive to emulate.

I liked the idea of raised beds, which make for good drainage and easier maintenance (you can sit on the wall to weed). Clearing the site meant removing the old railroad ties and levelling it to a grade about a foot lower than the contiguous lawn area to give the appearance of a sunken garden. I was indeed fortunate to have a very

knowledgeable garden contractor who is also a good friend.

The walls were built of Rundle rock, a locally quarried, argillaceous limestone, which breaks uniformly into layers of the desired thickness. (The quarry is outside the Banff National Park at Dead Man's Flats, but the well-known mountain bearing the name is the backdrop for the site of the 1999 Annual Meeting in Banff). Eight beds of varying sizes and heights were installed with curved outer walls to form a general free-flowing pattern, pleasing to the eye. Dividing walls that would be hidden or buried were built of concrete blocks...much cheaper than Rundle rock. Because of our dry climate, an underground sprinkler system was installed as the beds were built..

Different soil mixtures were made up and installed. This is where the planner must really come to grips with the variety and composition of the garden plants to be put in each bed. The key to a successful garden and less frustration in getting the little gems to grow is the installation of the appropriate soil mix, i.e.:

—peaty loam for primulas
(50%/50% loam /peat)
—very sandy soil for succulents
(75% sand and 25% loam)
—very gritty mixture for the saxifrages
(75% grit and 25% loam)

If anything, I found that I didn't get the soil mixes as lean as the plants appear to have preferred; some seemed to grow in nothing but rock. But now think about it. When you see these plants in the wild, it sometimes seems that is all that they are growing in—a rocky crevice with no soil. So, I have been "leaning down" my mixes ever since I began planting, not an easy job.

Once the soil was in place, I chose to locate and partially bury a number of more block-like slabs of Rundle rocks in each bed. This was not to imitate a mountain range as much as it was to give me the necessary crevices that the plants favor.

Planting time arrived. Eagerly I planted all the plants I had purchased and those I had grown from seed. I

made the common mistake of planting them too close together. After a few years, varieties of clematis that I intended to cascade gently down the walls to soften the appearance had taken over some of the beds. Drastic measures will have to be taken next spring to rectify the situation.

Some of my favorite plants that seem to do well in our climate are: *Aquilegia jonesii, Adonis vernalis, Rhododendron radicans, Delosperma basuticum* (formerly distributed as *D. congestum*), *Acantholimon* species, *Paraquilegia microphylla, Anemonella* species and cultivars, *Clematis tenuiloba* from the Big Horns, *Larix laricina* 'Newport Beauty', and *Gentiana acaulis.*

When I got serious about alpine gardening, acquiring plants was quite a problem. The garden centers in Calgary do not cater to specialized groups. They have a good thing going with annuals, especially if there is a late frost and sales can be repeated. Why should the nurseries change?

Holes Garden Centre in Edmonton, 200 miles to the north and some 200 miles east of the mountains were much more accommodating. (Edmonton has a climate much more amenable to all kinds of gardening). When a busload of Calgarian fanatics landed on their doorstep and dropped $5,000 in a couple of hours, they rubbed their hands with glee and proceeded to treat us like royalty; extra staff were laid on, home-made cookies were set out, and refreshments served. We now get red carpet treatment on our annual buying trip.

I also grow plants from seed, because I now belong to many different alpine plant societies that have seed exchanges. November and December are spent poring over seed catalogs. In the beginning of February our ping-pong table is set up in the basement with lights overhead, and the excitement of growing from seed begins again.

But the best source I've found for unusual plants is the NARGS study weekends and, of course, the Annual Meeting. My husband alerts the local

Agriculture Canada inspector when I return, and I usually sail through with no problems. Those who were with me on a 10-day trip around New Zealand are well acquainted with my fiasco of trying to kill the little bugs on the plants I nurtured with salt water—the plants also died.

Nowadays, more nurseries are starting up here and carrying more and more interesting and unusual alpine plants. This is alpine country (or nearly, at 3,400'), and these hardy plants are much more appropriate for our cool, dry climate than the usual petunias, pelargoniums, etc., which helplessly succumb to our unexpected late or early frosts.

It seems that I am willing to try anything even if it is said not to be hardy in our zone. One of my successes is *Delosperma basuticum*. Panayoti spotted it in my garden a year ago and exclaimed "No way! That's a Zone 6 plant, and this is Zone 3." Nevertheless, it seems relatively happy in that corner of my garden. My failures have been many. But then, what do you expect from gardening on the prairie? At the other extreme is one of my clematises, which is going to face a reckoning next spring before NARGS visitors arrive. It looked great for the first five years, but now, after 10 years, it has gone berserk. My attempts to prune it last year have just spurred it on. More severe measures may be needed to restrain—or even remove—it!

So see what sounds interesting in the catalogs and reference books, and then challenge nature, if your heart demands it. Small areas of microclimate can do wonders, and if a plant does poorly in one area, move it to another site. That's the challenge, and I must report that success gives a great deal of satisfaction. Failure gives a bit of knowledge. What the heck, if plants die, we can always blame the chinook!

I have a number of troughs around my garden with special soil mixes designed to grow some of the more interesting plants. These fill gaps in the landscape and give me further opportunities to experiment with unusual plants.

With the discovery of an abundant source of tufa (not tuff) a few years ago, the Calgary alpine gardening community has commenced a whole new style of growing many alpines. Plants that have difficulty in normal beds or crevices may truly enjoy a growing environment consisting of a hole bored in this soft porous limestone rock. This is especially true of *Saxifraga oppositifolia* (photo, p. 24) and *Primula allionii*. It will be fascinating to see just what all we can grow in this great planting medium, already so popular in England and Scotland.

As I write this article, fall is in the air and seed catalogs should soon be arriving. Alpine gardening is truly a year-round addiction for me.

Sheila Paulson emigrated from Bedfordshire, England, in the 1960s, from a farming background. She and her family have lived in Calgary for 21 years. She played a vital role in gardening societies there, reinvigorating the Calgary Horticultural Society and founding the Calgary Rock and Alpine Garden Society. She is now Chairperson of the Annual Meeting of NARGS to be held in Banff, Alberta, Canada, 24–27 June 1999. Photos by the author.

THE BEST OF ROCKS:
TUFA GARDENING IN CALGARY

by Becky Simrose

"Tufa is the best and rarest of all rocks for alpine gardens."
—H.H. Thomas

When I began developing my rock garden two years ago, rock selection was the first step. An experienced alpine gardener advised that there was no better choice of rock than tufa. I had never heard of tufa.

Tufa is a soft, white, porous, calcium carbonate rock. Tufa, along with travertine and calcareous sinters, are formed by calcium carbonate precipitation. Tufa is distinct from travertine in the abundance of molds of plant matter that it contains—leaves, sticks, moss, grass, algae. Travertine is densely layered and laminated. Tufa is spongy and porous with channels containing encased, decayed vegetable matter. Microbial activity plays an important role in calcium carbonate precipitation in both tufa and travertine. Calcareous sinters, on the other hand, form in caves and fissures where there is minimal microbial activity in the precipitation.

The conditions for the formation of tufa are complex and specific—water, mineral content, temperature, plant matter, and microbial activity must all be present and appropriate. The phenomenal Mono Lake tufa towers in Tufa State Reserve, California, form as underground fresh-water springs, containing dissolved calcium, emerge beneath the alkaline lake, and flow up through the carbonate-rich lake water. As the waters mix, the dissolved solutes combine and crystallize out of solution. The tufa-precipitating reaction occurs only in the lake itself. The towers stop growing when the lake level drops. The tufa mounds of Lake Chewaucan in Oregon likely formed as low-temperature, geothermal springs emerged into and mixed with the calcium-rich water of the lake. Again, the tufa-precipitating reaction appears to have occurred only in the lake itself, as these mounds are all identical in height. The mounds appear to have been fed by dense veins of travertine. Temperature appears to play an important role. Isotope studies have shown that the tufa precipitated at a slightly lower temperature than the travertine feeder veins. So whether tufa is deposited from solution in spring water or percolating ground water, all the perfect conditions must occur together to allow the formation of this unusual rock.

The value of tufa for alpine gardening is remarkable. Not only can plants grow in pockets and crevices between tufa rocks, but they can actually grow right in the rock. Natural crannies or drilled holes provide homes for tiny alpines, whose roots extend throughout the porous rock. Air and drainage, so essential to the roots, are assured. Nutrition is provided for growing roots by the encased, decayed vegetative matter. For alpines demanding lean growing conditions, you just can't get any leaner. Can you get any superior rock at all?

The Calgary rock and alpine gardener has ready access to some of the finest tufa commercially available—and at an inexpensive price. Rod Sykes, an avid Calgary alpine gardener, owned property at Brisco, British Columbia. His neighbors, the Wolfenden's, suggested that the interesting rocks in their pasture would be great for his rock garden in Calgary. Rod wasn't really interested. But he went over in the interest of being neighborly and looked at the mossy rocks lying around. Suddenly, he was very interested. Surely this was tufa.

Initially, the British Columbia Department of Mines showed little interest in looking at the alleged tufa find. Officials are frequently asked to examine dense, lacustrine limestone which people are convinced was tufa—but isn't. Eventually, in January, 1996, a senior geologist confirmed that the Brisco rock was indeed tufa, *and* this was the finest and largest deposit known in Canada. There are an estimated four million tons of tufa in a deposit 6–10' deep, just below the ground surface. The owners, Winston and Alan Wolfenden, have developed a commercial operation, 'Rocky Mountain Tufa'. Needless to say, this rock is now found in the gardens of many avid rock gardeners in Calgary.

I had my first truckload of tufa delivered, and I was hooked. I marveled at the leaf forms, the outlines of twigs, moss skeletons across entire rocks, and tiny shells stuck to the surface. Best of all, the rocks were incredibly light for their size, so I could easily manage to move, arrange, and re-arrange them. I couldn't bear to bury those rocks as deeply as they should have gone, couldn't bear to cover up so much of the rocks. A third to half of the rock should be buried for stability's sake, and planting holes in the rock should be within 6" of the soil surface to assure adequate moisture moves up from the soil.

Silene acaulis, Draba scardica, Arenaria tetraquetra, Saxifraga minutifolia, and *Saxifraga cochlearis* settled into holes in the rocks. Between the rocks, *Campanula raineri, Dianthus subacaulis, Dianthus* 'Nyewood's Cream', *Aquilegia jonesii, Aquilegia saximontana* x *A. jonesii, Eriogonum flavum, Penstemon nitidis, Penstemon rupicola, Gentiana acaulis, Androsace sempervivoides,* and *Androsace lanuginosa* flourished.

Of course, one truckload wasn't enough. The next summer we borrowed a small truck and spent a happy afternoon selecting and loading tufa in the pasture, while our large dog spent a happy afternoon cavorting with the young, playful heifers.

More rugged little mountain ridges sprouted around our garden, the rough and crumbling rock giving it all an age-old, untamed appearance. Wonderful little alpines settled in happily: *Androsace mucronifolia, A. hedraeantha, Androsace* 'Millstream', *Douglasia montana, Lewisia cotyledon, L. longipetala, L. nevadensis* and *Soldanella montana,* and porophyllum saxifrages.

As I became more enthralled with tiny cushion and bun alpines, crevice areas became an obvious must. A load of flat tufa pieces was ideal for creating crevice ridges. I buried three quarters or more of the rock (shutting my eyes when the pieces had beautiful vegetation forms), which is now home to *Draba acaulis, D.*

polytricha, D. oligosperma, Arabis androsace, Silene 'Frances', and *Gypsophila aretioides;* all have settled nicely into the crevices. The small, cheerful composites *Townsendia montana, T. hookeri, T. rothrockii, T. mensana, T. florifer, Erigeron pinnatisectus,* and *Aster coloradoensis* seem to love the crevices. *Delosperma ashtonii* bloomed all summer. The blue-gray foliage of *Degenia velebitica* grew up against a fine, dark gray mat of *Raoulia. Edraianthus pumilio* seedlings grew into healthy clumps.

Some plants have a survival advantage when planted directly in tufa. *Eritrichium aretioides* seems to prefer to grow directly in the tufa; seedlings planted into the tufa itself are doing well, whereas the two planted between the rocks both suddenly died. *Saxifraga oppositifolia* also seems to prefer growing in the tufa, as attested to by the extraordinarily beautiful specimen in Sheila Paulson's garden.

My enthrallment with tufa in my garden continues. A small waterfall now cascades from a tiny pond nestled in tufa rocks to a larger pond below surrounded by tufa. *Pinus aristata,* a gnarled, dwarf conifer, grows from the edge between the rocks. In the small valley between crevice ridges, *Picea abies* 'Pendula' sweeps gracefully. Mosses are starting to grow on older, shaded tufa. I'm enthralled with the rocks, just as I'm enthralled with the plants, and that surely is what rock gardening is all about.

HOW TO BUILD A TUFA GARDEN:

•MIX SOIL

Soil mix will depend on local weather and moisture conditions and on preferences of plants. I use one-third good topsoil, one-third coarse sand, and one-third sedge peat, and then add varying quantities of peat moss and 7mm gyra rock.

•SHAPE

mounds and valleys with a shovel.

•SORT TUFA

Put similar appearing pieces together, e.g. leaf formations, bark formations, moss formations. Sort flat pieces for crevice areas by thickness. Again try to put similar appearing patterns together. Save crumbled tufa dust.

•START AT THE BOTTOM

Dig holes to plant the rocks. Cover a third to half of each rock. The second layer of rocks should touch the rocks in the first layer and sweep in natural-appearing formations, with planting slopes and crevices between. Have similar appearing pieces touch, so that they appear to be part of the same big rock. Add some asymmetry to the design.

•CREVICE AREAS

should mimic sedimentary rock. Use pieces of similar thickness in a linear formation. Bury most of the rock, leaving just edges out. Add parallel layers to give symmetry, and then create asymmetry by tilting a layer, or adding a large, offset rock. Crevices can be horizontal or vertical or can start out horizontal and then gradually change to vertical.

• PACK SOIL
well between rocks as you plant them. The head of a hammer works well.

• PLANT
your plants in the crevices. Top dress and mulch with fine to medium gravel with tan shades.

• SELECT
tiny plants to plant directly into natural or drilled holes in the tufa. Planting holes should be within 6" of soil surface. Gently wash most of the dirt off the roots. Holding the plant by the stem with its roots in the hole, gently trickle the mixture of soil and tufa dust around the roots to fill the hole. Crumbled tufa bits can be gently packed into the surface of the hole. Water well until the plant is established.

• TRY PLANTING SEEDS
directly into the tufa (e.g,. *Saxifraga, Draba*). Water well. Feed young seedlings with weak solution of fertilizer in water.

Doaecatneon alpinum

Becky Simrose's interest in gardening started at a young age, growing up in Nepal, where her parents worked. She was only eight when her father taught her how to graft and bud fruit trees, grafting improved varieties onto hardy local root stock. She loved the mist of the greenhouse, full of growing plants, and shared her dad's excitement in acquiring and introducing kiwi vines to Nepal. She spent happy days wandering the hillsides, chasing butterflies and searching out wildflowers. In Canada she discovered the beauty of the Rocky Mountains and their flora. When she began her own garden, alpines were a natural choice, bringing the mountains into her backyard. She is now raising two young gardeners who identify and claim her choicest plants as their own. Photo by author.

ERICACEOUS ARISTOCRATS

by Arthur P. Dome

The family Ericaceae is rather an exciting group of plants. Their members are scattered all around the world. Most prefer to be out in the open but protected from the hot afternoon and evening sun. They do best in a loose, friable, humus-rich, lime-free soil on the acid side, in which air can get to the roots. Soil of this type should be deep enough to accommodate the root balls of established plants, be cool, well-drained, and never dry out.

The andromedas are small, evergreen shrubs, most with a spreading habit, that usually grow from 6–12" high in cultivation. The foliage varies in shades of gray-green to bluish-green, and the leaves are glaucous on the underside. Flowers are produced in clusters at the tips of the stems from late spring into the summer; various forms have white, pinkish, to dark red blossoms. There are two species in the temperate Northern Hemisphere. Zone 2.

Andromeda glaucophylla has glaucous, green stems, and the underside of the leaves are tomentose (covered with short, matted hairs, in this case). The flowers are pink usually fading to white.

Andromeda polifolia includes varieties with leaves varying in shades of green, bronze, or blue-green, all glaucous (waxy, but without hairs) underneath. The flowers range from white to pinkish to dark red. The type *A. polifolia* is a compact, erect-growing plant with green leaves and pink blossoms. It has many good cultivated varieties which include: *A. polifolia* 'Alba', with green foliage and white flowers; *A. polifolia* 'Choay', with an open, spreading habit and bright green foliage in the spring and summer that turns to bronze during autumn and winter. The flowers are dark red fading to pink. *Andromeda polifolia* 'Kirigamine' (photo, p. 37) has narrow, green leaves and produces a profusion of pink flowers; *A. polifolia* 'Macrophylla' is more dwarf with broader leaves and pink flowers. *Andromeda polifolia* 'Blue Ice' is a new introduction from Canada (photo, p. 37). It is a compact, upright plant with intensely blue-green foliage and pink flowers.

Chamaedaphne calyculata (photo, p. 41) is sometimes called Cassandra. In the wild some forms can get up to 4' tall, but there are "Nana" or dwarf forms that

make very desirable rock garden plants. The evergreen foliage is light green and in some situations can turn bronze to purple in fall and winter. It's arching branches are tipped with racemes of white, urn-shaped flowers. It is claimed to be tolerant of drier conditions than most of its family; nevertheless, don't let it dry out. Zone 7.

Gaylussacia brachycera is sometimes know as box huckleberry. It is a fine little evergreen shrub that can make an excellent groundcover around other ericaceous plants as it spreads by underground stolons. It has light green foliage that turns reddish in the fall and winter. The flowers are white with reddish streaks or blotches in them, borne from May to July. They even produce blue huckleberries when two or more plants of different clones of the species grow close together. In New Jersey a population exists that is estimated to be over 10,000 years old. Zone 7.

Kalmiopsis leachiana, from the mountains of southwest Oregon, is another small, choice, evergreen shrub. The Umpqua Valley form (now called *K. fragrans*) is a neat, compact plant. A ten-year-old plant would average about 8" high and 12" wide. This species is a profuse bloomer, and when in flower the lovely pink blossoms completely cover the deep green foliage. There is a Curry County form that is more open and more upright. Its pink flowers are in longer racemes at the ends of the stems. They also like a well-drained soil and a good deal of water during the growing and blooming season. Zone 7.

Leiophyllum buxifolium (photo, p. 41), sometimes called sand myrtle, is another nice little evergreen shrub from the eastern U. S. Its variable growth forms, ranging from erect to practically prostrate, have accounted for there being several named forms. It has small, glossy, deep green leaves that take on bronze hues in the fall and winter. It produces white to pinkish clusters flowers at the ends of the stems from late spring through early summer. Zone 5.

Loiseleuria procumbens (photos, p. 40) is found in many of the high alpine areas of Asia, Europe, and North America. It is usually very prostrate, but there are some forms that develop into little mounds. It has small, glossy green leaves and produces pink to rose-pink flowers during the late spring and early summer. There is a white form that is very rare and difficult to find. In growing *Loiseleuria* it is important to place the plant out in the open, while still making sure that the roots can be kept cool. Also, since this is a very shallow-rooted plant, pay special attention to keeping the roots moist. Zone 2.

Menziesia ciliicalyx is a deciduous shrub from Japan. In time it might grow too large for the smaller rock garden, but it still deserves some consideration. It is an erect-growing plant that seems to develop its branches in tiers. The leaves are light green and covered with small hairs. The flowers are pinkish and form little clusters at the tips of the previous year's growth. *Menziesia ciliicalyx* var. *purpurea* (photo, p. 38) is a slightly smaller plant with deep rose-pink to purplish flowers. Zone 6.

Andromeda 'Blue Ice' (p. 35)

Andromeda polifolia 'Kirigamine' (p. 35) photos, Art Dome

x *Phylliopsis* 'Coppelia' (p. 45)

Menziesia ciliicalyx var. *purpurea* (p. 36) photos, Art Dome

Rhodothamnus chamaecistus (p. 45)

Tsusiophyllum tanakae (p. 45)

Loiseleuria procumbens (p. 36)

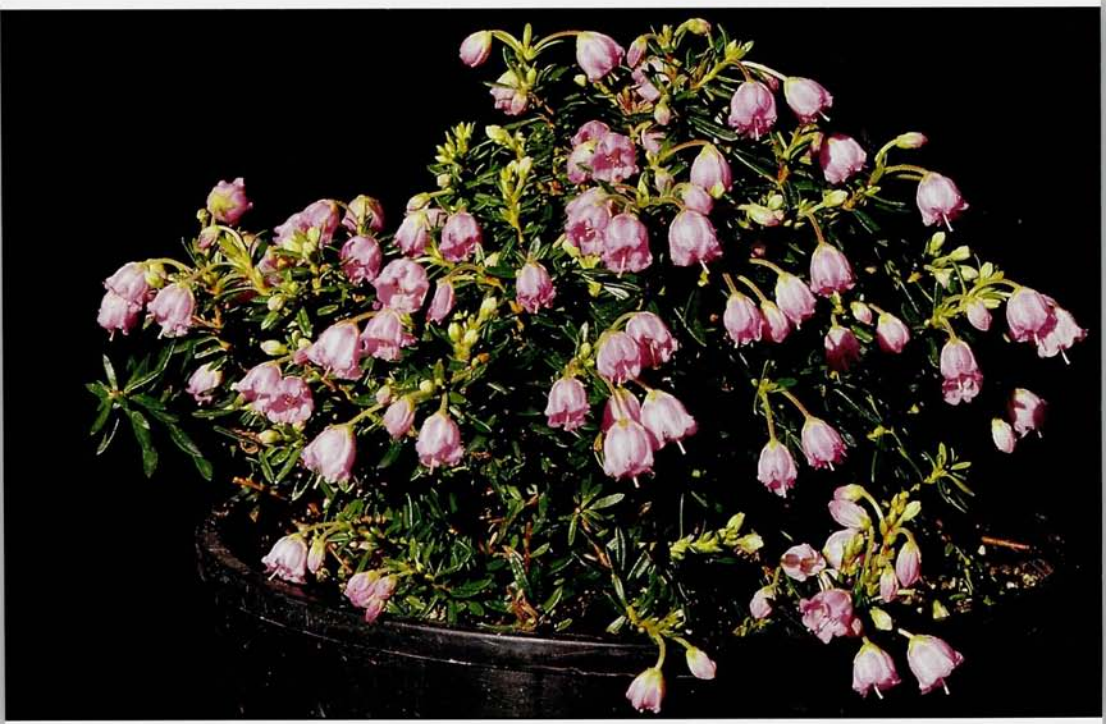
Loiseleuria procumbens on Midtlaeger Pass, Norway

Chamaedaphne calyculata (pp. 35–6)

Leiophyllum buxifolium (p. 36) photos, Art Dome

X *Phyllothamnus erectus* 'Peter Cox' (see p. 45)

X *Phylliopsis* 'Sugar Plum' (p. 45)

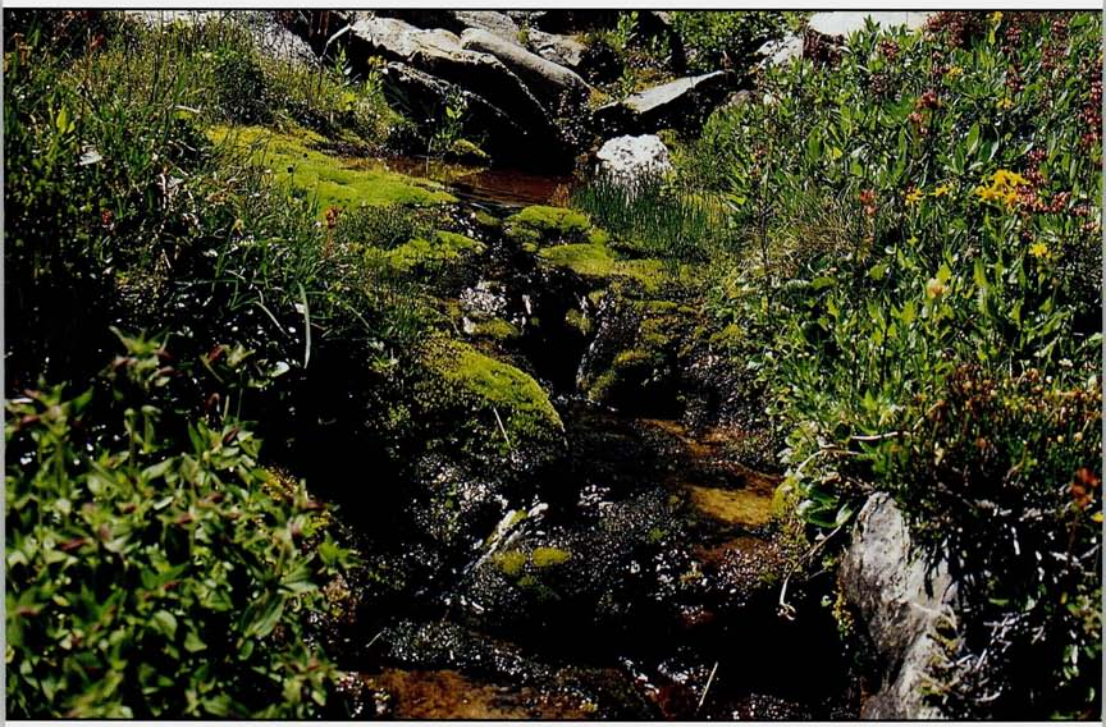


Mountain meadow in the Bugaboo Mts. (pp. 50–51) photos, Becky Simrose

Erigeron aureus (pp. 13, 50)

A steep scramble in the Bugaboo Mountains (pp. 50–51)

Mossy creek in the Bugaboo Mts. (pp.50–51) photos, Becky Simrose



The X *Phylliopsis* hybrids are a very desirable addition to many gardens. They are inter-generic hybrids, crosses between two genera, in this case between various species of *Phyllodoce* and *Kalmiopsis leachiana*. The resulting plants are small, evergreen shrubs that grow 8–12" tall. They bloom in the spring of the year, carrying the flowers in racemes of various lengths at the tips of the stems. X *Phylliopsis* 'Coppelia' (photo, p. 38), itself a cross between *Phyllodoce empetriformis* and *Kalmiopsis leachiana*, has lavender-pink, saucer-shaped flowers. It was created by Barry Starling, of Exeter, United Kingdom. X *Phylliopsis hillieri* 'Pinocchio' is thought to be a chance cross of *Phyllodoce breweri* and *Kalmiopsis leachiana* that occurred at Hillier's Nursery in England. It has rich pink, bell-shaped flowers. X *Phylliopsis* 'Sugar Plum' (photo, p. 42) is a cross between *Phyllodoce caerulea* and *Kalmiopsis leachiana* that bears rich pink, plum-shaped flowers. This plant is sterile, which accounts for its holding its flowers several months or more. 'Sugar Plum' was also created by Barry Starling. Zone 6.

The intergeneric cross X *Phyllothamnus erectus* is thought to have resulted from a chance mating between *Phyllodoce empetriformis* and *Rhodothamnus chamaecistus* at a nursery in Edinburgh, Scotland, back in 1845. It is a dwarf, erect, evergreen shrub. It reaches about 12" in height and has clusters of pink, funnel-shaped flowers late in the spring. Zones 6–8.

Rhodothamnus chamaecistus (photo, p. 39) is a small, evergreen shrub from the eastern Alps and the Dolomites. It seldom grows to more than 12" tall in captivity. It has bright green leaves and small clusters of pink flowers late in the spring. It has proved very difficult to grow past the second or third year. Some gardeners grow it in a rhododendron-type soil, others in a very gritty mix with the addition of some dolomitic lime. The only plant I can remember seeing that I thought was well grown was one that Steve Doonan of Issaquah, Washington, grew in a pot. Zone 6.

Tsusiophyllum tanakae (photo, p. 39) is a dwarf, loose-growing, small shrub from the mountains of Honshu, Japan. It has tiny, oval, deep green leaves that take on a bronze hue in the fall, and it is sometimes deciduous. It is not a prolific bloomer, but its tiny, white, tubular flowers will always draw attention. It is quite rare and difficult to grow, usually preferring a cool place in the garden. It is used by some as a container or bonsai subject. This plant is now considered by some botanists to be a rhododendron. Zone 7.

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Arthur P. Dome is an ardent admirer of ericaceous plants. He gardens in Seattle, Washington. He has written several articles for the *Quarterly*, including one on cassiopes and phyllodoces which later appeared in the journal of the Swedish Rock Garden Society.

TABLE 1

GERMINATION of DRIED TRILLIUM SEED
observations by John F. Gyer, August 1996

	Trillium albidum	*Trillium chloropetalum*
Dry seed weight, avg.	11.7mg (seed+aril)	11.8mg (seed+aril)
Hydrated seed weight, avg	27.0mg (seed+aril)	28.8mg (seed+aril)
	23.5mg (seed-aril)	23.6mg (seed-aril)
Aril, % of wet seed wt.	13	17
Water, % of wet seed wt.	57	59
Hydration increase, %	131	144
% survival at planting	67	Not calculable (An uncounted number of seeds were shared with a friend)

EMBRYO DIMENSIONS

0 days (assumed size)	0.3mm x 0.2mm	0.3mm x 0.2mm
62 days	2.0mm x 0.5mm	0.7mm x 0.2mm
107 days	not measured	2.8mm x 0.9mm
158 days	GERMINATION	GERMINATION

NOTES:

Because dissection of dried seed was not feasible, the 0 day assumed dimensions are based on embryo measurements from other sessile trillium species. Trillium embryos do not vary significantly from the assumed size.

Day count begins with the start of hydration.

Few dissections were made for embryo measurement because of small seed numbers. My desire for plants overwhelmed my desire for data.

Mature *Trillium grandiflorum* seeds contain 50 to 60 per cent water (see "Trillium Tricks", *Rock Garden Quarterly*, 55(2), p.139). This is the same moisture content range as the hydrated seeds in this experiment.

J.F.Gyer, 1998

GERMINATION
OF DRIED TRILLIUM SEED

by John Gyer

There is a general feeling among gardeners that *Trillium* species produce recalcitrant seeds. A recalcitrant seed has a high moisture content when it first matures and dies if it dries out. The feeling that *Trillium* seed is recalcitrant is supported by Norman Deno in his privately published book *Seed Germination, Theory and Practice,* in which he suggests that dry storage is fatal for most trilliums. The Ephemeral Seed Exchange of the NARGS is an effort to distribute moist seed as a response to the apparently severely reduced germination of dry seed of a number of species, including those in the genus *Trillium*. However, aside from Deno, I do not know of any detailed published data to support the idea that drying kills trillium seed.

In nature ripe trillium seed lies on or very near the soil surface, often in areas with little leaf litter over it. During July or August, the months when most trillium seed is dispersed in eastern North America, several weeks can pass between significant rains. Even in flood plain habitats the soil can become very dry. Trillium seeds must withstand these desiccating conditions and be able to rehydrate in September when lower temperatures reduce evaporation and rains moisten the soil.

When they are shed, trillium seeds contain between 50% and 60% water by weight. This high water content can soften the effect of summer desiccation. Published work by Lyudmyla Kozeko, et al. (*HortScience*, 33(3): p. 479) indicate that some recalcitrant temperate species seeds can lose about two-thirds of their water without damage. The data below indicates that trillium seeds behave in a similar fashion. They can lose much of their free water and remain viable for a month or more. These observations do not consider the effect of prolonged dry storage or storage temperature.

In March of 1996 I received dry seed of *Trillium chloropetalum* and *T. albidum*. I was told that the berries were harvested when ripe, I assume sometime in the summer of 1995. The arils and pulp were removed by about a week's soak in water, after which the seeds were dried just enough to prevent rot and stored at low, but not freezing, temperature. The amount of water loss associated with this initial drying and the storage temperature is

not known. There may have been additional drying in transit to me.

The dried seeds were counted, photographed, and weighed as received. I slowly hydrated the seeds in paper towels that had been moistened with tap water and wrung dry by hand. Three days later the seeds were weighed again, treated with 3% H_2O_2 and washed to remove remaining aril material, reweighed, and put in moist towels in plastic bags at about 70°F. From time to time a seed was dissected to see if the embryo had begun growth. After 158 days most rhizomes had emerged and grown roots. The seeds were planted outdoors in a humus-and-sand mix and lightly covered with a granular material called AXIS. The data are summarized in Table 1.

In 1997 I treated a gift of dried *Trillium undulatum* with the same slow rehydration and recorded the data in Table 2. Over 90% of the seed rehydrated without endosperm leakage or rot and germinated normally.

I think that only fully mature and dormant trillium seed can be successfully dried and rehydrated. Maturity in this case is defined as fresh seed with no more than 50% to 60% moisture by weight. Also, drying must be slow and happen when there is no active embryo growth. Rehydration must also be done slowly at moderate temperature so that the cell walls and membranes have a chance to reconstruct. Cell walls in particular will fold and crinkle as the seed dries. The very rapid expansion that happens during soaking in water will cause cracks along the fold lines, and cell contents will leak out. Bacteria and fungus have a feast on the leakage, where they gain strength to attack and rot the seed. Slow hydration under essentially 100% humidity, but without free water touching the seed, reduces leakage.

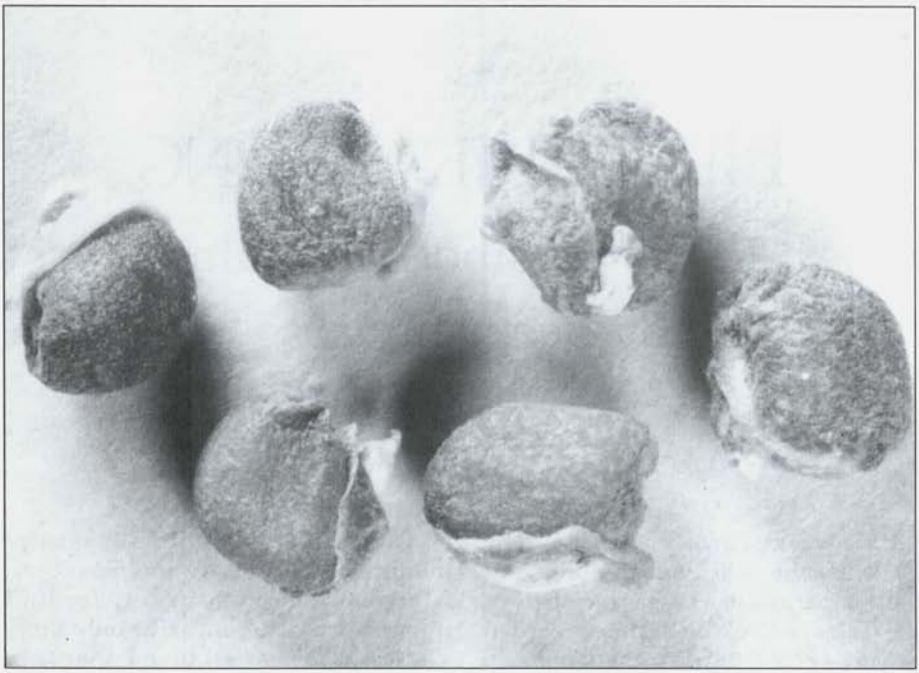
John Gyer and his wife Janet garden in Clarksboro, New Jersey and specialize in woodland gardens. Photos by John Gyer.

TABLE 2

HYDRATION OF DRIED *TRILLIUM UNDULATUM* SEED
1997 data

Hydration Time	Seed Weight, mg	Water Absorbed		
		Weight, mg.	% of dry wt.	%72hr wt.
0 (dry seed)	5.12 *	0	0	0
24 hr	8.6 *	3.48	68	35
48 hr	9.5 **	4.38	86	44
72 hr	10.0 **	4.88	95	49

* seed plus aril weights
** some aril material was removed by washing at 48 hrs.
Note: hydration conditions; moist paper towels in plastic bag at room temperature (~70°F). J.F.Gyer, 1998



Above, dried seed of *Trillium chloropetalum* as received.
Below, *Adonis amurensis* 'Fukujukai'; section of a young flower with receptive stigmas and anthers that have not yet matured.

HELICOPTER HIKING

in the Bugaboo Moutains

by Becky Simrose

Thwack! Thwack! Thwack! The blades of the helicopter resounded in the compartment, as eager members of the Calgary Rock and Alpine Garden Society peered through the windows. The helicopter rose above the sharply sloping, forested mountainside. Before us appeared a high mountain meadow. Sunlight sparkled on a crystal creek that ran through the purple- and yellow-flowered meadow. The vegetation was flattened by the wind from the helicopter blades as we touched down, jumped out, and crouched in a huddle around our packs. The helicopter lifted like a giant dragonfly and drifted off to pick up the next group.

We straightened up. Flowers surrounded us—*Erigeron peregrinus, Senecio lugens, Parnassia fimbriata,* pink *Castilleja,* glowing red seed capsules of *Leptarrhena pyrolifolia.* The morning sun and breeze danced on the flowers. Velvet moss carpeted the edges of the creek, where water chortled joyfully over the rocks. The sky was blue. The day was ours.

The helicopter returned and deposited the second load of flower enthusiasts. We crossed the creek and headed out in small groups. Some followed the creek up to the two tiny mountain lakes above the meadow. Others headed immediately for the ridges, anxious to climb. The only stipulation was that all be back at the pick-up point by 4 p.m.

Our group scrambled up a rocky slope, and discovered *Mimulus lewisii* and *M. guttatus,* glowing magenta and golden yellow along a steep, almost dry streambed. *Epilobium alpinum* formed dense patches of pink and white. The open, rocky slopes were studded with the purple of *Penstemon ellipticus,* the deep pink of *Epilobium latifolium,* and the emerald green and white of *Cassiope mertensiana.*

We climbed higher and reached snow patches, melting on steep shale slopes. Little ferns peeked out between the shale. *Erigeron aureus* (photo, p. 43) beamed in sunny spots. *Phacelia sericea,* soft and mauve, clung to the slopes.

The top of the ridge overlooked the harsh grandeur of tumbled rock and cliffs dropping away on one side and the soft colors of meadow and snowmelt lakes on the other. We paused for lunch and to enjoy the exhilarating view. We found, in the

eternal shade below the lip of the ridge, a huge mat of *Saxifraga bronchialis*, intensely white, densely flowered.

We followed the ridge until it became impassable, then scrambled down towards the lakes, across a slope of boulders, and then up to the next ridge. *Anemone occidentalis* seedheads, tow-headed babies, silently populated the tiny, grassy meadow on the ridge. Sunlight lit up clumps of *Phyllodoce empetriformis*, deep green and deep pink. And then there were more rocks to climb and scramble over, until the lakes appeared tiny, way down below. *Silene acaulis* flowered freely among the sheer rocks. *Tolmachevia integrifolia* grew in cracks of the rock. Mats of *Dryas octopetala* broke the solid gray of rock with patches of green and white. Silence enveloped the magical vista.

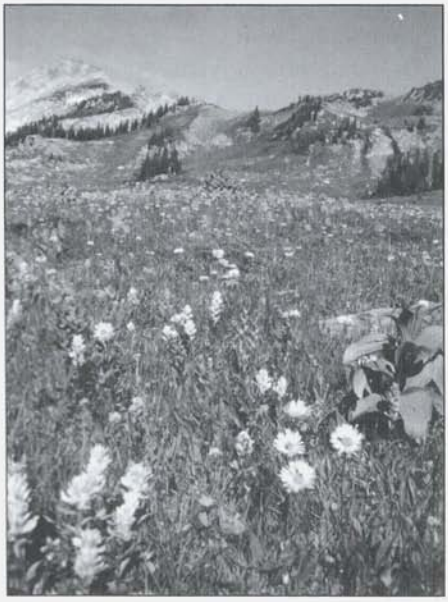
We then descended along the tree line to the cool waters of the little lakes, admiring the glimmer of *Ranunculus eschscholtzii* in the cool little hollows, the fiery red of *Castilleja* among twisted tree skeletons. The crystal creek originated here, fed by the lake. We followed it down towards the meadow. The moss formed brilliant green mounds and carpets in and around the creek. *Mimulus guttatus* shone shyly out, yellow against the brilliant green. Magenta clumps of *Mimulus lewisii* framed the creek banks. Shoes and socks came off, and the sensual feel of cool water and velvet moss soothed hot feet.

We followed the creek through the meadow and gathered among the purple, yellow, pink and cream of the meadow flowers, comparing experiences and sunburns. It had been a perfect and magical day.

Thwack! Thwack! Thwack! The sound of the helicopter blades signaled the end of our day among the flowers in the Bugaboos. But even now, when I close my eyes I see the crystal creek, the flower-bedecked meadow, the harsh, snow-tipped crags, the cool lakes, and with that memory comes a soothing peace. The magic is mine forever.

The Calgary Rock and Garden Society (CRAGS) organized a helihike on July 23rd, 1998. We met at Alan Wulfenden's ranch, in Briscoe, British Columbia, at the crack of dawn. The drive to the Bugaboos Lodge at the foot of the Bugaboo glacier, over bumpy logging roads, took an hour. From there, Canadian Mountain Holidays flew twenty-two CRAGS hikers up to Silver Basin. The Bugaboo glacier is in the Purcell Mountains in southeastern British Columbia. The area is famous for hikes, flowers, and in winter, for heli-skiing. As you can guess from my account of the day, I am eagerly waiting for next year's helihike.

Photo by author.



Transplanted from Connecticut

Allium christophii	successful
Allium karataviense	successful
Allium schubertii	so-so
Allium thunbergii	successful
Arisaema candidissimum	vanished
Arisaema fargesii	vanished
Arisaema ringens	successful
Arisaema sikokianum	limping along, really surprising not more successful
Arisaema thunbergii var. *urashima*	successful
Arisarum probiscoideum	successful
Arum 'Jerry Flintoff' or possibly now known as 'Green Marble'	
Camassia leichtlinii	very successful
Colchicum autumnale	successful
Colchicum speciosum	successful
Cyclamen coum	moderately successful
Cyclamen hederifolium	moderately successful
Cyclamen purpureum	dead
Eranthis hiemalis	successful
Galanthus 'Desdemona'	successful
Galanthus 'Mighty Atom'	successful
Galanthus 'S. Arnott'	successful
Galanthus elwesii	successful
Galanthus nivalis 'Virid-apice'	successful
Lilium martagon 'Album'	successful
Lilium tsing-tsauense	dead
Trillium erectum	reasonably successful
Trillium grandiflorum	reasonably successful
Trillium grandiflorum 'Flore Pleno'	successful
Trillium luteum	fair (I think my soil's too acid)
Trillium sessile	fair (see previous comment)
Tulipa aucheriana	successful
Tulipa hageri	successful

INTO THE WOODS:

MOVING BULBS TO BELLEWOOD

by Judy Glattstein

I like bulbs, also corms and tubers. These lumpy underground packages conceal rainbow beauty in plain brown wrappers. Geophytes (the conglomerate term for bulbs, corms, and tubers) are forgiving plants better able to withstand delays in planting than fibrous-rooted plants. Like good house guests, many of the spring-blooming kinds arrive, make themselves welcome, then depart in a timely manner. Though spring-flowering geophytes are arguably the most familiar, there are others for summer and autumn interest. And, just as geophytes developed their underground reserves to get through hard times, geophytes helped me through a difficult transition in my gardening.

Transplant shock is discernible in gardeners as well as plants. Say the fateful words, "We're moving," and anticipatory horror twists a gardener's heart. Plants, more pragmatic, do not fret over what might be. My first response was to wonder not what to pack but which plants to move, and how. How soon we moved would all depend on how soon we found a new gardenable site with affiliated new house. As it turned out, I was digging plants for about two years before we moved, well before we owned any place to replant them. Knowing winter care for containerized plants would be a consideration, I asked permission to store pots at the walk-in cold storage facility at the Institute of Ecosystem Studies in Millbrook, New York, where I was an instructor. Space is at a premium, so I planted up community pots: *Acer shirasawanum* `Aureum', golden full-moon maple, in a container with yellow-leafed hosta, some *Epimedium perraldianum*, and a nice layer of *Eranthis hyemalis* just below the soil surface. This sort of combination—small tree or shrub, perennial, ground cover, and geophytes—proved quite successful. Larger pots meant the soil didn't dry out as quickly. Come replanting time I figured I could dig one hole and just slide the associated plants into place.

The woody plants and herbaceous perennials were easy to find. Geophytes were often a different story. My recollection of about where what was growing was fairly accurate after nearly two decades in that garden. However, geophytes multiply underground, and that small planting

of *Galanthus nivalis* `Viridapicis' had increased to a three-layer deep, solid mass of bulbs. I'm especially fond of snowdrops and was concerned that the different cultivars I'd acquired—`S. Arnott', `Magnet', `Mighty Atom' and others—and the different species—*Galanthus ikariae* ssp. *latifolius*, *G. elwesii*, *G. caucasicus*, etc.—not get mixed up. Community containers with a record of what was planted in each container mean that even if the labels fade or get lost, I would know which plant was where. This was the theory, and in large part it was my practice. But remember that I was digging with some leisure in the beginning of the preparations for the move, then with more haste and less finesse as moving approached reality rather than theory. Some geophytes never even made it into pots. *Camassia esculenta* had settled so firmly into its location that I was excavating rather than digging in order to retrieve them. They ended up in bags in the garage at the new house. Ditto for *Colchicum*, meaning they did become mislabelled, only to be straightened out after flowering in autumn and leaf production in spring. *Colchicum agrippinum* has distinctively wavy-edged, grayish green leaves, quite different from the pleated, green leaf, cornstalk production of *C. speciosum*.

We left Connecticut for our new home in New Jersey, the Garden State, just a mile or so from the Delaware River. We left an acre with that mythical, high-organic-content, moist-yet-well-drained loam, shaded by several mature white oaks (*Quercus alba*), for not quite nine acres of Hunterdon County clay. And the soil had rocks embedded like raisins in a pudding, though considerably larger. I'd played in the previous garden for 19 years. The new site had never been gardened. At a guess, its now wooded acres had been sheep pasture perhaps 60 years ago, as the north-facing slope is too steep for crops or cattle. Though my husband said it was not permissible to remove the soil and leave the old house surrounded by an empty moat, I did move the ample supplies of compost. I quickly learned to double-stack my Sable station wagon for the 125 mile trip. Each time I'd also load five or six buckets of compost, to start the plants off in their new home. By summer's end there were only scrapings left in the compost bins.

As well as clay and rocks I have weeds at BelleWood: multiflora rose, Japanese honeysuckle, garlic mustard, and Japanese stilt grass. The slope behind the house had thoughtfully been planted to crown vetch to keep it from sliding into the kitchen. Deer saunter through in all directions, and wild turkeys are a not-uncommon sight. I knew the first spring would be the worst. The Connecticut garden was established, with many plants, such as the various hellebores, self-sowing or otherwise multiplying, as did many geophytes, by offsets. When gardening season came around I'd be busy enough not to notice, but the first flowers at winter's end would be vital to keep my spirits up.

That first season I planted something over 4,000 newly purchased geophytes, in addition to the ones I moved. The next year I doubled that, to 8,000 geophytes. The third season, back down to 4,000. There was nothing especially exotic, but I bought lots of what I did buy. I planted *Scilla sibirica* and *S. mitschenkoana* by the thousand; ditto *Chionodoxa lucillae*, *Eranthis hiemalis*, *Fritillaria meleagris*, *Galanthus nivalis*. With a large property, ten, or even a hundred of these little geophytes are easily overlooked. I planted in large groups in the woods along the drainage creek towards the eastern

edge of the property. A surging torrent in spring, in most summers the creek dries to a couple of isolated pools. I'm pleased to report that the scillas and fritillarias are self-sowing freely, the *Eranthis*, too, at a more modest rate. Remember that 1998 was only the third spring for some of these plantings. Later interest is supplied with hellebores I moved from Connecticut: *H. niger, H. foetidus, H. viridis, H.* x *orientalis*, and its choice form now called Early Purple Group. Some of these spent an extra season in the New Canaan, Connecticut, garden of Stan Barnes, following me to New Jersey a year after the actual move. New additions include *Geranium macrorrhizum, Phlox stolonifera*, and *Euphorbia amygdaloides.*

Scale has much to do with taste, I've decided. I used to disdain *Hyacinthoides hispanicus.* In a one-acre garden it spread too rampantly. On nine acres it pleasantly fills the woodland in spring after the smaller geophytes have finished. The wood hyacinth is paired with *Mertensia virginica*,which also enjoys the moist creekside. Since both go quickly dormant after flowering, they're combined with *Lamiastrum galeobdolon*, a galloping groundcover I would formerly have eschewed. Dead-nettle is a useful plant, if there's room for it. Copying a pleasant pairing I saw in Holland, I have it with some *Allium ursinium*, a shade-tolerant, white-flowered, ornamental onion, most attractive with the dead nettle's silver-splashed leaves and yellow flowers.

Other alliums inhabit the crown vetch slope, about the only sunny site on the property. I moved *Allium christophii* and *A. karataviense.* The one I enjoy for its large, airy, soft purple, soap-bubble flowers, the second for its good foliage and mauve-pink flowers. Since deer don't dine on *Allium*, I've been busy adding others: `Gladiator', `Goliath', `Lucy Ball', `Purple Sensation', and `Rien Poortvliet'. Tall enough to show over the crown vetch, I mostly manage to keep their planting sites clear of that scourge. They mix with *Liatris, Achillea, Hemerocallis* (which do need protection from the Bambi lunch crowd). The *Camassia* ended up here also. *Camassia* apparently loves the heavy clay, and they are ready for division, if I can find the time (and the energy) to pickax into the clay to get them out.

At the toe of the slope, rather close to the house, is where I grow species tulips and little crocuses. Though I gather school is still out on its effectiveness, I add gypsum to (supposedly) flocculate the clay and clump it up. Not sand, but 3/8" gravel is what I add for drainage. And, living in a semi-rural farming area as I do, manure is often free for the asking—horse, from the neighbors across the street. Lately my manure of choice is llama "beans," from one of the carpenters who built a deck in the woods for us this spring. *Tulipa pulchella* 'Violacea', *T. hageri, T. tarda*, and others all do well under thymes or *Phlox subulata.*

Narcissus are eminently suitable in deer country. I've been planting an old farm path up into the woods. The path is wide enough for a four-wheel, all-wheel drive, all-terrain vehicle with trailer that my husband uses to bring firewood out. I've planted the edges to *poeticus* daffodils: `Old Pheasant Eye', `Actaeus', `Felindre', and 'Cantabile'. There are approximately 1,200 bulbs, in groups of 25. Many were a gift that first autumn from my friends Sally Ferguson and Judy Sloat of the Netherlands Flower Bulb Information Center. Flowering at the end of the daffodil season as they do, their white petals and narrow orange, red, or green cups make a fine finale to the

spring bulb season. I've learned that white flowers, such as snowdrops and *poeticus* daffodils, are best seen closer up. `Dove Wings', a favorite white-flowered *cyclamineus* cultivar, fades to invisibility when seen up hill and from across the creek. I've ordered 1,000 `Trevithian', a sturdy, fragrant, yellow-flowered *jonquillus* cultivar, to spill down the hillside and be viewed from the deck that was built in the woods this spring.

Lilies are a problem. I love them; so do the deer. Our passions run in different directions—mine is admiration of their beauty, while the deer have a fondness for their edible qualities. *Lilium martagon* `Album' has been surviving quite nicely in a large, inelegant, black plastic pot next to the deck. No matter its container, this June there were five flowering stems. *Lilium tsing-tsauense* that I'd raised from seed was not so fortunate; its pot became waterlogged, and the bulb rotted.

I look forward to spring with real pleasure. Geophytes bloom from late February through June, then return again with fall-blooming crocus and colchicums. My friend Sydney Eddison of Newtown, Connecticut, gave me some *Galanthus nivalis*. She'd gotten them from her friend Mary Ley, who got them from her grandfather, Mr. Krippendorf of Lob's Woods. He was a great friend of Elizabeth Lawrence. She wrote a book called The *Little Bulbs: A Tale of Two Gardens*, which very much influenced me as a beginning gardener. I like to think that she, and he, and all the other gardeners who have had the pleasure of planting bulbs as leaves fall from the trees to await their flowering with the turn of the year, are smiling with me at the pleasure of bulbs at BelleWood.

Judy Glattstein gardens at BelleWood, in Frenchtown, New Jersey. She is an undaunted lover of bulbs and author of books on shade and water gardening and Japanese plants.

Adonis amurensis buds about to open in February at Fern Hill Farm

ADVENTURES WITH ADONIS

by John and Janet Gyer

Norman Deno has spent his retirement years developing experimental data that define the special temperature and time cycles needed to germinate seeds of native plant species and the seeds of exotic plants that populate our rock gardens (*Seed Germination Theory and Practice*, 2nd ed., 1993, by Norman C. Deno). In one of his talks about techniques for germinating recalcitrant seeds, we heard him mention that no seed of *Adonis amurensis* had ever germinated for him. He had tested seeds from several plant society seed exchanges. Since his seeds were received dry and had been stored for some time, he concluded that *Adonis* seed died if it dried out. Deno was looking for a source of fresh, moist seed for experiments. We thought we could help.

We had seen *Adonis amurensis* in several gardens. The largest patch is near Wilmington Delaware, on the March Bank at Winterthur Museum, Garden and Library, the home of the late Henry Francis du Pont. The Garden Department at Winterthur permitted us to study its plants and collect any seed that might form for Norm's experiments.

Adonis amurensis has large, yellow flowers, much like the buttercups, fellow members of the *Ranunculus* family. It has no common name that we have ever heard. Most gardeners just call it adonis, even though this may cause confusion with other species grown in gardens, such as *A. vernalis*. *Adonis amurensis* leaps into bloom at Winterthur in February or early March. It beats even the earliest crocus and stays in bloom until after the last winter aconite (*Eranthis hyemalis*) has faded.

Adonis amurensis is native to eastern Siberia, northeastern China, Korea, and Japan, but it naturalizes well in North American deciduous woodland landscapes. At home in Japan it grows in loose, well-drained, high-humus soils in cool situations, often on the north or east slopes of valleys in deciduous forest. It does not do well in heavy clay soil or severe drought, particularly autumn and spring drought.

The first horticultural use of *Adonis amurensis* dates from 17th Century Japan. The Japanese lunar calendar put the New Year celebration near the first day of February, a time when wild adonis sprinkled the awakening hill-

sides with flowers of sunlight gold. It became popular to bring the plants indoors for a New Year's decoration, a tradition still followed nearly 400 years later. Over the years hybridization and selection of attractive seedlings and natural mutants have produced today's cultivars. Thirty-six separate forms were recognized by Monjiro Nakamura in 1964 (Adonis Amurensis *in Japan*, Monjiro Nakamura, J. Royal Horticultural Soc.; Vol. 89(3), pp. 121–125, March 1964), but many of the most unusual forms are not vigorous and are not now available.

The incentive to propagate adonis commercially increased as the Japanese population grew and the adonis habitats were destroyed. Most adonis is propagated asexually, by careful division of dormant crowns. Cultivation of adonis as a crop began roughly 100 years ago. Then, as now, both Japanese and export markets were served by adonis raised beneath the mulberry trees that provide forage for silkworms. One cultivar, 'Fukujukai', dominates Japanese home and export markets. The March Bank planting of 'Fukujukai' at Winterthur was put in before 1909, about the time Japanese exports began. It is probably the oldest planting in the United States. One large, nearly circular clump about 14' in diameter probably grew from a single plant set into the garden 100 years ago. From its size and age I calculate that adonis spreads at about the same rate at which some continents collide—roughly 1.7" per year.

We watched 'Fukujukai' grow through a full season. It began to flower, as usual, about mid-February. The first blossoms are supported by a short stem ensheathed by the still-folded leaves. As the plant matures, parsley-like leaves expand, and two or three branches flower to prolong the bloom season.

Numerous new roots begin to grow from the crown just after the leaves begin to expand. As they grow, their cells rapidly fill with starch and become the primary food storage organ of the plant. An individual root functions for only two seasons. The roots are 1/16–1/8" diameter, 6–12" long, straight, generally unbranched, and brittle. The relatively small root surface area suggests that adonis depends on mycorrhizal fungi for growth. This is consistent with its preference for moist, but well-drained, light, humus-rich soil.

Small buds that develop into next year's flowers have formed on adonis crowns by the time the foliage dies down in late May and the plant enters its summer dormancy. Dormancy seems to be triggered by long days. Consequently, plants should be set well away from security lights or street lighting that could artificially produce long days in early spring and trigger premature dormancy. Through the summer, dormant adonis needs only enough moisture to prevent root desiccation. The bare spot left in the garden can be covered by a shallow-rooted perennial such as *Begonia grandis* or shade-tolerant annuals. The perennial begonia starts its summer-to-fall growth cycle just as adonis foliage dies down.

The summer dormancy of adonis is broken by the lower soil temperatures and increased soil moisture of September. Flower buds begin to grow and are well formed by the end of October. At this stage, pollen and egg cells are maturing in preparation for a quick start when soil temperature reaches about 45°F in February.

The best time to divide the plant is just as flower bud growth begins, about late September or early October. If divided earlier, buds are difficult to see, and the wounds may not heal

quickly; if divided later, the flower buds are so large that damage is inevitable. Gently lift two-year or three-year-old plants, wash the roots free of dirt, and cut the crown into sections with two to four buds. Replant with the buds one inch or less below ground level. Water well to reestablish soil-to-root contact.

Autumn is also the time to pot adonis plants for the house. Leave the potted plants outside until late November. Bring them indoors two to three weeks before you want bloom, and stand back. If forced plants are kept cool and given light and water but not subjected to long days (indoors), they can regain strength when set into the spring garden. Although a forced plant may bloom in the garden the next year, an individual plant should be forced only every other year.

Adonis flowers have numerous stamens and a cluster of 30 to 50 pistils at the center of the flower. The flowers are protogynous. The pistils are receptive as soon as the flower opens, but the stamens do not ripen and shed pollen until the pistils have matured past the receptive stage. Because of this sequence, an individual flower is unlikely to fertilize itself. At Winterthur we dusted pollen from older flowers onto newly opened buds and waited for the heavy seed crop that was sure to come. It did not. The petals dropped, but the seeds did not enlarge. When the foliage dried into compost, and the plants went into their summer dormancy, the receptacles held no seed.

"Why," we asked horticulturists who had watched adonis for years, "should such obviously healthy plants be so reluctant to reproduce sexually?" They said, "It needs a mate." They thought that years of propagation by division had produced widespread clones that are self-sterile. Plants are self-sterile when their stigmas are, in effect, allergic to the flower's own fertile pollen. Pollen from a flower of a different clone grows normally and produces seed. We set out to find other adonis clones.

The US National Arboretum in Washington, D.C., gave us permission to study their collection of adonis cultivars. We found one plant producing seed and surrounded by several seedlings. This self-fertile plant demonstrates that adonis is not entirely self-sterile and that crossing between clones is not an absolute requirement for seed production. We took some pollen from this fertile plant and dabbed it on Winterthur's 'Fukujukai.' No seed. 'Fukujukai' is sterile.

Why should the most common cultivar be sterile when the species produces good seed and seedlings in its native home? We needed detailed observations of adonis's behavior over a long period of time. We found records of such observations at the National Agricultural Library at Beltsville, Maryland. People had published on seed germination in Hungary, described details of pollen structure in Bulgaria, counted chromosome numbers and illustrated physiological details in Russia, described adonis culture and genetics in Japan, and listed cultivars in England. Two authors agreed that 'Fukujukai' is sterile, but despite nearly a century of close observation, no one had said why.

We wanted to make our own observations. But what should be observed and how? At this point we were introduced to Dr. Nicholi Vorsa, associate research professor at the Blueberry and Cranberry Research Institute of Rutgers University. He suggested staining pollen with aceto-carmine to assess how extensively adonis was bothered by infertility. If a pollen

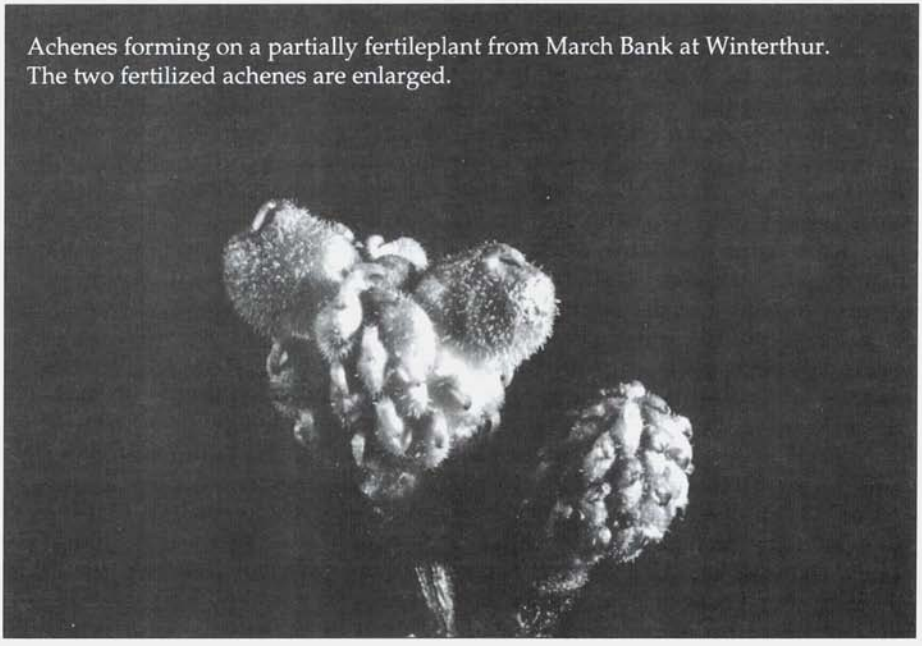
grain takes up stain and looks red under the microscope, it may be fertile. If it does not, it is dead. Only 5% of 'Fukujukai' pollen stained, while 92% of that of the fertile plant at the National Arboretum stained. We found several other cultivars with very low pollen fertility, two isolated plants at Winterthur with 30% to 50% fertile pollen and, at a private garden, a plant with red flowers and minute pollen grains that took up no stain at all. Adonis cultivars have serious fertility problems.

To look at adonis chromosomes, we had to wait until late October when meiosis began in the anthers of developing flower buds. This gave time to review the reports of others who studied the species. Botanists agree that adonis has a basic set of eight chromosomes. Most populations in nature are diploid, i.e., they carry two basic sets or 16 chromosomes. One population on the island of Hokkaido in Japan has 32 chromosomes, or four times the base set number. It is tetraploid.

The fertile National Arboretum plant has 32 chromosomes, the tetraploid number. 'Fukujukai' has 24 chromosomes; thus, it is triploid, a botanic mule. Although triploids can grow successfully, the uneven number of chromosome sets produces genetic irregularity during the complex cell divisions that create eggs and pollen. This usually leads to sterility.

Triploid adonis comes from crosses of diploid and tetraploid plants, such as those reported growing in Hokkaido. Since they are sterile, the triploid flowers last longer than those of either parent, because no hormone signal is produced by developing seeds to cause the flowers to drop their petals. Japanese gardeners undoubtedly noticed this trait and began to propagate 'Fukujukai' extensively because of its long bloom season.

Although new cultivars can appear as bud sport mutations during routine crown division propagation, cultivars are more frequently selected from seedling populations that involve



Achenes forming on a partially fertileplant from March Bank at Winterthur. The two fertilized achenes are enlarged.

Adonis amurensis buds in a February snowbank at Fern Hill Farm. Buds form in the fall, grow slowly through the winter, and may begin flowering as early as late January in the Delaware Valley.

diploid or tetraploid parents. Adonis "seed" is an achene that consists of a fleshy coat that covers a hard, dark-colored, reticulated seed coat. Within the shell-like seed coat the endosperm is covered by a thin skin. Often the hormones from a developing seed induce the enlargement of adjacent infertile achenes. This induced achene enlargement gives the impression of a high seed set, but the induced seeds are empty of endosperm. They may be responsible for some of the observed poor germination.

At Winterthur the achenes of the diploid adonis cultivar 'Nadeshiko' ripen about the first or second week of April and fall quickly from the mature receptacle. In fresh, ripe seed, both the fleshy coat and the endosperm are engorged with water.

The seeds need a period of after-ripening to dry a bit and consolidate the endosperm. Too much moisture just after harvest will cause endosperm cells to leak and the achene coat to mold. This combination can induce severe endosperm rot and seed death. Too little moisture for a long period can collapse the endosperm and kill the seed. The most practical solution is to plant the seed shallowly in a shaded, humus-rich soil that receives normal summer moisture. Embryo growth and germination happen at low temperature. Two cotyledons appear the next spring when soil temperature reaches about 55°F. These seedlings go dormant along with the adult plants in late April and produce their first leaves the next year. Development from seed to flower takes three to five years.

Adonis has few problems in the garden. Deer seem to avoid it, and voles tunnel around the root mass rather than through it. Slugs will eat the flower buds that form in the late fall; quick removal of leaf litter can minimize this problem. Tetraploid forms bloom about two weeks earlier than diploid or triploid cultivars. These may need additional protection from severe late-winter weather. Crown rots are minimized by well-drained, high-humus soil.

Our study of adonis with all its tricky genetic quirks came from a simple question, "Why didn't 'Fukujukai' form seed for Deno's experiments?" The pursuit of an answer led us to helpful, interesting people and wonderful gardens. It gave us a much greater understanding and respect for the complexity of nature. And it demonstrated to us the pleasure not of just growing plants, but of becoming familiar with them as individuals.

A Glossary of Gravel

A compilation from Alpine-L and NARGS Members, including Rod Haenni, Vicki Morin Gallagher, Bob Nold, Kelly O'Neill, and Andrew Simpson.

The Wentworth-Udden scale (metric), following, is used by geologists and people in the sand and gravel business. Screens are calibrated according to these sizes.

Boulder	greater than 256 mm
Cobble	64–264 mm
Pebble	4–64 mm
Gravel	2–4 mm
sand	1/16 mm to 2 mm
silt	1/256 mm to 1/16 mm
clay	smaller (but also has other characteristics)

Below are some commonly used terms.

Bank run
Rock dug from a river bank deposit, just as it is mined, unsorted. Varies widely from quarry to quarry. Known as Pit run when dug from a pit.

Breeze
Dust or fine bits of a material, especially used with limestone.

Crushed
Rock crushed by machine, then run through various screens to sort to size.

Cobblestone
Rounded gravel containing particles between the sizes of 64–256 mm in diameter, usually rounded because they are from a streambed.

Crusher fines
Very small particles produced in the crushing of larger gravel.

Fish tank gravel
Evenly sized, well-washed gravel about 2–8mm in diameter.

Flagstone
A hard, evenly stratified stone, such as fine-grained sandstone or firm shale, that splits into flat pieces suitable for paving. random flag is pieces of flagstone in irregular shapes (as opposed to cut into rectangles or other regular shapes).

GRIT

"to me means something for poultry: turkey grit, pigeon grit, etc. We used to be able to buy turkey grit here, just tiny granite chips. I purchased several pounds of pigeon grit once, to surface seed-pots, and after watering them a few times, discovered a white foam on top. It was salt. The seeds did not germinate."

—Bob Nold, Lakewood, Colorado

HOGGIN

Screenings or siftings of gravel, or a mixture of loam, coarse sand, and fine gravel mixture.

LAVA ROCK

Any of several different materials resulting from the cooling of lava under different conditions, including PUMICE (light in weight because of many cavities caused by water vapor during cooling) and SCORIA (rough, vescicular, cindery lava, caused by expansion of gasses during cooling, usually of basalt). CINDERS are lava rock that has very little pore space, of andesite, rhyolite or basalt. They are much the heaviest of the lava rocks.

MOSS ROCK

Any rock with a large number of lichens on the surface.

MINUS

The size given, in addition to any smaller sizes.

"3/8" minus means that all the rock is less than 3/8". If your minus rock contains the fines below sand size, I would try to avoid it. The fine fines are bad for drainage, and weeds grow like you-know-what in this material."

—Kelly O'Neill

OPEN

One diameter size, produced by screening and washing. "Our local pits have stopped making the small open sizes due to problems disposing of the fines."

—Kelly O'Neill

PEA GRAVEL

Tiny, pea-sized, round rocks. Usually washed and not usually crushed.

PLUS

contains a size, for example 2"–diameter, plus larger sizes only and nothing smaller

ROAD BASE, ROAD METAL

contains many fines as well as larger size particles and sets into a solid base. Can have gypsum, limestone, anhydrite, and clay.

SAND

Usually quartz material, typically including feldspar also, sometimes iron, between 1/16 mm and 2 mm in diameter. Washed sand has had the fine particles removed.

BLASTING—slightly larger, usually about 1/8", used for blasting brick or stone.

CONCRETE OR MASON'S—a very uniform, usually rounded sand.

GLAUCONITE OR GREEN SAND—used as fertilizer because it is rich in nutrients, thought to be fecal pellets from ancient organisms

PLAY BOX—could be anything.

SHARP—sand composed of irregularly shaped pieces, resulting in more rapid drainage of water, at least until the pieces settle together. The top few inches can become packed, especially in dry climates.

SILICA—a very pure quartz sand, in which all the particles are about the same size, usually rounded, usually from sand dunes. Often found in hotel cigarette ash cans, death to plants.

SHINGLE

A coarse rounded gravel from the seashore. The stones may be as large as a man's head.

SQUEEGEE

"Dredged from river beds, along with pea gravel and screened. Larger than sand and smaller than pea gravel. The most common application for squeegee in the Denver area is in sanding icy roads."—Bob Nold, Lakewood, Colorado

RIP-RAP

"is common civil engineering term for a layer of rocks, boulders, or whatever, to protect steam banks against water scouring. The size of the rocks depends on the speed of the water flow—too small, and they'll get washed away as well. Too large, and they're hard to place, and the water will scour between them.

You will also find rip-rap on the upstream faces of earth dams and on coastal protection works. The damage that results from unwanted scouring (like washouts, dam collapses, etc.) is expensive to repair "

—Andrew Simpson, Auckland, New Zealand

"Better than rip-rap are small stones in cages called gabions, because the water won't scour between and the cages can be attached to the bank."

—Rod Haenni

TUFA

A general name for porous limestone formed by deposition from solutions of calcium bicarbonate. Formed mostly in regions with lots of limestone (see p. 31, this issue.) Includes stalactites and stalagmites. Travertine is a form of tufa associated with hot springs, harder than regular tufa but can still be carved fairly easily.

WASHED

The gravel is run through a washing plant that gets rid of smaller material.

PLANT PORTRAIT

A Peculiar *Pedicularis*

Few plants I have come across in my local travels have mystified me as much as *Pedicularis*. In my first hiking explorations of the eastern slopes of the Canadian Rockies I barely noticed the existence of these species; not until I had the opportunity to study evolutionary botany did I become aware of them, and my curiosity was piqued.

The scientific name *Pedicularis* seems a bit of a label on its own, but the English common name for these plants, the louseworts, also brings much imagery to mind. *Pedicularis* stems from the Latin name *pediculus*, meaning louse; apparently, to some the flower resembles the anatomy of a louse. I have not had the pleasure of being intimate with louses, so I accept this explanation. I prefer to compare the flower to an elephant's head instead. Our widely distributed native *P. groenlandica* exhibits this shape, with the central upturned corolla beak resembling an elephant's trunk, and its lower, two-lipped petals flared to mimic the ears. Will Ingwersen mentioned the folk belief that this plant produces lice in sheep. In suggested culinary use, parts of the plants, primarily shoots, were used as food and tea for the Inuit people of the Arctic. Apparently one can suck on the flowers to extract sweet nectar. Considering the plant's relationship to lice, I don't feel a burning need to try this. *Pedicularis* is also a staple fodder for local caribou populations. Sometimes the history and myth of plants is as fascinating as the plants themselves.

According to the *Flora of Alberta*, there are twelve species that grow in our province. Their habitat ranges from damp, open grasslands of the lower montane to the upper alpine regions. The main attraction of these perennial herbs is their bilabiate flowers, exhibiting striking colors against a varied and contrasting vegetative background.

One of my favorite species, which might be seen during the annual general meeting in Banff, is *Pedicularis arctica*. Also known as *P. langsdorfii* ssp. *arctica*, this alpine lousewort is truly a gem of our range. During early snowmelt up on the Mt. Edith Cavell hike in Jasper National Park it is easy to find. Hike on the well-marked path up to the meadows, and once past treeline the trail starts up a rocky bluff. I visit this location yearly, usually late May. Here are colonies of *Silene acaulis* and *Gentiana glauca*. It may be difficult to pick out the *Pedicularis* in the showy meadow of flowers, but as soon as you see one in the crowd, several more will pop into view. Their exquisite color against the backdrop of the Angel Glacier, under the beautiful, azure spring sky is amazing. They are found in many locations up and down the Jasper and Banff National Parkway.

The flowers of *Pedicularis arctica* resemble some ornamental *Nepeta* species, with a prominent upper hood extending over flared, lower corolla lobes. The bright pink flowers are congested into an elongated head, nestled in the axils of bracts covered with soft, fine hairs. The foliage is exquisite, finely dissected, giving a very delicate appearance to the whole plant.

In my experience, these plants, while highly desirable, are extremely hard to propagate and grow. As with some other genera, e.g., *Castilleja*, they appear to be partly parasitic on the roots of other plants and will not survive without the appropriate hosts. If you try to grow them, sources recommend scarification of the seed, followed by 4–8 weeks of stratification. I have tried this process on *Pedicularis* species, with no success. So, with poor prospects of growing them in your garden, enjoy these plants all the more in their native homes.

—Thom Rypien

BOOKS

Garden Artistry: Secrets of Designing and Planting a Small Garden, by Helen Dillon. 1995. Macmillan (in association with *Horticulture Magazine*): New York. Hardback, 192 pp. with index. ISBN 0-02-860379-6. $35.00.

It is a joy to discover a new gardening book, particularly if it is by a writer with a fresh, unencumbered view of gardening. Helen Dillon was unknown to me until I first learned of her this spring on Alpine-L, the Internet rock gardening discussion group, where she was showered with warm praise for the plants she is able to grow and write about. Hers is a one-acre garden, surrounded by stone walls, less than a 30-minute walk from downtown Dublin, Ireland.

Although her "town house" garden, she says, is in USDA zone 8—roughly equivalent to that of Seattle in both temperature and moisture—it is situated at a latitude similar to that of Hudson Bay and Newfoundland. Thus, she enjoys long summer evenings when she can garden until nearly midnight yet struggles with low winter sun that barely warms the greenhouse. Indeed, I was puzzled why *Horticulture Magazine* and Macmillan would go to the extent to include in the text the US horticultural zones, a feature that may be widely misleading, of the plants she experiences in Ireland; in other words, the plants will be fully adaptable in those zones here in the States. The reason is quite simply the numbers of plants she grows. Also, her pointed observations of her experience of battling a plant collector's binge within her small gardening space and instead of balancing each plant with an eye for overall garden design are so insightful. Her writing is concise, yet unabashedly enthusiastic, her observations at once idiosyncratic and charming, some might even say eccentric.

Her plant subjects range widely. *Dahlia* 'Bishop of Llandaff' is the "height of refinement" but vulgar when age creeps in on the flowers. Regarding daphnes, she reminds us that "you just hope the flowering stage takes place before the dying stage." On *Rosa* 'La France', the first hybrid tea rose, Dillon pens that it has a weak constitution, as befits a grande dame "Nice as it is to own a delicate antique, one can tire of being a nursemaid," she thinks.

In her roller coaster tour through her garden, she tosses out several *bons mots*: "Tree peonies...make me think of burst water pipes." *Erigeron karvinskianus* from Central America is such a "miserable little creature in a nursery pot that nobody would buy it." And Johnny jump-ups are torn out by the bucketful during the summer to make room for choicer plants, "but all is forgiven during milder spells when the cheeky flowers brave the winter air." One of the reasons to own a greenhouse is to "provide excuses for dawdling away whole afternoons, gazing at the plants, doing nothing in particular except occasionally sticking a finger in a pot to see if it wants watering." Or she laments that she wishes alpine plants came with specific instructions on how to grow them, such as "Apply two tablespoons of water every second Saturday." Regarding a potting shed that is filled with an array of gardening paraphernalia that might come in useful: "Nobody knows exactly what goes on in a potting shed. At the sound of approaching footsteps, flowerpots are noisily moved around to give the impression of work in progress."

She describes with glee the opening of an opium poppy flower and the habit of some gardeners who itch to touch, fondle, and enjoy the tactile quality of plants. Elsewhere, she suggests that someone will probably write a complicated thesis at a university on why women dislike strong colors in the garden. Dillon says she once purchased *Acanthus spinosus* 'Lady Moore' (the variegated form) "more out of respect for the great gardener she [Lady Moore] was than love of the plant." And, of delphiniums, "They are trouble. One needs a Ph.D. just to stake them properly," she observes.

Dillon can also be effusive in writing. "If I could grow only one [*Galanthus*], it would have to be 'S. Arnott', a snowdrop of singular quality. As [its] petals open in the sun or a warm room, they are voluptuously curved, symmetrical, beautifully poised, and faintly fragrant of honey." She won my heart with the following thoughts: "Hellebores are perhaps the most magical plants I grow. I adore them all. Heaven, for me, would be a large field of rich, retentive soil on a north-facing slope, in which to grow their numerous seedlings to flowering size. But here they must be culled before they smother the parent plants, an almost unbearable operation....Even after the flowers are fertilized, as spring turns into summer, their colors dim to beautiful understated hues—old rose and mauvy greens—that remind me of faded dowagers."

There is much to be recommended in Dillon's *Garden Artistry*. Certainly there is a wealth of photographs, but they are far less interesting to me than the delightful refreshing text. However, I was drawn to the photograph of the national flower of Chile, *Lapageria rosea*, which we are informed is named after Napoleon's wife, Empress Josephine Tascher de La Pagerie. I think the title of the book is a bit misleading, suggesting it is a design book, and there is no mistaking that certainly she is a garden artist, but it is her experiences and knowledge of plants that I like most. Simply put, savoring the observations in *Garden Artistry* is a wonderful way to putter around. As Helen Dillon writes, "The nicest part of gardening is walking round in a daze, wondering at all the beauty that surrounds you. It is amazing how long you can spend doing nothing at all."

—Bobby J. Ward

Essays on Gardening in a Cold Climate, by Brian Bixley. 1998. Whitfield Press: Shelburne, Ontario. 189 pp ISBN 0-9683982-0-0. $25 Canadian; $18 US.

Books are legion that address the practical concerns of our art, all the building and maintaining and stocking of a rock garden. But few speak to the thoughts that spin in our heads as we crouch in the gravel with our trowels. What is it that possesses us, holds us so entranced? To what extent have we succeeded in making something that reflects our taste and wit and general sensibility? It is these issues of style, of personal authenticity, that Brian Bixley addresses in his collection of essays, *Gardening in a Cold Climate*. They are, as he says in his foreword, "less about what went into the making of our garden, but more about what came out of it: despair and jubilation, chance successes, shifting enthusiasms, tranquillity and turmoil, the ambiguous poetry of a frail and temporary beauty." He goes on, "The decision to 'make a garden' is momentous, since the consequences of that decision fill our eyes, our minds, our hearts."

For Bixley, the garden is nothing less than "the greatest of art forms..." It is the challenge that engages him as a writer. Why, if gardening is an art, has it produced so little in the way of genuine literature? Instead, as he notes in a review of gardening books, "all, or almost all, beautiful and stimulating, dull and drab, are flawed by a certain cynicism regarding the intelligence of the reader." Bixley's response is to put himself squarely on the spot. The tour of his garden that the major part of *Gardening* offers us is also a tour of a man who is witty, widely read, and something of a poet as well. Describing his rock garden, he writes, "A smaller segment is filled with labels on which are written names sure to thrill the *cognoscenti*, but most of the plants to which they refer are small, sickly and possibly close to death. It is a fundamental of rock gardening that if a plant is healthy and flowering vigourously, it is to be regarded with disdain. As with Violetta in *Traviata* and Mimi in *Boheme*, physical beauty is rendered more intense, more affecting, in the eyes of the devoteé by its very fleetness. The beauty and frailty are complementary parts of the legend."

Much of Bixley's own garden is a series of clematis-hung rooms; one all the more eccentric, and precarious, because of where it lies, out in the middle of a working farm in central Ontario. In all of this, the rock garden comprises only a small part: a 3'-high bank on one side of the driveway; a large cattle trough brimming with those gem-like labels; and a recently constructed sand garden, of a hard, brilliant, white quartz sand.

But if Bixley is something less than a committed rock gardener—if rock gardeners are "the cream of the horticultural crop, why," he asks, "are their gardens the least attractive?" He understands the irresistible lure of the small. "To grow well an alpine plant that is both difficult and beautiful is not simply to cultivate, but to reach out to wild and lonely places that mirror the wild and lonely places of the heart." And about a *Draba mollissima* he writes, "The surface was so enticing that everyone who saw it wanted to touch it, as though it were a talisman, as though it could heal some human ache."

Bixley has not only raised the bar for the rest of us, but he has provided a verbal trip that is bound to be savored by anyone with any claim to "garden thinkingly in the countryside." —Robin Magowan

Variegated Plants in Color, by Yoshimichi Hirose and Masato Yokoi. 1998. Varie Nine, Ltd.: Iwakuni, Japan. 296 pp., with index. Soft cover. No ISBN number. Approx. $50.

Two decades ago plant enthusiasts Yoshimichi Hirose and Masato Yokoi published *Variegated Plants* (1978), a book devoted exclusively to plants with patterns on their leaves due to a lack of the green chlorophyll pigment. Unfortunately, it was written in Japanese; nevertheless, its limited printing quickly sold out, and even used copies have remained in demand. Now a much expanded edition with more color photographs (about 1,350 total) has appeared in both English and Japanese. Titled *Variegated Plants in Color* and published by Varie Nine, Ltd. (Japan, 1998), it is certainly the most comprehensively illustrated book on the subject, a veritable encyclopedia. As copies of the book begin arriving in the United States, its content and quality will surely recruit new acolytes to the wondrous world of variegated plants.

The authors have included brief overviews on finding, cultivating, and propagating variegated plants, and on the description and cataloging of the types of variegation on a plant, such as splashed, dusted, margined, banded, etc. They note the origin of variegated plants, in general, whether from seedlings, branching sports, viruses, or the more recent tissue culture, where a *Veltheimia bracteata* produced yellow streaks. The book contains high-quality photographs of plants, including their Latin, English, and Japanese names, the latter also transliterated so that the English speaker can pronounce them. Many plants are photographed in green house or under controlled light conditions; most are not shown as landscape plants, rather as potted specimens.

As I scanned the book, I jotted down a list of plants to put on my "must have" list, and I quickly realized that I had filled a page by the time I had finished the 296-page, soft-covered book. Among the stand-outs were the white-mottled *Acanthus mollis*, various ardisias, a yellow-stripped ginkgo, *Hymenocallis caribaea*, and the elegant, yet unworldly looking haworthias. And there are many more to whet the appetite. Two plants, *Psidium cattleyanum* (Myrtaceae) and *Torreya nucifera* (Taxaceae), are shown with variegated fruit.

The authors point out that cultivation and enthusiasm for variegated plants is not a late-Twentieth-Century interest. In fact, two classic works were published in Japan in 1827 and 1829. *Koten Engei* is a Japanese term that describes the classical horticulture practice that includes the growing of cultivars of variegated plants, which may include the growing of plants in artistic ornamental pots. In the West, it has been said that sooner or later all gardeners aspire to growing alpine and rock garden plants. I would add to that adage the collection and growing of variegated plants. The addition of this handsomely produced and highly recommended *Variegated Plants in Color* to our bookshelves should help us all aspire to *Koten Engei*.

—Bobby J. Ward

Note: Membership in "Anything But Green" is $10/year for three issues of the newsletter. Send payment to Denis Garrett, 2765 Old Sams Creek Rd., Pegram, TN 37143. NARGS member Jim Waddick of Kansas City, Missouri, is the newsletter editor.

NARGS Coming Events

Western Study Weekend

February 26–28 Portland, OR
Columbia-Willamette Chapter
Registrar, Mary Hoffman, Oregon City, OR

Annual Meeting 1999

June 24–27 Banff
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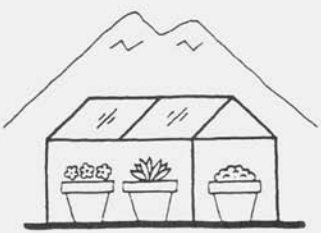

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ERRATA

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

Fall 1998 Vol. 56(4) p. 296 *Galanthus caucasicus* is now considered merely a form of *G. elwesii*.

p. 298 top right, *Galanthus* 'S. Arnott' at Colesbourne, not Colestown.

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(This title includes a chapter on our own Ellie Spingarn)

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*Garden Bulbs for the South**, by Scott Ogden. Taylor Publishing, 250pp., 192 color photos. List $22.95, members .....$18.50.

*Gardener's Atlas: Origins, Discovery and Cultivation of the World's Most Popular Garden Plants**, by John Grimshaw (Bobby Ward, consultant). Firefly Books, 224pp, 300 color photos, 50 maps. List $29.95, members $24.00

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