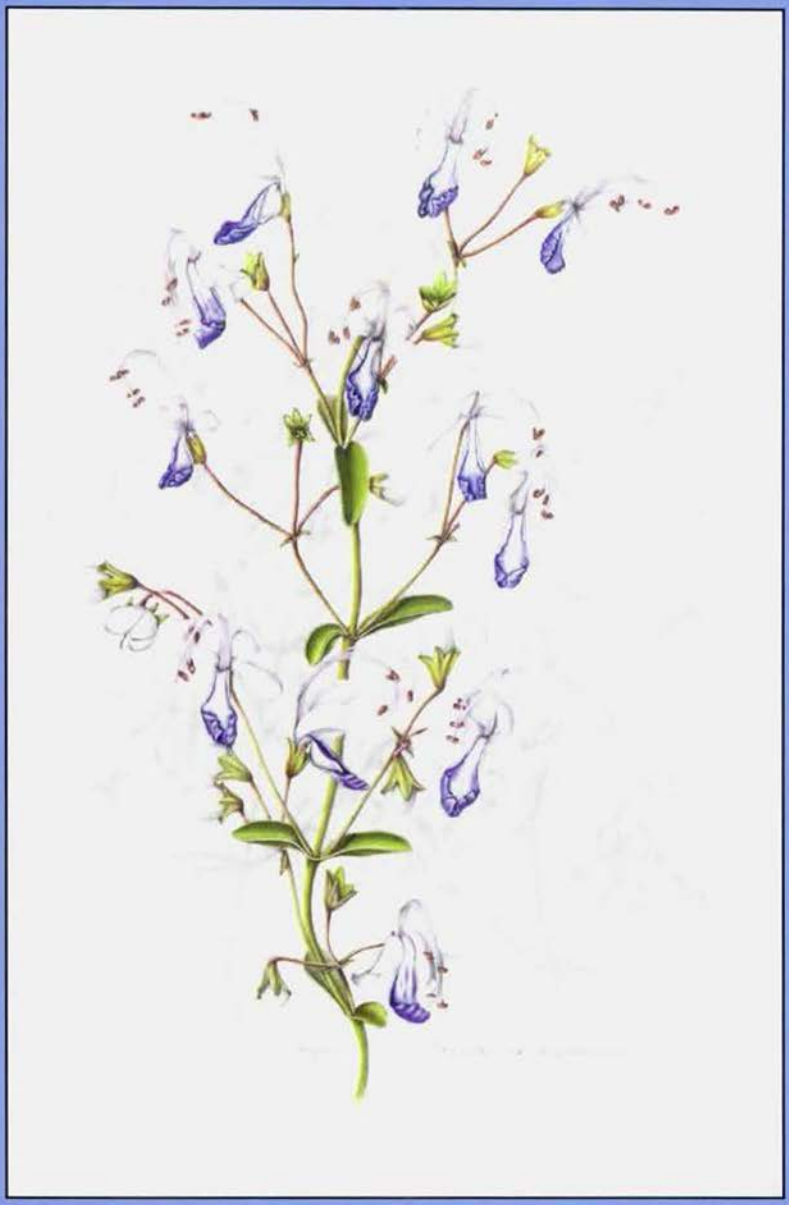
ROCK GARDEN *Quarterly*



Volume 66 Number 1 Winter 2008

Front cover: *Trichostema arizonicum*. Painting by Mervi Hjelmroos-Koski.

Back cover: *Anemone narcissiflora* in Andorra. Photograph by David Sellars.

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ROCK GARDEN *Quarterly*

BULLETIN OF THE NORTH AMERICAN ROCK GARDEN SOCIETY

Volume 66 Number 1 Winter 2008

Contents

From the Editor

As is our custom in the winter issue, we begin by featuring the places and plants to be seen by participants in the coming Annual General Meeting of NARGS, this time in Ottawa. Thanks are due to Peter Calamai, who gathered and edited the articles that appear in this special section.

I'd like to remind organizers of other meetings, particularly Winter Study Weekends, that we're always happy to promote meetings by running articles that will stir interest in meeting themes, activities, and presentations. A certain amount of lead time is necessary to get the article in the right issue, so please contact me early for information on publication schedules. I'd also like to remind any chapter wishing to insert a brochure in the *Quarterly* mailing that there are a number of requirements associated with doing this; please check at least three months before the time you want to mail your insert.

Recently several NARGS officers and other members have requested that I update the cumulative index to the *Bulletin of the ARGS/Rock Garden Quarterly*. The 50-year cumulative index, prepared by Executive Secretary Jacques Mommens, was published as a separate issue in 1995. Annual indexes have appeared since then (owing to space constraints in the fall 2007 issue, the 2007 index appears in this issue).

I've begun preparing a new cumulative index in the form of a searchable database, with the intent that it can be provided to interested members on a CD or DVD and also posted on the NARGS website. I'm using a non-Microsoft database application to do this, but I can convert it into Excel once it's complete, if this proves to be the most suitable format. I welcome input from potential users on what format (PC, please) would be most generally useful. The fields I'm using are author, title, volume plus page, subject (multiple fields per article), and plant name. Send comments to: janemcgary@earthlink.net

As I read through the early years of our Society's journal, several differences strike me. The *Bulletin* began as a bimonthly of small size, and many of the articles are only 300 to 500 words. I'd be delighted to publish more short articles of this kind, especially the plant portraits that made up a significant part of these early issues.

Another difference is one I've hesitated to mention because I don't approve of segregating writing by authors' gender, but I have to say this. Women members used to contribute a great many articles, and they are no longer doing so. There has been no demographic shift that I can detect. When I ask women to write for the *RGQ*, they usually tell me either that they "don't know enough" or that they don't have enough time. Sociologists have written that indeed, women have less leisure time than men, but I don't think that's the entire explanation. Look: 60 years ago women rock gardeners may have been signing their articles in the form "Mrs. Edwin F. Babb," but they were *writing*, and they *knew their stuff*. You women gardeners still know your stuff, and you can use your own names now. I hope to hear from you!

Special Section: The Ottawa Valley

The following articles introduce the land and plants of Canada's Ottawa Valley, where the 2008 NARGS Annual General Meeting will be held. Thanks are due to Peter Calamai, who gathered and edited these contributions.

One Valley—Five Habitats

ERNIE BOYD

Flowing 1,271 kilometers (788 miles) from its headwaters to its mouth at Montreal, the Ottawa River drains a basin of 146,400 square kilometers (56,525 square miles), an area nearly the size of Montana. Originating at the margin of the northern boreal forest in northwest Quebec, its source waters are at the very edge of the vast northward-flowing watershed that empties into James Bay. Along much of its length, the Ottawa River forms a natural boundary between Ontario and the province of Quebec.

The topography of the Ottawa Valley is remarkably varied. The upper reaches flow through nearly continuous igneous rock exposures of the Canadian Shield and boggy muskeg to the northwest of Ottawa, Canada's national capital, hence through an immense area of glacial deposits, and finally through a broad, fertile valley of alluvial soils. As with most of Canada, the Ottawa Valley was covered during the most recent ice age by a glacier estimated to have reached a thickness of as much at 2 kilometers (1.25 miles), which crushed and altered everything beneath. Mountains were reshaped, valleys were filled with glacial debris, and vast quantities of boulders, gravel, sand, clay, and silt were redistributed. At the end of this period, as the ice melted during its northward retreat, the Ottawa River was a mighty torrent many times the size of the benign flow of today. Evidence of these great natural forces and the changes they produced can be found throughout the valley. The five habitats we have selected for field visits during the NARGS 2008 Annual General Meeting were directly shaped by and are visible examples of these dramatic geophysical events.

Although stripped of its vegetative cover during the Wisconsin glaciation from about 18,000 to 10,000 years ago, the Ottawa Valley is today covered with a great diversity of flora. Much of the river in its upper portion courses through Great Lakes Mixed Forest, comprising mostly conifers (red and white pines, white spruce, eastern white cedar, and larch [locally called tamarack]), birch, and aspen. As the valley widens and becomes increasingly fertile toward the east, this forest mixture includes more maples, beech, ash, oak, ironwood, willows, cottonwoods, and other deciduous species. One of the field sites for the AGM is the Lauriault Trail in Gatineau Park, just minutes from downtown Ottawa at the junction of the Canadian Shield and Saint Lawrence Lowlands. This easy-to-moderate hiking trail offers a splendid cross-section of this type of forest. The park includes many seeps, small streams, boggy areas, small ponds, and lakes, as well as dry habitats at higher elevations, and is said to contain more than 1,000 plant species and some 50 types of trees. Three lookouts at the end of the Champlain Parkway offer superb views across the Ottawa Valley and of the Eardly Escarpment, the highest point in the park at 300 meters (975 ft) elevation. Gatineau Park is a naturalist's heaven, with 230 observed bird species and 54 mammal species, including timber wolves, which are rarely seen so far south, and a small resident black bear population.

Surprisingly, the Ottawa Valley within a few kilometers of Parliament Hill provides many suitable habitats for a large number of terrestrial orchid species. The dates of the NARGS AGM, June 12–15, were chosen as the most likely time to see the showy lady's slipper orchid (*Cypripedium reginae*; photo, p. 17) in full bloom at the Purdon Conservation Area. A dedicated group of volunteers works to maintain safe public access and a protected habitat there for some 10,000 of these splendid plants. Another site to be visited during the AGM is the Mere Bleue Bog, a unique wetland featuring many plants and trees usually found farther north at the margin of the subarctic boreal forest. Both of these wetlands have boardwalks for access.

The Burnt Lands alvar, another AGM field site, is a small provincial park reserve within the recently expanded city limits of Ottawa. It is home to a large variety of plants, including *Cypripedium parviflorum* var. *parviflorum* (p. 17) and the diminutive, relatively rare ram's head orchid (*Cypripedium arietinum*), which blooms in late May. The Cedar View Trail, also to be visited during the AGM, offers level but somewhat rough walking as it meanders through the Marlborough Forest, a 30,000-acre (12,000-hectare) reserve on the Smith Falls limestone plain. This is a second-growth, old field area that contains slow-moving streams, small lakes and pothole ponds, swamps, and meadows. Cleared by early settlers but found to be unsuitable for agriculture because of thin, lean soils, this reserve has been repopulated by native trees and other plants, but it also hosts a few introduced intruders still hanging on to confuse the unwary. This area is also much appreciated by birdwatchers and naturalists because it offers habitats for many bird and animal species, including a few reptiles (none venomous) and amphibians, as well as a small population of butterflies.

For those less inclined to tramp the forests and wetlands of the Ottawa region, there will be many attractions of interest close to and even within walk-

ing distance of the AGM meeting site at the University of Ottawa. These include Parliament Hill, home to Canada's Parliament, the National Gallery, the National War Museum, a colorful open-air marketplace and restaurant area, and the Rideau Canal, recently declared a UNESCO World Heritage Site. Another nearby attraction is the Central Experimental Farm with its arboretum and substantial rose garden. The city of Gatineau, directly across the Ottawa River from Parliament Hill in Quebec, is the site of the Museum of Civilization. This sinusoidal building houses an impressive collection of First Nations (Canadian indigenous peoples) artifacts, including full-sized West Coast totem poles, unique Inuit artifacts, and an IMAX theatre. In short, there are ample attractions in the Ottawa-Gatineau area to keep NARGS delegates happily occupied for the duration of the AGM . . . and beyond.

Ernie Boyd is a past president of the Ottawa Valley chapter of NARGS and longtime member of the executive committee. An avid amateur photographer, he has used his images of plants, gardens, and alpine landscapes to promote rock gardening. He chairs the group hosting the 2008 NARGS Annual General Meeting at Ottawa.

The Burnt Lands Alvar: Horticultural Hot Spot

Brian Carson

In Ottawa's west end, there is a large, flat, open area of scrubland known locally as the Burnt Lands. For years I had sped through this barren wasteland without bothering to stop. There was little of horticultural interest there to slow me down . . . or so I thought. While bricklaying on a local estate, however, I was amazed when I saw a great number of beautiful *Lilium philadelphicum* (wood lily; photo, pp. 20, 21) there. Somehow the bulldozer operator had missed them, and they were not just growing but thriving in the shallow limestone soil of this alvar, the formal name for such a biological environment. Rambles through the Burnt Lands alvar for the rest of that summer and for years since have confirmed how wrong initial impressions can be.

This harsh habitat comes alive in early spring with many tough, tantalizing gems. They have little soil to buffer them from the extremes of our northern winters, periodic flooding by torrential storms, and broiling summer heat. *Saxifraga virginiensis* whitewashes the borders of the alvar's limestone pavement with its alabaster spikes. In the garden their succulent rosettes of crenulate leaves quickly disappear, candy for our eastern chipmunks. In the open barrens, however, any venturesome chipmunk is easily picked off by patrolling hawks. In shady areas, tiny pink squadrons of *Polygala paucifolia* jostle for ground control and then take flight. Airy cushions of *Arenaria stricta* and vibrant *Viola adunca* billow out of the ancient limestone crevices. Woodland edges are decorated with globose, creamy

floral clusters of *Ceanothus herbaceus* (New Jersey tea); this diminutive shrub should be every gardener's cup of tea. Wet areas are adorned with many cool, naked spikes of *Petasites frigidus* (butterburr); their foliage does not appear until later.

In late spring, ubiquitous *Cypripedium parviflorum* (yellow lady's slipper; photo, p. 17) can be found anywhere in the barrens—except in the holes left by unethical collectors. Hidden from all but the most daring, hundreds of magnificent, picturesque clumps of *Cypripedium reginae* (showy lady's slipper; p. 17) enliven a shady fen. The rarer and daintier *Cypripedium arietinum* (ram's-head lady's slipper) is a little shyer about showing its head and could easily be trampled on by an unobservant hiker. Dormant seed of the unusual *Calystegia spithamaea* (low bindweed), rekindled by a recent fire, has joined the race to renew the charcoal woods with glorious white trumpets. That fire, fueled by extremely dry conditions and high winds, quickly raged into the largest brush fire the Ottawa Valley had seen since 1890 and took seven strenuous days to extinguish. Teamwork by many fire departments—aided by the barricade of a large local limestone quarry operation that had devastated much of the alvar—limited the damage to 400 acres.

In early summer, meadows of the short, pink *Rosa glauca* are enhanced by tufts of dainty *Campanula rotundifolia* (harebell). An ingenious local resident seeded harebell in his front lawn and transformed it into a stunning sea of blue. Near the entrance to the burn meadow, the dull mauve spikes of *Penstemon hirsutus* are enlivened by a serendipitous backdrop of yellow *Hieraceum caespitosum* (hawkweed); Monet could not have done better. Legions of the elusive and illustrious *Lilium philadelphicum* set the burnt meadows aflame (p. 20). While collecting seed from an interesting 12-tepaled mutation several weeks ago, I almost collided with a black bear cub and its watchful, beady-eyed mother. That incident was almost as exciting as the kamikaze dives of some large, powerful Northern Goshawks. The tough little *Asclepias tuberosa* (butterfly weed), quite unusual this far north, lit up an old logging road and gave local butterflies a nectar high. Later, rippling through the meadows, pink waves of the carefree *Agalinis tenuifolia* (slender gerardia) serve as a beautiful foil for the royal blue candelabra of *Gentianopsis crinita* (fringed gentian; p. 18), one of our most beautiful and untamable rare wild flowers. These fringed gentians grow most gloriously in the damp roadside ditches and, surprisingly, in the ruts left by local ATV cowboys.

This Burnt Lands alvar through the seasons has proven to be a most interesting ecosystem. With its unique habitat of shallow soil over flat limestone, it is one of the horticultural hot spots of the Ottawa Valley, and it has been recognized now as a globally rare habitat deserving protection. Thanks to the Nature Conservancy of Canada and local politicians, the Burnt Lands alvar has been designated as our newest provincial park.

When not playing as a stonemason, Brian Carson helps OVRGHS with hypertufa workshops, plant sales, and the library. A great propagator, he has four children and enjoys rambling around the valley with his renowned dachshunds and pretty wife, exploring the fauna and flora. In the fall he delights in tiptoeing through the gentian meadows and scattering orchid seeds in some of his favorite haunts.

A Ramble on the Cedar Grove Trail

ZANDRA BAINAS

The Marlborough Forest is the largest forested area at 30,000 acres (12,000 hectares) within the Ottawa city boundaries. Three-quarters of the area is managed by the municipality itself; the rest is either owned by the province of Ontario or belongs to private owners. It consists of mixed evergreen and deciduous forest, plantations, wetlands, and old fields. Forestry, hunting, trapping, farming, and recreation—hiking, paintball, ATVs in the summer and skiing and snowmobiling in the winter—all occur in the forest.

The Marlborough Forest rests on the Smith Falls limestone plain, an area of shallow soil over limestone. The oldest forested areas are approximately 80 to 100 years old; the original settlers cleared most of the area for agriculture, and the rest was burnt off in 1870.

The Cedar Grove walking trail is roughly at the center of the Marlborough Forest, sharing part of its route with the Rideau Trail between Ottawa and Kingston on Lake Ontario. The Cedar Grove trail itself starts at the only cliff in the Marlborough Forest, a 2-meter face that provides a home to ferns, *Trillium grandiflorum, Maianthemum canadense*, and *Rhus radicans* (poison ivy). The trail then parallels the cliff to an area of cleared bedrock through "old-growth poplar" forest, which at 80 to 90 years old is near the end of its lifespan, with cedar (the local name for *Juniperus virginiana*), white spruce, and balsam fir moving in to replace the deciduous trees. Conifers, mostly cedar, then line a rocky trail until you reach an emergency turnaround.

In early spring the path and throughout the cedar are carpeted with *Viola papilionacea* (common blue violet), *Viola pallens* (northern white violet), *Fragaria virginiana* (wild strawberry), and *Waldsteinia fragarioides* (barren strawberry). Middle to late spring features *Aquilegia canadensis* (photo, p. 18), *Trillium grandiflorum*, *Maianthemum trifolium* and *Maianthemum racemosum* (false Solomon's seal), and *Diervilla lonicera* (northern bush honeysuckle) blooming in the deciduous forest, with *Cypripedium parviflorum* var. *parviflorum* (yellow lady's slipper; p. 17) in the cedars.

A quick walk through deciduous trees brings the trail to a circle around Roger's Pond. The pond, with its cattails, pond lilies (*Nuphar polysepalum*), and beaver house, is in view along one side of the path running on top of a constructed dam and small metal bridge. The other side has a creek and then a deer feeding meadow, before the trail enters the dark, cool evergreen forest. If spring is quickly warming into summer, it is along this section of the path that you will find yellow lady's slipper orchids lingering later into the season. If it has stayed cooler, then *Polygala uniflora* (gaywings), *Trientalis borealis* (starflower), and *Maianthemum canadense* will still be found.

Just before another small creek and wooden bridge, there are more orchids: *Cypripedium arietinum* (ramshead orchid) earlier in the spring, or a small patch *of Cypripedium reginae* (showy lady's slipper; p. 17). On the other side of the bridge

spreads a small green sea of sarsaparilla (*Aralia nudicaulis*), before the trail dives back into the evergreens. Somewhere between the bridge and the next boardwalk area I saw an early coralroot (*Corallorhiza trifida*), a saprophytic plant, during a walk in May. There are rattlesnake ferns in the drier areas, and marsh ferns and *Aralia racemosa* (spikenard) flowering along the boardwalk.

From the boardwalk to an old log shelter, the forest becomes more mixed. The ground is springy and can be somewhat muddy in a wet spring. Moss clumps and sphagnum are still present, but *Chamaepericlymenum canadense* (bunchberry), mayflower, and *Linnaea borealis* (twinflower; p. 20) show up in larger and larger patches. As the trail swings towards the pond, there is a more open area of willow, sensitive fern, and bluebead lily (*Clintonia* sp.), with green berries in June. An old log shelter has a view of the pond, as well as the occasional yellow lady's slipper and twinflower.

Past the shelter, the trail continues through mixed forest. Here trees have often fallen along or across the trail, letting in light for more undergrowth. This section in May has ramshead orchids springing up along and on the trail. In June, twinflower and bush honeysuckle bloom along the path.

The walking trail then meets a straight, deeply rutted dirt road that starts with pine forest and merges into poplar, birch, and maple deciduous forest until it reaches the emergency turnaround we first encountered on the walk in. The ruts usually contain water even into July, acting as vernal ponds. Walking along these ruts. On a warm day, you will startle leopard frogs sunning on the edge into jumping into these shallow ponds every two or three feet.

Depending on your pace, you may or may not complete the circuit around the pond in the time available. For that matter, when looking and photographing plants with a group of people on a beautiful day, you might make it only to Roger's Pond itself in two hours, especially if you, like me, spend a lot of time trying to figure out exactly what plant you might be looking at.

Hiking boots, or at least sturdy shoes that you don't mind getting muddy or wet, are recommended, along with a hat, long sleeves, and bug spray. June is late enough in the year that all the mosquitoes will be out to get you, and if the mosquitoes don't drive you mad, the deer flies just might!

Zandra Bainas grew up on a farm in Saskatchewan (cold winter, short gardening season, great soil), picked up a B.Eng. at the University of Victoria in British Columbia (warm but too much rain, no garden), and has been working in Ottawa ever since (snow in winter, hot summers, nasty clay, and highly appreciated mushroom compost).

Mer Bleue: Small but Vital

Hugh Hope

It's early autumn as I write. A beaver pond in the Mer Bleue is warmer than the cool morning air, and wispy clouds of pale blue mist, quiet before sunrise, magically begin to rise. A myriad of shapes drifts over the water and adjoining peat bog as the warm sun stirs up convection currents in a blue sea.

How long has this ethereal dance been going on? Long enough to encourage indigenous peoples to camp in the area because of its natural beauty. Long enough to inspire early voyageurs from France to name the area the Mer Bleue, or "Blue Sea." Long enough to mark the formation of a fascinating relict pocket of arctic lowlands flora in the suburbs of Ottawa, within sight of the Peace Tower on Parliament Hill.

Scientists tell us that about 10,000 years ago, at the end of the Wisconsin Glaciation, the most recent glaciers to cover Eastern Ontario, then more than a mile deep, receded northward. A massive body of glacial meltwater, the Champlain Sea, soon formed in much of eastern Ontario and neighboring western Quebec. Following the glacial edges northward, an essentially arctic flora established itself on the barren soil. Slowly the inland sea drained eastward toward the Atlantic, leaving a river we know today as the Ottawa River.

The Mer Bleue slowly emerged in a little backwater of the evolving Ottawa River. Technically, the Mer Bleue is classified as an ombrotrophic bog. This raised boreal peat-dome sphagnum bog is a kind of biotope or biological community usually found much farther north in Canada, in the boreal forest zone. Imagine a low dome surrounded by a moat, and you have a good idea of its physical shape. Now as much as 6 meters deep, the bog began forming about 8400 years ago and is surrounded by mixed coniferous and broadleaf forest. A major feature of this bog is a large open pond inhabited by beaver and other aquatic mammals. The peatland raised central portion is highly acidic, nutrient-poor, and—importantly—rich in dissolved organic carbon.

The hydrology of the Mer Bleue is intriguing. Rain is the main source of water, but the bog periphery is surrounded by a lagg that stabilizes the water level in the bog. A lagg is a ditch-like buffer zone just beyond the peat at the outer edge of a bog. Laggs act as buffers between adjacent land use and the bog—especially constraining water chemistry exchange, invasive species, fire, and wildlife movement. Drainage from the bog is reduced by underlying clay deposits that form a natural membrane, and by several beaver dams. Small streams receive what water does escape.

Some of the more easily observed groups of plants on the bog surface are ericaceous shrubs and grasses. Hummocks are covered predominantly by two species of *Sphagnum* moss, while the hollows are covered by *Maianthemum trifolium, Eriophorum vaginatum* (photo, p. 19), and two other species of *Sphagnum*.

Of the 22 mammalian species present in Mer Bleue, the most easily observed are beaver (*Castor canadensis*), muskrat (*Ondatra canadensis*), and weasel (*Mustela*

sp.). The spotfin shiner, a regionally rare fish, is found in Bear Brook Creek. A turtle rare in Canada, *Clemmys guttata*, inhabits the center of the bog.

At 7660 acres (3100 hectares), the Mer Bleue is relatively small by Canadian standards, but it is of national and international importance. Its value was recognized by inclusion in 1995 on the international list of important wetlands established by a 1971 treaty signed in Ramsar, Iran. Canada has one of the largest extents of wetlands on the planet at an estimated 32 million acres (13 million hectares). Wetlands are important agents in the biological sequestration of carbon dioxide, especially in cool-climate parts of the Northern Hemisphere. As global temperatures rise, bogs diminish in size and may also become net sources of carbon dioxide rather than enormous sinks for the gas. Research groups from Trent University in Peterborough and McGill University in Montreal are currently studying the carbon relationships of the Mer Bleue.

For over a century the Mer Bleue has been a blueberry-picking area for people living around it. Low ericaceous shrubs flower gloriously in late spring and early summer. The season begins with blueberries (*Vaccinium oxycoccus*), followed by more typical northerners, cottongrass and sedges (*Eriophorum vaginatum* and other species; Cyperaceae). Several magnificent prairies of *Kalmia polifolia* and *K. angustifolia* are in plain view from the boardwalk. Kalmia foliage is toxic if eaten, and some species are given the name "lamb-kill." Individual plants can be photographed close up from a 1200-meter-long wooden boardwalk that winds as a veritable magic carpet through the Mer Bleue. Without this wheelchair-accessible path, the bog would be almost impossible to traverse and would involve considerable danger to anyone foolish enough to try. Local lore has it that past berry pickers have perished in the Mer Bleue.

Situated at 45°22'N and 75°30'W, the bog contains two characteristic boreal lowland species: *Picea mariana* (black spruce) and *Larix laricina* (tamarack or larch). Tamaracks or larches, the only deciduous conifer found in Canada, are gems in the spring when the delicate green needles emerge, again in early summer when pale rose "flowers" emerge (photo, p. 19), and in the autumn as the needles turn a rich gold. A magnificent witch's broom over a meter in diameter can be seen in a bog tree close to the boardwalk.

Shrubs abound along the edges of the beaver pond. The rich green of alders (*Alnus* sp.) contrasts with *Spirea* and other shrubs in the transition zone from pond to land. In this same area *Typha angustifolia* (narrow-leaved cattail) grows in profusion. It provides cover for a broad spectrum of fauna as well as filtering water. Artificial bogs have been constructed in eastern Ontario that use the purification properties of cattail roots as a "soft engineering" approach to cleaning sewage effluent.

North Americans have had a lamentable history of draining swamps, theorizing that the only good swamp was a dry one. It is to be hoped that the next generation will have a better understanding of the value of wetlands. The wetland is not only a precious store of water but also a refuge for flora and fauna. Maybe, just maybe our descendants will take a gentler approach and protect our most valuable of all resources—clean water.

Resources

http://www.trentu.ca/academic/bluelab/research_merbleue.html
http://www.ramsar.org/index_about_ramsar.htm
http://www.geog.mcgill.ca/faculty/moore/
www.trentu.ca/academic/bluelab/trentclimatestation.html

Hugh Hope has been a gardener all his life in eastern Ontario. Along the way he directed research on improving winter survival of field crops at the federal government's Central Experimental Farm in Ottawa. His main gardening interests are alpines, rhododendrons, hardy cacti, and autumn-flowering bulbs.

Along the Lauriault Trail

MARILYN H. S. LIGHT

As rock gardeners, we think rocks, dream rocks, and plant among rocks. It follows that we need to learn how plants grow with rocks and how rocks influence what to plant where. Rocks are the parent material, the underpinning of soil. In Gatineau Park, Quebec, there are rocks aplenty, from huge boulders (glacial erratics), cliffs and rock faces, to hidden marble beneath our feet. Rock composition determines the character of the soil derived from it. Carbonate-rich limestone and marble buffer to about neutral (pH 7), whereas the absence of carbonate and the presence of aluminum yields acidic soils buffering to as low as pH 4. Most of Gatineau Park, which is located north of Ottawa, is set on the Canadian Shield, an ancient Precambrian assemblage of metamorphic rocks including marble, feldspar, and gneiss. The intrusion of molten rock—including syenite, pegmatite, and diabase dykes during Precambrian times—has further influenced the geological landscape, which in turn supports a high diversity of plant communities. What is most exciting to rock gardeners visiting this place is the close proximity of different rock types, which causes plant assemblages to change within a few feet.

The Lauriault Trail rambles within the forest along the western edge of Gatineau Park and atop the 300-meter-high Eardley Escarpment. This trail was named after Jean-Baptiste Lauriault (1799–1869), who farmed in the vicinity. Along this 1.8-kilometer trail are many examples of how rock and hence soil type favors a particular flora. *Acer pennsylvanicum* and *Trillium erectum* grow in soil derived from gneiss, whereas *Acer saccharum* and *Trillium grandiflorum* thrive in carbonate-rich soil atop marble. Furthermore, much of the marble is fractured, permitting good drainage and also wicking of moisture from underground reserves during drought. Also preferring carbonate-rich soils is the introduced orchid *Epipactis helleborine,* which is sometimes quite common alongside the trail. When we know what such indicator plants prefer, we can predict the parent material beneath and better appreciate plant assemblages.

The fern *Polypodium virginianum* forms dense mats on acidic rocks, whereas *Cystopteris bulbifera* favors moist calcareous rock surfaces along streambanks and on damp, rocky seeps. In the rich soil of seasonally wet places grows *Arisaema canadense*, and in the deeper, humusy and slightly acidic soil of the forest floor grow *Actaea pachypoda, Actaea rubra, Asarum canadense*, *Caulophyllum thalictroides*, *Hepatica acutiloba, Thalictrum dioicum*, and *Uvularia grandiflora*. All along the Lauriault Trail are white-flowered *Viola canadensis*, diminutive rosy pink *Geranium robertianum,* and yellow-flowered *Viola pubescens*. We may be fortunate to see the rare *Allium tricoccum* just coming into bloom. The garlic-scented leaves are spring-ephemeral, so by the time inflorescences emerge in mid-June, there is no leaf to be seen. This wild garlic is now protected in Quebec because it was threatened by unsustainable harvest.

A short drive from the Lauriault Trail is the Champlain Lookout, which provides a panoramic view of the Ottawa River valley and the flat plain stretching as far as the eye can see. There are educational panels presenting the geological history of the area as well as the 1.3-kilometer Champlain Trail, which takes us out onto the escarpment for a close look at the unique vegetation found there. The steep southwest-facing escarpment has a warm, dry microclimate which supports some plants at the northernmost limit of their range, including *Quercus alba* and *Juniperus virginana* as well as *Woodsia obtusa*.

Perhaps humblest are the lichens that cling to rocks where little else grows. These were the first "plants" likely to have colonized exposed rock after the Wisconsin Glaciation retreated from this part of Canada about 10,000 years ago. It was the lichens (algal-fungal partners) that contributed to soil formation for the larger plants that followed. Lichens still can be found on exposed rock, especially on large glacial erratic boulders, where they make excellent photographic subjects. Seeing plants in such habitats gives us a unique opportunity to understand how they grow and why they favor particular conditions. Travel to different places provides us with a chance to learn and hence to grow plants better.

Born and raised in Montreal, Marilyn Light studies the long-term behavior of terrestrial orchid populations in the Ottawa area. She grows tropical orchids and has registered 20 of her own orchid hybrids. Raising plants from seed is a passion, and passing on the knowledge gained through experiments is a lifetime goal.

Showy Lady's Slippers of Purdon

Judy Wall

The Purdon Conservation area is a small, unique habitat situated in the Lanark highlands, about 90 minutes by bus west of the center of Ottawa. Access to this site is by means of a 400-meter wooden boardwalk trail over the saturated, organic, spongy moss and peat soil mat, which is characteristic of a fen. Interpretive signs along the trail point out many species of interest. The

trail from the upper parking lot leads to a lookout area with a wonderful view over Purdon Lake, the 20- to 30-meter slopes and marshes surrounding the lake, and the fen immediately below. The boardwalk trail across the fen can be reached from parking areas at either end and can be traversed in about 45 minutes at a leisurely pace. The Ted Mosquin Highland trail, which opened in 2007, meanders southward along the east side of the lake through the fen edge, and by another short boardwalk into a marsh, then onward into the highlands deciduous forest that is typical of the area.

This fen is home to many wetland plants that are easily viewed right beside the boardwalk, including the spectacular showy lady's slipper orchid (*Cypripedium reginae; p. 17*). Masses of these delicate orchids thrive today thanks to the care and cultivation of Joe Purdon, a dedicated local farmer who found the small colony in the 1930s on a patch of wetland that was a part of his farm. *Cypripedium reginae* cannot self-pollinate and has no nectar to attract insects. Although each flower produces between 15,000 and 35,000 seeds, only a few endure to produce new plants. Very precise conditions are required to ensure survival of the orchids. This fen receives seepage water from the surrounding chalky cliffs, and it loses water over a beaver dam during spring floods or times of heavy precipitation. Layers of decomposed peat near the base of the surrounding slopes create a slightly alkaline soil ideal for orchid species.

By carefully controlling the water level, selectively thinning the brush on his farm, and hand-pollinating the plants, Purdon was able to improve the orchid habitat, making it possible for the colony to grow to its peak a few years ago of 16,000 plants. This is the largest single colony of this species in Canada, and possibly in North America. Over time the population of plants has declined and now stands at about 10,000. The Mississippi Valley Conservation Authority and additional volunteers continue careful management of the site. Through thinning of encroaching trees and hand pollination of the flowers, they are striving to increase the *Cypripedium reginae* population to its former number. They are also attempting to keep the local whitetail deer from grazing in the area; these animals have become a significant threat to the orchids and other plants.

Numerous other plants typical of northern fens and hillside habitats are present at this site, including *Sarracenia purpurea* (pitcher plant), *Linnaea borealis* (twinflower), *Hepatica americana, Trillium grandiflorum, Trillium erectum* (wake-robin), *Uvularia grandiflora* (bellwort), and *Caulophyllum thalictroides* (blue cohosh), along with many mosses, grasses, ferns, trees, and shrubs. As if all these native plants are not enough, it is equally interesting to take in all the mushrooms, lichens, insects, and some 30 species of birds as one strolls along the Purdon trails.

Judy Wall is the owner-operator of a nursery specializing in rockery, alpine, drought-tolerant and succulent plants. She has a passion for unique and unusual plants and a growing interest in learning more about local native plants. www.rockwallgardens.com

Alpine Flowers of Andorra

David Sellars

The tiny independent country of Andorra lies in the headwaters of the Valira River, which flows from Andorra into Spain through a rocky canyon. Except for this outlet, a continuous mountain ridge encircles the country. The northern boundary of Andorra is the main divide of the Pyrenees, which forms an almost unbroken mountain chain from the Atlantic Ocean to the Mediterranean.

Andorra is situated on the south side of the Pyrenees in rain shadow from Atlantic weather systems and experiences hot, dry air drifting up from Spain as a result of the high pressure systems of the Mediterranean. The climate of Andorra is consequently relatively dry, and snow cover has usually melted by the end of June. The weather is also very stable, which is a real bonus for hiking as every day is mostly sunny and clear.

Dry mountain climates always seem to support a rich alpine flora. Competition from plants needing moister conditions is reduced, and specialized plants can find a happy ecological niche. Andorra also enjoys a varied geology, with granitic rocks to the south, gneiss in the northeast, and shale and slate in the northwest. The shale areas are particularly good for flowers, with the shattered rocks forming an acidic substrate. In the center of Andorra, Pic de Casamanya (photo, p. 22) is a limestone mountain with a flora quite different from that of the rest of the country.

Andorra has a reputation for tacky commercial development and a crowded main valley. However, the peak tourist seasons are in the winter for skiing and in August, when the people of France and Spain typically take their annual holidays. Late June and early July, the peak months for alpine flowers in Andorra, are considered the off-season there. Consequently the roads are quiet, the trails are not crowded, and it is easy to find inexpensive accommodation. Furnished *apartamentos* can be rented by the day. Traveling to the country is straightforward. We flew to Barcelona, which is only three hours' drive from Andorra.

There are many excellent hikes to choose from in Andorra. The terrain is rugged but often not precipitous, so there are opportunities for walking along mountain ridges. We always look for hikes with a high starting elevation so that we can spend most of our time in the alpine areas exploring for flowers. We completed

a number of splendid one-day hikes, mostly in northern Andorra, and some of the best are described below. For more information on hikes in the Pyrenees, visit www.mountainflora.ca.

A paved road climbs to an elevation of 2200 meters (7216 feet) below the clear, cold waters of the Tristaina Lakes in northwestern Andorra. A dramatic trail provides a circular walk above the three lakes, traversing steep grassy and rocky slopes. Within the first few hundred meters along the trail we spotted *Androsace vandellii* (23) clinging to a dark rock outcrop. A classic cushion plant which grows only in rock fissures, *A. vandellii* has pure white flowers elegantly contrasting with the gray-green leaves.

The trail continues up to a grassy saddle with a surprising variety of interesting flowers. The pink flowers of *Androsace laggeri* (p. 23) lit up the turf together with white *Ranunculus pyrenaeus* and *Gentiana pyrenaica* (p. 25), which has very distinctive dark blue flowers quite unlike any other in the genus that we have seen. On the top of a small grassy knoll we were delighted to find some *Erythronium dens-canis* still in flower (on June 25, 2007), although other plants nearby had already gone to seed.

The path climbs up to the right of the highest of the Tristaina Lakes and then traverses to the left between a series of cliffs. *Primula integrifolia* (p. 25) was abundant at about 2400 meters (7872 feet), and there were also fine specimens of *Gentiana alpina* (p. 25), which is like a diminutive *Gentiana acaulis* but has olive-green leaves. We found more *Androsace vandellii* on the rock faces above the path near the high point of 2500 meters (8200 feet), together with creamy yellow *Pulsatilla alpina* subsp. *apiifolia* and sweetly scented *Daphne cneorum*. We returned to the car well satisfied with our first day in Andorra.

In the center of Andorra, the limestone peak of Pic de Casamanya can be ascended by an easy walk along a broad grassy ridge starting at 1980 meters (6500 feet) on a paved road where it crosses the ridge at Coll d'Ordino (p. 22). The trail starts in an open pine wood, and we found *Hepatica nobilis* just starting into flower along the trail. Emerging from the trees, the trail climbs the broad ridge with occasional rocky bands that are easily climbed. At the first major rock outcrop at 2300 meters (7544 feet), we found *Saxifraga media* growing in crevices. This plant, endemic to the Pyrenees, has unusual red flowers rising on stalks from rosettes of symmetrical silvery leaves. *Saxifraga media* is in the Engleria subsection and has some similarities to *S. stribrnyi*. There were also beautiful specimens of *Daphne cneorum* var. *pygmaea* clinging to cracks in the limestone.

Although we were looking for endemics, we were surprised to find a common rock garden plant, *Iberis sempervirens*, growing all over the ridge; we did not see it elsewhere in the Pyrenees. Although it can be found growing wild in the United Kingdom and the United States, *Iberis sempervirens* is native to the Mediterranean area and was not listed in our bible, *Alpine Flowers of Britain and Europe* by Grey-Wilson and Blaney. The limestone bedrock and proximity to the Mediterranean must provide the right conditions for this candytuft. We also spotted another Mediterranean species on the ridge—*Paronychia capitata*, a mat-forming plant with attractive gray foliage and numerous showy silver bracts enclosing the tiny, inconspicuous flowers.

As we approached the summit, a lovely field of blue *Myosotis alpestris* provided a foreground to the extensive views to the north. The summit at 2740 meters (8987 feet) is rocky and a good place to explore for plants. We found a lovely lilac candytuft, *Iberis aurosica* (p. 24), growing in coarse scree together with another member of the cress family, pure white *Hutchinsia alpina* (p. XX). *Silene acaulis* and *Saxifraga exarata* were abundant at this elevation.

Our most memorable hike in Andorra was the trail to the summit of Pic de la Serrera. This hike starts near El Serrat in the Parc Natural de la Vall de Sorteny, which was created as a conservation area for its interesting alpine flora. The parking lot at the start of the hike is at elevation 1780 meters (5838 feet), but before 10:00 A.M. you are allowed to drive higher up a gravel road to 1880 meters (6166 feet).

The trail follows a wide valley and the initial meadows are lush with *Dactylorhiza* sp., *Pinguicula grandiflora*, and *Asphodelus albus*. Huge mounds of the delightfully named *Molopospermum peloponesiacum* rise from the boulder fields. This umbellifer (member of the parsley family) has soft feathery leaves below large compound umbels of yellow-green flowers.As we climbed higher past pretty streams and light stands of pine, we found extensive drifts of *Anemone narcissiflora* and *Pulsatilla alpina* subsp. *apiifolia*. The pure white flowers of the anemone in combination with the yellow pulsatilla and red *Rhododendron ferrugineum* were an unforgettable sight.

The path crosses over from the Riu de la Cebollera to the Riu de la Serrara. This stream flows through a particularly beautiful valley above the tree line, with extensive meadows of flowers. At about 2300 meters (7545 feet) *Narcissus poeticus* can be found in the meadows, together with the orchids *Nigritella nigra* and *Dactylorhiza fuchsii*.

At about 2400 meters (7872 feet) the meadows become stony and drier. Drifts of white *Ranunculus pyrenaeus* combined with the blues of *Gentiana pyrenaica, G. alpina*, and *G. verna*. *Primula integrifolia* was also decorating the turf and rocks with lovely pink flowers. The path climbs up to the Collada dels Meners at 2724 meters (8935 feet), and the main path then descends to Estany dels Meners de la Coma. Turning left at the pass and climbing along the shattered shale crest, we gained the broad south ridge of Pic de la Serrera and climbed a loose path up the scree to the summit at 2913 meters (9555 feet) on the main Pyrenees divide. It was fascinating to look over blankets of cloud covering France, while on the south side of the ridge blue skies and sun prevailed. Plants of interest at this high elevation included *Saxifraga geranioides* and *Veronica nummularia,* both Pyrenean endemics. There were also very fine specimens of *Linaria alpina*, without yellow blotches on the flowers as more commonly seen in the Alps.

Another interesting excursion in the El Serrat area is the walk up the Vall de Rialb (p. 22). The lower areas of this beautiful valley are carpeted with *Erythronium dens-canis* (in seed on June 28, 2007), and there are fine specimens of St. Bruno's lily, *Paradisea liliastrum*. Climbing through meadows full of *Dactylorhiza fuchsii* and *Androsace laggeri*, it is easy to cross the divide into France and visit the well-named lake Estany Blau. Plant highlights during our trip included *Loise-*

Cypripedium parviflorum mingles with *Trillium grandiflorum* in the Ottawa Valley (p. 4). (Brian Carson)

Cypripedium reginae is the glory of the northern spring and carefully protected (p. 4, 6, 13). (B. Carson)

Aquilegia canadensis, an Ottawa Valley native popular in gardens (p. 7). (B. Carson)

Gentianopsis crinita in the Burnt Lands alvar (p. 6). (B. Carson)

Eriophorum vaginatum is a decorative sedge of northern marshes (p. 9). (Hugh Hope)

An ornamental summer branch of the tamarack, *Larix laricina* (p. 10). (H. Hope)

Linnaea borealis in Ottawa Valley woodland (p. 8). (Steven Marsh)

Early June in the Burntlands Alvar (p. 5, 6). (B. Carson)

Lilium philadelphicum (p. 5). (B. Carson)

A trail through the Vall de Rialb in Andorra (p. 16) (David Sellars)

Hiking along a ridgetop toward Andorra's Pic de Casamanya (p. 15). (D. Sellars)

Androsace laggeri (above) and *Androsace vandellii* (below) are among the choicest alpine plants of Andorra's mountains (p. 15). (D. Sellars)

Two alpine crucifers in Andorra: *Hutchinsia alpina* (above) and *Iberis aurosica* (below, p. 16). (D. Sellars)

Primula integrifolia in Andorra (p. 15). (D. Sellars)

Two gentians of the Pyrenees: left, *Gentiana alpina* (p. 15); right, *Gentiana pyrenaica* (p. 15). (D. Sellars)

Erythronium caucasicum (p. 40) in the garden. (A. Guppy)

Left, *Erythronium dens-canis* (p. 40) from the Balkans (A. Guppy);
right, *Erythronium sibiricum* (p. 40) east of Novosibirsk (Dr. Oleg Kosterin).

Left, *Erythronium albidum* (p. 42); right, *E. mesochoreum* (p. 42). (A. Guppy)

Two specimens of *Erythronium elegans* (p. 50) on Mt. Hebo, Oregon. (A. Guppy)

Left, *Erythronium quinaultense* (p. 49) north of Lake Quinault, Washington. Right, a group of hybrids between *E. revolutum* and *E. montanum* (p. 51). (Art Guppy)

Erythronium quinaultense in the garden. (A. Guppy)

Two forms of *Erythronium grandiflorum* (p. 42): one with red anthers on the left, and one with pink anthers on the right. (A. Guppy)

Erythronium grandiflorum from Roman Nose Mountain (p. 43). (A. Guppy)

Erythronium multiscapoideum (pp. 48). (A. Guppy)

Left, *Erythronium californicum* without red nectar guides (p. 47);
right, a hybrid between *E. californicum* and *E. multiscapoideum* (p. 49). (A. Guppy)

Left, *Erythronium hendersonii* (p. 47); right, *Erythronium howellii* (p. 48). (A. Guppy)

Left, *Erythronium helenae* (p. 49); right, a hybrid between *E. revolutum* and *E. oregonum* (p. 53). (A. Guppy)

Left, *Erythronium klamathense* (p. 38); right, a hybrid between *E. hendersonii* and *E. oregonum* (p. 55). (A. Guppy)

Two forms of *Erythronium oregonum* (p. 45). (A. Guppy)

leuria procumbens, an ericaceous mat-forming plant of high alpine meadows, and *Pinguicula grandiflora* with large flowers to match its name.

With easy road access and accessible mountains, alpine flower hiking in Andorra is a wonderful introduction to the Pyrenean flora. For interesting alpines, we thought the area was comparable to the Dolomites but much quieter. In late June and early July the roads in the Dolomites are crowded with cyclists, buses, cars, and motorcycles, and the trails are also busy. On some of our hikes in Andorra we only saw one or two other people. While there are many flowers in Andorra that can also be found in the Alps, discovering new plants such as *Ranunculus pyrenaeus* or *Gentiana pyrenaica* adds a special frisson to the visit. Rounding a boulder and being surprised by the elegant flowers of a group of *Narcissus poeticus* or coming nose to nose with *Androsace vandellii* jammed under an overhang makes the effort of ascending the Andorra mountain trails so worthwhile.

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David Sellars gardens near Vancouver, British Columbia. An enthusiastic photographer and hiker, he is developing a website offering information on plant-oriented hikes.

Do you have a favorite alpine flower hike?

A group of hikers in British Columbia, Canada, are hosting a website providing information on selected alpine flower hikes around the world. So far, 22 of the finest hikes from mountain areas in North America and Europe have been uploaded to **www.mountainflora.ca** with information on access, maps, elevations and routes. Each hike includes a set of photos illustrating a sample of the local flora and more details provided on one featured plant of particular interest.

Submissions from mountain flora enthusiasts to **www.mountainflora.ca** are welcome. Text and images of your favoarite alpine flower hikes should be sent to hikes@mountainflora.ca.

A New Look at *Erythronium*
Part 2

Art Guppy

NOTE: *Part 1 of Art Guppy's study of* Erythronium *appeared in issue 65(3), Summer 2007. It focuses on the role of ants in distributing the seeds of one group of species. Part 2 is a broader consideration of the genus.*

To understand and appreciate the various *Erythronium* species and their relationships, it helps to have the names of all the species laid out in their natural groupings, as I have done below. Keep in mind that species are not fixed entities for all eternity. They evolve and change, and at any moment what we call a "species" is in the process of changing, though likely no evolutionary change would be noticed within the span of several human lifetimes. In some cases the identity of a species may be clear-cut, but in others, probably because the species is gradually evolving, it may be a matter of opinion. Trying to describe and delimit species can be rather like trying to capture rainbows. The best I can do is give my impressions, and as much as possible follow tradition.

This is not intended to be a complete identification guide to the species. It is assumed that anyone growing or identifying *Erythronium* will have a suitable reference book, such as the NARGS *Bulbs of North America*. My purpose is to provide a new way of looking at the genus, and to iron out some of the difficulties with identification and offer some suggestions about growing the plants. The latter, however, is difficult because gardens elsewhere across the continent will be very different from my garden on Vancouver Island, just off the coast of British Columbia.

The two subgenera divide naturally into smaller groups.

Not only does the genus *Erythronium* divide naturally into two subgenera, but each subgenus seems to divide naturally into sections. Here we run into a problem with the two sections, the *Concolorae* and the *Pardalinae*, into which Applegate divided the western American species. Applegate's sections were published

in 1935, before much known today about *Erythronium* was understood. Using the information available today, I have found that the western subgenus divides naturally into sections that are very different from those named by Applegate. Let us look at the entire genus with its natural groupings. I didn't make these groupings; I am trying to describe what evolution produced over time.

The Myrmecochorous Subgenus: Plants with Ant-distributed Seeds

The Eurasian Section

Erythronium dens-canis: Europe: Portugal almost to the Black Sea.

Erythronium caucasicum: Russian Caucasus into Iran.

Erythronium sibiricum: central Siberia and the Altai Mountains into Mongolia and Kazakhstan.

Erythronium japonicum: Japan and islands to the north, Korea, and likely a nearby part of China.

The Eastern North American Section

The yellow-flowered group: base chromosome number n = 12.

Erythronium umbilicatum: diploid (2n = 24): southeastern U.S.

E. umbilicatum subsp. *monostolum*: border of North Carolina and Tennessee.

Erythronium rostratum: diploid (2n = 24): Mississippi region.

Erythronium americanum: tetraploid (2n = 48): Newfoundland to Tennessee to Wisconsin.

E. americanum subsp. harperi: Alabama, Tennessee, and nearby states.

The white-flowered group (tinted pink, purple, or bluish): base chromosome number n = 11.

Erythronium mesochoreum: diploid (2n = 22): Illinois to Texas.

Erythronium albidum: tetraploid (2n = 44): central and eastern U.S. and Ontario.

Erythronium propullans: presumed to be tetraploid (2n = 44) as it can cross with *E. albidum*: Minnesota.

I omit varieties of *E. dens-canis*. It seems that commercial bulb-growers are sometimes tempted to concoct names that look like scientific names to cater to collectors' demand for as many named varieties as possible. I have yet to encounter a named taxonomic variety of *E. dens-canis* that seems valid, but perhaps I will meet one someday.

Applegate's Subgenus

The Grandiflorum Section (diploid, 2n = 24)

Erythronium grandiflorum: southern B.C. and Alberta to northern California to Colorado.

E. grandiflorum var. *nudipetalum*: Idaho.

Erythronium idahoense: eastern Washington, Idaho, and western Montana.

The Multiform Section
The group with plain green leaves (diploid, 2n = 24).
Erythronium montanum: southern B.C. to northern Oregon.
Erythronium klamathense: southern Oregon into northern California.
Erythronium purpurascens: southern Cascades and northern Sierra Nevada, California.
Erythronium pluriflorum: Madera Co., Sierra Nevada, California.
Erythronium pusaterii: Tulare Co., Sierra Nevada, California.
Erythronium taylori: Tuolumne Co, California.
Erythronium tuolumnense: Tuolumne Co., California.

The group with mottled leaves (diploid, 2n = 24).
Erythronium revolutum: near the coast, southern B.C. to northern California.
Erythronium oregonum: west of the Cascade summits, southern B.C. to northern California.
Erythronium californicum: northwestern California.
Erythronium multiscapoideum: Sierra foothills, northern California.
Erythronium citrinum: southwestern Oregon into northwest California.
E. citrinum var. *roderickii*: Trinity Co., northern California.
Erythronium howellii: southwestern Oregon into northwestern California.
Erythronium helenae: vicinity Mt. St. Helena, northwestern California.
Erythronium hendersonii: southwestern Oregon into northwestern California.

The group of hybrid origin with only a trace of mottling (tetraploid, 2n = 48).
Erythronium quinaultense: near Lake Quinault in western Washington.
Erythronium elegans: Mt. Hebo and two nearby mountains, northwest Oregon.

In the *Flora of North America North of Mexico* (2002) the spelling of two species names has been changed from those long in use: *E. multiscapoideum* to *E. multiscapideum*, and *E. taylori* to *E. taylorii*, but here I have retained the usual spellings. It is true that in 1855, when *E. multiscapoideum* was not placed in the genus *Erythronium*, it was given the name *Fritillaria multiscapidea*, but the *oi* spelling has been in use for a very long time—notably by Applegate in 1935 and by Munz in 1959. Changing the spelling now is certain to cause enormous confusion. In the case of *E. taylori*, the *International Code of Botanical Nomenclature* requires an *ii* ending after a consonant unless the name ends in *-er*, in which case a single *i* is used; however, the rule was made to accommodate pronunciation, and I believe it should apply to this *-or* name as well. As *taylori* is the spelling in the paper in which the species was named, I have retained it.

Applegate's sections, the *Concolorae* and the *Pardalinae* must be abandoned.

Above, I suggested a division of Applegate's subgenus into sections very different from the familiar *Concolorae* and *Pardalinae* described by Applegate. He obvi-

ously felt that there was an important genetic difference between *Erythronium* with plain leaves and those with mottled leaves. It is now evident that the difference in leaf coloration is an adaptation to the difference between snowy winters at high elevations and mild winters lower down, but it otherwise indicates no important genetic difference. (I will comment in more detail below on the probable adaptive importance of the difference of leaf coloration.) On both Mt. Hebo in northwestern Oregon and near Lake Quinault in Washington, at some time in the past the plain-leaved *E. montanum* has crossed with the mottled-leaved *E. revolutum* to produce a tetraploid hybrid species with only a faint trace of mottling. Applegate did not encounter either species, or he would have had to abandon his sections, for the hybrid species would fit in neither section.

There is other evidence against Applegate's sections. In my garden I have crossed *E. montanum* from San Juan Ridge on Vancouver Island with *E. revolutum* from a lower elevation, and produced more than 50 vigorous hybrid plants that are apparently fully fertile. Also, I have collected seed from *E. montanum* in my garden, and to my surprise got two apparently fully fertile hybrid offspring from it. They have leaves that each spring unfold with quite strong mottling but quickly fade to plain green. Their white flowers have reddish markings near the base of the tepals, which could only have come from either *E. oregonum* or *E. californicum*. In the year I collected the seeds, both *E. oregonum* and most *E. californicum* in my garden had finished flowering well before *E. montanum* bloomed, so I am reasonably sure that the pollen parent was *E. californicum* 'White Beauty', which often flowers quite late. All the vigorous fertile hybrids in my garden between *E. montanum* and two mottled species, as well as the occurrence of tetraploid hybrid species in the wild, demonstrate clearly that the plain-leaved *E. montanum* is genetically closely related to species with mottled leaves. Consequently, they cannot be put in separate sections.

Mottled leaves and plain green leaves must each have an adaptive importance.

It seems probable that the ancestral *Erythronium* from which all existing species are descended had mottled leaves, as there are mottled species right around the Northern Hemisphere, while species consisting entirely of plain-leaved plants are confined to western North America. There, because the plain-leaved species are largely restricted to regions with long, snowy winters, it seems reasonable to assume that plain leaves are advantageous where winters are long and snowy, but it is not easy to explain why. It has been suggested that leaf mottling originally evolved to provide camouflage as protection from grazing animals, but this idea seems contradicted by the fact that species with plain leaves, such as *E. grandiflorum*, commonly grow in open meadow habitats where the plants are exposed to grazing, while species with mottled leaves are most often in habitats at low elevations where shrubs provide some protection.

I suggest the following hypothesis. At low elevations, where the winters are short and mild, *Erythronium* species leaf out very early in spring, often in February or March, when the sun is so low in the sky that its rays strike the leaves at a low angle and give little heat. Under such conditions, the plants need all the heat they can get in order to grow, and the brown mottling would be valuable for absorbing heat. In contrast, where winters are long and snowy, the snow often does not melt and the *Erythronium* leaves cannot emerge until May or June, when the days are long and the sun's rays strike the leaves from a high angle. Under such conditions, the leaves are more likely to get too much heat than too little, and shiny green leaves that reflect some of the heat would be advantageous.

We must look at the division of Applegate's Subgenus into two sections.

At this point an explanation is required for the rather strange division I have suggested of Applegate's Subgenus into the Grandiflorum Section and the Multiform Section. Looking at the entire subgenus, I can see only one break between species where there is no indication of a close genetic relationship and no record of hybridization. *E. grandiflorum* and its close kin *E. idahoense* seem to stand in isolation from all the other western species. Several times I have tried to cross *E. grandiflorum* with other species in my garden, but always failed. That proves nothing, as even closely related species can have barriers to hybridization, but observations in nature provide additional evidence. *E. grandiflorum* has a huge range, it has many different forms, and in a number of places it grows in close association with other species, both mottled and unmottled, but no one has ever reported finding a hybrid, except with *E. idahoense*.

In Applegate's 1935 monograph he writes of his encounter with a mixed population of *E. grandiflorum* and *E. klamathense* flowering together on the Umpqua-Rogue Divide. As both species have unmottled leaves, he felt they belonged together in the same section and therefore he expected them to hybridize. He wrote, rather plaintively I think, "Whether or not they hybridize, I have not as yet been able to determine with certainty, although I am inclined to think they do." As *E. grandiflorum* has yellow tepals and fairly long, recurved stigma lobes (though lobe length depends on the strength of the plant), while *E. klamathense* (p. 32) has white tepals and a more or less unlobed stigma, Applegate would certainly have been able to spot intermediates, had any been present. I do not want to make the same mistake as Applegate by being too sure of the sections into which the subgenus divides, so I must emphasize that the two sections I have suggested are tentative. I am certainly not thinking of giving them scientific names.

My suggested sections are based entirely on evidence that species within each section seem likely to be able to hybridize with one another, while there is no evidence of hybridization between sections. We know that *E. grandiflorum* and *E. idahoense* can hybridize with each other, but it is unlikely they can cross with any

other species, so they belong together in what I call the Grandiflorum Section. There are so many records of hybridization among the other species that, tentatively, it seems they all belong together in the same large section, the Multiform Section.

I have included two possibly doubtful species in Applegate's Subgenus.

I have recognized two species that are not recognized in the *Flora of North America North of Mexico*. That does not make me a "splitter." I merely refuse to go along with the "lumping" of those two species.

E. idahoense has long been lumped with *E. grandiflorum* as *E. grandiflorum* subsp. *candidum*. An excellent paper by Jane Fritz-Sheridan (1988) shows that subsp. *candidum* and *E. grandiflorum* "are two biological species" that in nature can grow in mixed populations without hybridizing. The paper does not assert that the biological species called subsp. *candidum* should revert to the name *E. idahoense*, but very cautiously leaves unanswered the question of whether it is a taxonomic species. I am not that cautious. It behaves as a biological species, it is easily identified by its white flowers, and a valid species name exists. That is enough for me. To me it is *E. idahoense*.

The paragraph above may seem to contradict my earlier statement that *E. grandiflorum* and *E. idahoense* can hybridize with each other, but actually it does not. Jane Fritz-Sheridan observed that in Montana where the two species are growing together, they have evolved barriers to hybridization, but where they are not growing in populations in close proximity, those barriers have not evolved, and plants of the two species from those populations can hybridize. However, nature does not follow strict rules, and south of Coeur d'Alene in Idaho there is a large natural population of hybrids. That population could be used as a reason for recognizing the name *E. grandiflorum* subsp. *candidum* rather than the name *E. idahoense*. I do not agree, and would point to large natural hybrid populations such as those between *E. oregonum* and *E. citrinum* which botanists have not lumped into one species.

E. howellii is a somewhat different problem, though it also is excluded from the *Flora of North America*. The author who deals with the western species made the reasonable decision to lump *E. howellii* with *E. citrinum* on the grounds that, to her knowledge, the two taxa differ only in *E. howellii*'s lacking appendages near the base of its inner tepals. That left *E. howellii* without even a name as a variety, which is inconvenient. More important, I do not agree with lumping the two species because, in my garden, for years I have observed a group of *E. howellii* raised from seed from Sanger Mountain on the Oregon/California border; and clearly the species, at least from that area, differs from *E. citrinum* in a second conspicuous way. The flower stem of *E. howellii* has a strong tendency to be much shorter than that of *E. citrinum* and, more important, it tends to have more flowers. I have never seen more than four flowers on an *E. citrinum* (and that number

is very unusual), while *E. howellii* frequently manages five, and I have seen six. Considering that *E. howellii* differs from *E. citrinum* in lacking appendages on the inner tepals and in frequently having a shorter stem with more flowers, and it has been recognized as a species for many years, it seems reasonable to continue calling it a species.

Now let us look through the entire genus, species by species, starting with the Myrmecochorous Subgenus.

The four species of the Eurasian Section are all rather similar, with *E. japonicum* being the most distinctive, as is indicated by the elaiosomes (fleshy appendages) on the seeds being distinctly different from those of the other three species. Identification in the garden must always be slightly uncertain unless the plants were raised from wild-collected seeds; in that case the geographic location always gives positive identification. With bulbs obtained from commercial sources or grown from garden-collected seeds, one must always rely on the identification supplied with the bulbs or seeds, and hope it is right, while keeping in mind that the plants may be hybrids. With very rare exceptions, the following descriptions will apply to plants from wild-collected seeds, and with luck to other plants.

Erythronium japonicum has purple or pink flowers and purple anthers, and it is the only species that has appendages in the form of ridges or "fins" near the base of both the outer and inner tepals. The other three species have them only on the inner tepals. *E. sibiricum* has purple or pink flowers with yellow anthers. White flowers are reported to occur in the wild, but evidently are extremely rare. *E. caucasicum* (photo, p. 26) has white flowers (sometimes pinkish) with yellow anthers. *E. dens-canis* has purple or pink flowers with purple anthers and can be distinguished from *E. japonicum* by having no appendages on the outer tepals. In the Balkans there are populations of *E. dens-canis* with white flowers which are easily identified by their purple anthers (p. 26).

In the Eurasian Section, *Erythronium sibiricum* (p. 26) requires our special attention as it has an enormous range and, in suitable habitat, carpets the ground in spring with its purple blooms. Possibly it competes with *E. grandiflorum* of western North America as the world's most numerous species. Nevertheless, *E. sibiricum* is very poorly known. Although the species has two forms, one with mottled leaves and one with leaves that are plain green except for often being tinted reddish when young and often having reddish main veins, no one seems to know what the respective ranges of the two forms are. Dr. Oleg Kosterin, a lepidopterist who lives near Novosibirsk, just west of the western edge of the range of *E. sibiricum*, is very familiar with the species. In connection with his study of Russian butterflies, he has traveled extensively throughout much of Siberia, and he told me that he has seen millions of *E. sibiricum*, which is his favorite plant, but he has not seen even one with unmottled leaves. Evidently the mottled

form is much the most common, but the range of the unmottled form remains a mystery. Nevertheless, the latter certainly exists, for it is available from bulb dealers and I have it in my garden, grown from seed.

The Eastern North American Section is quite well known, but a certain haziness surrounds even those plants, because within both the yellow-flowered group and the white-flowered group there are species that are so alike that few people can distinguish between them.

To identify species in the yellow-flowered group, the first observation should be of the plants' habit of growth. Two species, *E. americanum* and *E. rostratum,* spread by underground rhizomes (stolons) and consequently form patches of irregularly spaced plants, often with many of the plants not flowering. The third species, *E. umbilicatum*, does not produce rhizomes but spreads by seeds and by offsets tight against the parent bulb, so that mature plants usually have flowers and often form tight clumps. Unfortunately, there seems always to be an exception to complicate matters. *E. umbilicatum* subsp. *monostolum* does produce rhizomes, but that causes only a moderate amount of confusion as the subspecies is found only fairly high in the mountains near the border between Tennessee and North Carolina. There it forms patches of mainly nonflowering plants.

The next step toward identifying a yellow-flowered species is to closely examine the female reproductive parts of the flower; that is, the ovary, style, and stigma. With *E. umbilicatum* the ovary is very distinctive as its outer end is umbilicate (indented or shaped like a navel), and the same description is true when the ovary has matured into a seed capsule. The ovary and capsule of *E. rostratum* are also very distinctive, but in the opposite way to *E. umbilicatum*. The *E. rostratum* ovary extends into a sturdy style, and as the ovary matures to become the capsule, the style becomes a strong beak on the capsule, which gives the species the name "beaked trout lily." In contrast to *E. rostratum*, with *E. umbilicatum* the style is slender and after the flower fades it shrivels and falls off. With the third yellow-flowered species, *E. americanum*, the ovary and later the capsule are somewhat intermediate between those of the other two species, which is not surprising as it is believed, as I mentioned in Part 1, that *E. americanum* originated from the hybridizing of *E. umbilicatum* and *E. rostratum*. This intermediate species has an ovary and later a capsule which generally have the outer end rounded, though with subsp. *harperi* they usually have a small point. With *E. americanum* subsp. *americanum*, it seems that the style eventually shrivels and falls off, but as far as I can judge from dried material, with *E. americanum* subsp. *harperi*, it shrivels but remains attached.

Fortunately, identification is much easier in the group with white or whitish flowers. First, we can eliminate *E. propullans.* It is endemic in a small area in Minnesota and is listed as an endangered species. The flowers are smaller than those of any other *Erythronium* and often have only four tepals. It generally does not produce seeds, but has the unique trait that flowering plants reproduce by sending out rhizomes that originate from the stem a short distance above the bulb. That leaves us with only two species to identify. *E. albidum* (p. 27) spreads by underground rhizomes, while *E. mesochoreum* (p. 27) reproduces mainly by seeds,

though it does produce offsets close against the parent bulb. Leaf shape provides the other important clue to identity. *E. albidum* has oblong-lanceolate leaves, the "normal" shape for an *Erythronium*, while *E. mesochoreum* has long, narrow leaves that are V-shaped in cross-section. Many *E. mesochoreum* plants have unmottled leaves, though the majority seem to show a trace of mottling when they first unfold in spring. Mottling, when present, can vary from faint to very strong.

Those who grow eastern *Erythronium* species often find that plants of *E. americanum* and *E. albidum* spread so rapidly by fast-growing rhizomes that they seem more like weeds than good garden plants. That need not be the case: it depends on what clones you have and the amount of sun they get. With a good clone of either species in a fairly sunny location, the majority of the bulbs should produce flowers.

In Applegate's Subgenus, *Erythronium grandiflorum* comes first to our attention.

In looking at Applegate's Subgenus, the western Americans, it is logical to start with *E. grandiflorum*, the most numerous and widespread. Over its huge range, it exists as numerous separate populations. Because *Erythronium*, especially western American species, lack an effective method for dispersing their seeds for even a moderate distance, populations that are separated by a geographic barrier, even a stretch of forest, behave as if they were on islands. Over time, each population tends to evolve its own characteristics, and in some cases populations are so different from one another it is difficult to believe they are not different species. Some forms of *E. grandiflorum* have been named as botanical varieties or subspecies, but there are so many populations with intermediate characteristics, it seems impossible to identify what plant belongs in what named variety, so none, or almost none, of the varieties are now recognized by botanists.

In a garden, the different forms of *E. grandiflorum* often behave very differently. In general, the forms from high elevations fail in most lowland gardens. They tend to die out quickly, and if they flower, the flower is a silly, upward-facing thing at ground level. East of the Cascade Mountains, at fairly low elevations close to rivers and lakes, there are populations that truly merit the name *Erythronium grandiflorum*. The plants are robust and have large, deep yellow flowers, often with dark red or purple anthers. In the garden these generally thrive and put on a wonderful show, though they tend regrettably so have somewhat twisted tepals. In the same general area, perhaps usually at somewhat higher elevations, there are populations of similar plants with yellow anthers, and there are occasional populations with both red anthers and yellow anthers, with a few pink anthers included (photos, p. 29). In my garden I find that often plants with yellow anthers do not do as well as their red-anthered companions, perhaps because at some time in the past they came from a higher elevation. The form of *E. grandiflorum* that does best of all for me was raised from seeds from Roman

Nose Mountain in western Oregon (p. 29). It is smaller and has smaller flowers than the forms I have described above, and its anthers vary in color from cream to yellow, but it makes up for the lack of show by looking perfectly at home in a garden. Roman Nose is only about 870 meters (2854 feet) high and lies about halfway between the northern and southern boundaries of Oregon, which is quite far south for this species. Plants react to a lower latitude much as they do to a lower altitude, so it is not surprising that the *Erythronium* from there do well in a garden.

In my list of *Erythronium* I have recognized just one variety of *E. grandiflorum:* var. *nudipetalum*, which is endemic in a rather isolated part of Idaho. It is a doubtful variety, but I include it because it was recognized as a variety by C. L. Hitchcock et al. (1969), and accounts by field researchers seem to support that classification. Applegate named it as a species, *E. nudopetalum*, on the basis of two characteristics distinguishing it from *E. grandiflorum*: its stigma is without lobes or is only slightly lobed, and its tepals lack appendages at the base. In my experience, the lack of stigma lobes often means nothing more than that the plant's growing conditions are poor, but the lack of tepal appendages may qualify this Idaho form as a variety. The *Flora of North America* does not recognize it even as a variety, and suggests it may simply be a depauperate form of *E. grandiflorum*. I am treating it as a variety as a compromise, because I have not been able to study it. The plant's natural habitat is at high elevation where winters are long and snowy, so there is little chance I could grow it in my garden.

I have omitted two varieties of *E. grandiflorum* often encountered in the literature. Applegate recognized var. *pallidum* and named subsp. *chrysandrum*, both on the basis of anther color, but those taxa are not recognized by Hitchcock nor in the *Flora of North America.* They do not merit recognition because with this species there is almost no correlation between anther color and other important taxonomic features. One finds populations consisting of plants that are very similar except that they have different-colored anthers, and it would not make sense to believe that plants growing together and otherwise looking identical are different varieties for that reason alone.

Var. *pallidum* is frequently encountered in the literature, and while Hitchcock (1969) does not recognize it as a variety, he suggests it might qualify to be named as a botanical form with a range west of the Cascade Mountains, as it has pale anthers and that is the only anther color which has been recorded in that area. The problem is that there are several distinctly different forms in the region from the Cascades west, and they cannot reasonably be grouped together as one botanical form or as a variety. In different populations throughout the area, the anther color varies from white to pale yellow, the leaf shape varies from wide and almost erect to narrow, undulate and almost prostrate, and the plant's stature varies from moderately tall to almost dwarf. I am very familiar with the extremes. From the window above my desk I look out at Mt. Prevost (780 m/2558 feet), scarcely a half-hour's drive from my door. On its rocky summit *E. grandiflorum* plants are very short and have long, narrow, undulate, almost prostrate leaves and white to pale yellow anthers. If raised from seed, the plants retain

those characteristics, though unfortunately they tend to die out after a few years. In contrast to the plants on Mt. Prevost, at Botanie Valley, a central valley in the mountains at the north end of the Cascades in southwestern British Columbia, the slopes above the valley are clothed with millions of sturdy, erect *E. grandiflorum* with wide leaves and anthers of various shades of yellow—except that scattered here and there, at a ratio of one in several thousand, are plants with red anthers. As if to illustrate the difficulty of describing varieties of this species, high above the valley, my son Cris photographed a fine *E. grandiflorum* plant with pale pink anthers and yellow pollen. The Botanie plants do not do well in a garden, unlike the similar though smaller plants from Roman Nose Mountain. Perhaps someday someone will sort out reasonable varieties from this hodgepodge of different populations, but it has not been done yet.

Before leaving *E. grandiflorum*, I must mention the closely related *E. idahoense*, which is often treated as *E. grandiflorum* subsp. or var. *candidum*, and seems to differ from *E. grandiflorum* only in having white tepals and somewhat larger flowers (Applegate 1935). However, as I explained earlier, research by Jane Fritz-Sheridan in western Montana has convinced me that those differences are significant enough to warrant recognizing the taxon as a species.

Of all the world's *Erythronium* species, the Multiform Section is the most complex.

Turning to the extraordinary assemblage of *Erythronium* species that I have called the Multiform Section, the plain-leaved group can be thought of as dividing into two subgroups: a northern subgroup consisting of *E. montanum* and *E. klamathense,* and a southern subgroup consisting of five apparently closely related species, of which *E. tuolumnense* is the best known. From northern Oregon to Mt. Waddington in British Columbia, in suitable subalpine meadow habitat, there are many dense populations of *E. montanum.* These high-elevation plants are generally not successful in a garden, but there are two atypical populations at lower elevations that can be a source of garden plants. I have already mentioned the San Juan Ridge *E. montanum* that are fairly satisfactory in a lowland garden, especially if given a little low-nitrogen fertilizer, but they are not first-rate plants in cultivation. It seems that at present I am the only person who knows of the existence of the other atypical population, though seeds from it will produce excellent garden plants. I will have much to say about these two atypical populations later in this article. In southern Oregon and in Siskiyou County, California, at fairly high elevations, there are populations of *E. klamathense*, which is evidently closely related to *E. montanum*. It survives in my garden and flowers, but I cannot say it thrives.

In California from the southern Cascades to high in the Sierras in Tulare County, there are five species with plain green leaves, all apparently closely related, and each growing in its own separate area. *E. purpurascens, E. pluriflorum*, and *E. pusaterii* are all high-elevation species that likely will not prove good gar-

den subjects. In my garden, *E. purpurascens* has flowered but so far not satisfactorily, and I am still waiting to see what the other two will do. *E. tuolumnense* comes from a fairly low elevation and does so well in the garden that it can be a nuisance by crowding out other plants, but nevertheless it is beautiful. Most clones of this species tend to increase rapidly by producing numerous offsets and rarely set seeds, but recently I bought a clone of unknown origin that reliably sets seeds and seems to produce fewer offsets. This different reproductive behavior of clones within the same species seems to be quite usual in the genus *Erythronium*. It is especially noticeable in the Eastern North American Section, especially with *E. americanum* and *E. albidum*.

E. taylori is a recently discovered species from the same area as *E. tuolumnense* but at a somewhat higher elevation. My plants of the species are still young, but a few flowered for the first time in 2006, and this spring several put up a wonderful display with up to four flowers on a stem. Everyone who saw them in my garden admired them greatly, and I am convinced this new species will become one of the very best *Erythronium* for the garden. The strikingly beautiful flowers are white, with a central area bright yellow, rather like the flowers of *E. helenae*, except that they have white or cream anthers. I noticed with my young plants that some, even before they flowered, had started to form clumps by producing offsets, which suggests a close relationship to *E. tuolumnense*.

In the group with mottled leaves, *E. oregonum* comes first to our attention.

In the Multiform Section, it is in the group with mottled leaves that one finds the greatest complexity. One species seems to require special attention. *Erythronium oregonum* is extremely variable throughout its extensive range from Vancouver Island to northern California, and the many variations seem to group naturally into forms that are somewhat distinct, but are poorly understood and can be confused with other species. Accompanying this article is a photograph (p. 32) for which I posed flowers representative of the two forms most familiar to me. On the left is what I call the "northern form," which has white tepals with a showy reddish nectar guide toward the center on the face of the tepals. This is the form native to Vancouver Island and, with many variations, south through western Washington. In Oregon I have seen the form only quite high in the Cascades. In a patch of these flowers, I like to lift the flowers one by one to admire the vivid colors of the nectar guides, for they are amazingly beautiful creations of nature designed not for our benefit, but for the practical function of guiding bees to the nectar so they will pollinate the flowers. Typically these nectar guides consist of one or two zigzag reddish bars against a yellow background, but they vary greatly, from the showy guide in the flower selected for the photo to a more modest, narrow reddish bar against pale yellow.

On the right in the photo is a form of *E. oregonum* with very pale yellow or cream tepals and a rather modest orange nectar guide, a form found in the Wil-

lamette Valley of Oregon, especially around Corvallis. In Britain, where there are no native *Erythronium* but probably more gardens with this beautiful genus than anywhere else in the world, this pale yellow form is called the "sulphur form," a descriptive name I like. It has been suggested that this is the form that Applegate (1935) named as subsp. *leucandrum,* but Applegate stated very clearly that "this subspecies differs from the species only in having white anthers instead of golden-yellow ones." The sulphur form near Corvallis has anthers that are almost identical in color to the tepals, or sometimes slightly darker. They definitely are not white, and consequently to me the plants are not subsp. *leucandrum*. If one looks at the list of the specimens of subsp. *leucandrum* collected by Applegate, they were found almost entirely in an area from Roseburg on the north to Grants Pass on the south. Unfortunately, I have not been in that area when the *Erythronium* were in bloom, so I have not seen subsp. *leucandrum*, but it seems likely that when I do get there at the right time, I will find Applegate's subspecies.

Still to be considered is the area that was home to Applegate, the Siskiyou region of southwestern Oregon. Undoubtedly Applegate thought of the *E. oregonum* of this region as being the typical species. Unfortunately, it was many years ago that I was in the Siskiyous with the *Erythronium* in bloom, and my memory of them, though helped by photos, is a little hazy, but I will do my best to describe how I believe they differ from the other forms. They are most similar to the northern form, though it seems to me that the tepals were often a less pure white and the anthers were a little paler. The striking difference—at least for the plants I saw—was that the nectar guide was like a burst of orange at the base of each tepal, rather than being reddish bars as in the northern form.

There is one other group of *E. oregonum* I must mention, though they may not be distinct in appearance from Applegate's subsp. *leucandrum*. In the now rather outdated *A California Flora* by Philip Munz (1959), *E. oregonum* subsp. *leucandrum* is given as occurring in Mendocino County and is described as having white anthers. I have not seen that population, but I have a hypothesis that may explain the origin of white-anthered *E. oregonum* both in California and Oregon. Both *E. citrinum* and *E. californicum* have anthers that vary from white to pale cream. In Oregon, wherever a population of *E. oregonum* meets a population of *E. citrinum*, as happens along Eight Dollar Road near Selma, there is a swarm of hybrids. In all probability such swarms have existed for thousands of years. In northwestern California no doubt there have been similar swarms, and though I do not know of any contact between *E. californicum* and *E. oregonum*, past contacts likely would have produced swarms of *E. californicum* × *oregonum* hybrids, many with white anthers. There would likely be introgression of white anthers from the hybrids into the *E. oregonum* populations. I hope that someone working with DNA will test this hypothesis.

For those who would like to look for hybrids, I should mention that the ones on Eight Dollar Road are very easy to miss. *E. oregonum* and *E. citrinum* are both more or less white species that are superficially very similar. One must stop along the road and look very closely at the flowers to see that the *E. oregonum* have wide

stamen filaments and long styles with long, recurved stigma lobes, while the *E. citrinum* have slender filaments and rather short styles tipped by stigmas without lobes or, at the most, with very short lobes. The hybrids, as one would expect, are intermediates, and often have rather deformed stigmas with the three lobes of different lengths.

Keep in mind as you read my descriptions of the forms of *E. oregonum* that I am generalizing about a species with flowers that vary in almost every imaginable way. My main point is to warn those who wander about in the West, especially in Oregon, that *E. oregonum* has different forms, and they should not be confused with other species. More than once I have heard someone identify the sulphur form as *E. citrinum* because its color seems to fit that name, though actually *E. citrinum*, despite its name, is usually more or less white.

Two distinctive species scarcely need describing.

The lovely pink *E. revolutum* is apparently a close relative of *E. oregonum*, and like that species has stamen filaments that are wide toward the base. A plant often sold as "*Erythronium revolutum* 'White Beauty'" has flowers with narrow filaments and therefore cannot be a form of *E. revolutum*; it is obviously a form of *E. californicum*. Note that in the flowers of *E. revolutum*, the stamens tend to cluster closely around the style, rather than spreading apart, as is usual with *E. oregonum*. That trait is important in identifying the flowers of the rare albino *E. revolutum*, if one is fortunate enough to encounter it.

E. hendersonii (p. 31) is an even more distinctive and very beautiful species. What its relationships are I cannot even guess; I'll leave that question to the DNA experts. Its flowers can be described as violet to violet-pink, varying from quite pale to a good, bright color. At their center is a striking, dark purple nectar guide. The style is very short (under 8 mm), the stigma lacks lobes or has very short lobes, the filaments are slender, and the anthers tend to be violet or purple.

Several species in Oregon and California can be easily confused.

Having mentioned the similarity of *E. citrinum* and *E. oregonum*, I must note that in southwestern Oregon and northwestern California there are three species that not only can be easily confused with each other, but sometimes actually do lack clear-cut morphological differences. All of them have mottled leaves, white flowers, white or cream anthers, and narrow stamen filaments. *E. citrinum* and *E. oregonum* can always be distinguished from each other by the different widths of their stamen filaments, but there is often no such clear-cut difference between *E. citrinum, E. californicum*, and *E. multiscapoideum*. Often the flowers of *E. californicum* have showy red nectar guides that make identification easy, provided one remembers that *E. oregonum*, which can have somewhat similar nectar guides,

has wide stamen filaments. It is when *E. californicum* lacks these red markings, which it often does, that identification becomes difficult (photo, p. 30). Generally *E. citrinum* has a rather short style (6 to 10 mm) with a stigma that lacks lobes or has very short lobes, while *E. californium* has a longer style (over 10 mm) with well-developed, slightly recurved stigma lobes, but there can be considerable overlap of these sizes, especially with weak plants of *E. californicum* that have abnormally short styles and short lobes.

Fortunately, a well-developed plant of *E. multiscapoideum* (p. 30) identifies itself by appearing to have two or more scapes or flower stems from a single bulb, a unique trait of this species. Instead of the flower stem (peduncle, if you want to be technical) branching high up into flower stalks (pedicels), it branches below ground, often at the junction of the leaf petioles, to produce two or more apparently separate flower stems. That means that an *E. multiscapoideum* plant with only one flower may be impossible to identify, as it could be an *E. californicum* without a red nectar guide. In summary, it is generally possible to identify *E. citrinum* by its short style and stigma lobes, and *E. californicum* by its longer style and lobes, while strong plants of *E. multiscapoideum* can be identified by what appear to be several flower stems from a single bulb, but there will be some plants that defy identification. Such difficult plants may best be identified by identifying the populations from which they came.

In the same general area as the above three difficult species and the less difficult *E. oregonum,* there are two other, somewhat similar species and a variety that may need a careful look to be identified correctly. I have already mentioned *E. howellii* (p. 48), which looks very like *E. citrinum* except for having a different habit of growth and flowers that lack little ear-like appendages near the base of the inner tepals. Here I can mention an additional reason why I am reluctant to follow the *Flora of North America* in giving up recognition of *E. howellii*. Above, I have described three generally recognized species that tend to lack clear-cut dividing lines between species. With *E. howellii*, in spite of its lack of the little appendages being a rather minor difference to distinguish it from *E. citrinum*, it is at least a clear-cut difference. The other species to be noticed is somewhat farther south in California. On and near Mt. St. Helena, one finds *E. helenae* (p. 31), another white-flowered species with narrow stamen filaments, but it is easily identified by its yellow anthers and a beautiful nectar guide that looks like a large patch of sunshine at the center of the flower.

Some distance to the west of Mt. Shasta is a small area in the mountains hosting *E. citrinum* var. *roderickii*, a remarkable plant that can be readily identified by its white flowers with showy anthers with bright orange-brown pollen. I have raised this beautiful variety from seed, and though my plants are still very young, I am already impressed with them. There is no question that the variety is thoroughly distinct from var. *citrinum*. The anthers of var. *roderickii* are pale pinkish or reddish with a purple tint, and have bright orange-brown pollen, and as soon as the anthers have dehisced it is that bright orange-brown color that one sees. Anther color seems much more significant with *E. citrinum* than with *E. grandiflorum* because the normal anther color of *E. citrinum* is pale cream or white and

there is no fluctuation from that color, except for this one variety. Though my plants are still young, my impression is that var. *roderickii* has a distinctly shorter growth habit than does the typical variety. It has been suggested that this new variety may be just a hybrid between *E. citrinum* and *E. hendersonii,* but I am skeptical. It tends to have a longer style than var. *citrinum*, whereas *E. hendersonii* has a very short style. Perhaps it has *E. hendersonii* in its ancestry, but that must have been far back in time, and evolution has been at work.

As if all of the above did not offer enough of a challenge for the person wandering about in northern California or southern Oregon and trying to identify the many lovely *Erythronium* he encounters, I must mention a very enigmatic population. In 1993 Jim Robinett collected seed in Trinity County, California from a group of *Erythronium* which he described as being "in an area where *californicum* would be expected. However, they displayed the stem-branching characteristics of *multiscapoideum*." I obtained some of that seed, and the plants I raised from it certainly fit Jim's description. They look exactly like normal *E. californicum*, except they branch exactly like *E. multiscapoideum*—at least, most of them do, though a few branch an inch or so above ground level (p. 30). One might think they were simply *E. multiscapoideum* with a few plants careless about branching in the right place, but aside from being quite far from the normal range of that species, some have the red bar in the nectar guide which distinctively identifies *E. californicum*! The probable explanation is that this is an *E. californicum* × *multiscapoideum* hybrid swarm, but hybrid swarms generally occur where populations of two species meet. In this case the plants are in a known *E. californicum* area and a considerable distance west of the known range of *E. multiscapoideum*. In this area the range of *E. multiscapoideum* must extend farther west than has been reported. If anyone knows where Jim found that remarkable population, I hope he or she will write to me (care of the editor) with that information. I would very much like to have a good look at it and at the surrounding area.

Two unusual species require some explaining.

There are two tetraploid species in western North America, and both make excellent garden plants, though neither is well understood. Both apparently originated from the hybridizing of *E. montanum* and *E. revolutum* accompanied by doubling of the chromosomes, and consequently they both tend to have characteristics that are intermediate between the two parent species. Although *E. elegans* was named in 1985 and *E. quinaultense* not until 2001, the latter has been much more clearly described and therefore is more easily understood. I will start with it and come back later to the enigmatic *E. elegans*.

E. quinaultense (p. 28) was named by Geraldine Allen, and in her publication she provided a key identifying the species as having leaves with only a faint trace of mottling and flowers with tepals more or less white near the base, shading to pink at the margins and tips. Unfortunately, the plants often fail to conform to that description. There is no great problem with the leaves, though to my eyes they

often look plain green. In the garden even the flowers generally conform fairly well, but some have the outer tepals more strongly colored, especially on the outer surface, which is the description given in the key for *E. elegans*. For me the serious problem arose when I visited a population of *E. quinaultense* in its natural habitat at about 600 meters (1968 feet) on a north-facing bank beside a logging road north of Lake Quinault in Washington state. It was a rather miserable day with a dense, misty rain falling, but I will not soon forget the beauty of that scene. There must have been a hundred or so flowers on that bank, and except for two paler ones, they were all a beautiful shade of pale pink. Far from having tepals that were white shading to pink at the edges and tips, the flowers were pink with the tepal edges paler (photo, p. 28). No, I had not strayed to the wrong location. I was at a site mentioned in Dr. Allen's paper, and the roads were easy to follow. Furthermore, there is no other species with pinkish flowers and almost plain green leaves except *E. elegans*, and that is found only in northwest Oregon.

My garden had provided a clue that enabled me to understand the reason for what I was seeing. My *E. quinaultense* plants had been grown from seeds kindly sent to me by Dr. Allen some years before she named the species. One precocious plant had bloomed a year before the others, and its undersized flower was a clear pink. The next year a number of the plants bloomed, and all of them, including the precocious one, had flowers that were white except for a little pink along the tepal edges. About then I had to move my garden, and the *E. quinaultense* bulbs did not get into their new home until March. They all flowered in spite of the late move, but all the flowers were a beautiful pink. The following spring they went back to being mainly white. The obvious conclusion seems to be that stress makes *E. quinaultense* flowers pink. The soil on that bank beside the logging road seemed to consist mainly of stones embedded in clay-like soil. Perhaps that or the spring weather subjected those plants to stress and made their flowers pink. Such chameleon flowers present a taxonomic quandary. How can we describe the species when its flower color is changed by its growing conditions and the amount of stress it is under?

Erythronium elegans is an enigmatic species.

E. elegans (photos, p. 27) is a much more difficult problem. Its main population is on the rolling, hilly summit of Mt. Hebo (945 m/3100 feet) in northwestern Oregon, where it is spread over an area of some three square miles, though two small populations are reported from mountains 15 and 25 miles to the south. It was named in 1985 by Paul Hammond and Kenton Chambers, who described it as having flowers varying in color from white to deep rose-pink, and as having leaves varying from plain green to being so heavily mottled as to be almost entirely brown. When I read their paper, I immediately thought that such a varied population sounded more like a swarm of hybrids than a species, and judging from the description, the species involved would be *E. montanum* and *E. revolutum*. I held to that hypothesis until I read that two botanists had counted the

chromosomes of a small number of Mt. Hebo *Erythronium* and found them to be tetraploid. That forced me to change my hypothesis. I thought of how *E. americanum* in eastern North America was believed to have originated as a tetraploid species as a result of the hybridizing of two diploid species, and I decided that one or more of the hybrids on Mt. Hebo must have had a double quota of chromosomes and started a tetraploid population. Otherwise I clung to my hybrid swarm hypothesis, and guessed there would still be diploids in the population. There was one weakness in my idea. I did not know if *E. montanum* and *E. revolutum* could hybridize. It would be unlikely if Applegate's division of the western species into two sections was correct. To test my hypothesis, I crossed the two species in my garden and got more than 50 beautiful hybrids (p. 28).

Since then I have spent several days on Mt. Hebo studying the population. It includes a large number of white-flowered plants which appear to be identical to the *E. montanum* on San Juan Ridge, Vancouver Island, in a similar habitat to that on Mt. Hebo, and at a similar elevation and distance from the sea. Both taxa have plain green leaves, white flowers, long, recurved stigma lobes, yellow anthers, and narrow stamen filaments. I believe, therefore, that the white-flowered plants on Mt. Hebo are *E. montanum*. They are more successful in a garden than the San Juan Ridge plants because Mt. Hebo is much farther south.

For a time I felt rather uncertain of my conclusion that the white-flowered plants on Mt. Hebo were *E. montanum*, as I was haunted by the fact that a small sampling of the population had been found to be tetraploid. One would expect *E. montanum* to be diploid. I am not equipped to do chromosome counts, so I resorted to what I call a "poor man's chromosome count." Using a white-flowered *Erythronium* that I had raised from seed from Mt. Hebo, I forced open a flower just before it would have opened naturally, and removed the anthers to prevent self-pollination. Then I enclosed the flower in a fine-mesh bag, and twice during the next few days, I opened the bag just long enough to dust the stigma with pollen from a San Juan Ridge *E. montanum* (which I am sure are diploid as they can cross with *E. revolutum*). As the plant produced a full capsule of seed, I feel sure it is diploid, which is what one would expect *E. montanum* to be.

The largest proportion of the Mt. Hebo plants have flowers of some shade of pink, and these are very difficult to explain. In the paper in which she named *E. quinaultense*, Geraldine Allen accepted the name *E. elegans* for the Mt. Hebo population, but considerably changed the description of the species from that by Hammond and Chambers. She concluded that the species is tetraploid and must have originated in much the same way as had *E. quinaultense*. She gave a key to distinguish between the two species, in which *E. elegans* is described as having "tepals more or less white to pinkish, the outer ones generally more strongly colored, especially on the outer surface." In contrast, *E. quinaultense* is described as having "tepals more or less white near the base, shading to pink at the margins and tips." She made no specific mention of the white-flowered plants in the *E. elegans* population.

Unfortunately, I have found that the descriptions in Dr. Allen's key do not reliably apply to the plants in nature or in the garden. I have already mentioned

the wild population of *E. quinaultense* in which almost all of the flowers fit the key description for *E. elegans*. Even a few plants of *E. quinaultense* in my garden have the coloration supposed to belong to *E. elegans*. On Mt. Hebo I found the pink-flowered plants to be extremely varied, and could find no distinct group of plants that seemed to fit the description of *E. elegans* in the key. To complicate matters, I found that often when a plant bore two flowers, the most recently opened flower would be almost white while a flower a few days old would have become strong pink. I have often observed that in *E. revolutum x oregonum* hybrids, the pink coloration usually deepens rapidly after the flowers open. That rapid color change makes it very difficult to describe the flowers, as they are not the same from one day to the next. No one can precisely describe the color of the flowers of a species when various influences can change that color, and without a reliable description of *E. elegans*, there is no way of knowing whether all the pink-flowered plants in the Mt. Hebo population are that species, or whether some are simply diploid *E. revolutum x montanum* hybrids, like the ones in my garden.

I am back almost to where I started my investigation of the Mt. Hebo population. I now know it must include some tetraploids we can call *Erythronium elegans,* but I have only a vague idea what they look like. I continue to suspect the population includes diploid hybrids, but I cannot be sure. I have made some progress, because I now know there are a large number of *E. montanum* in the population, and they are a form of that species that does well in the garden, and that is very useful knowledge. Nevertheless, for me the Mt. Hebo population remains the great *Erythronium* enigma.

Hybrids are of great interest and give us information about the parent species.

A byproduct of investigating the *Erythronium* on Mt. Hebo was that I raised from seed a beautiful group of *E. revolutum x montanum* hybrids. I had long been interested in *Erythronium* hybridization, and especially in a phenomenon I had become aware of as a result of reading Applegate's 1935 monograph. In connection with the hybrids that occur in nature where two *Erythronium* species meet, he wrote: "Usually there are unmistakable indications of hybridization. These consist of color changes and various malformations of flower parts."

About the time I read those perceptive lines, I learned about a very interesting hybrid swarm of *E. revolutum x oregonum* at Skutz Falls, not far from where I now live on Vancouver Island. It was almost a two-hour drive from what was then my home, but reaching it was worthwhile, and I spent much time studying those plants. Near the river falls in one direction is hilly, dry-in-summer, rocky land with some impressive patches of *E. oregonum*, and in the other direction is a moist river floodplain with many *E. revolutum*. Near where those two very different habitats met, sometime in the past someone had cleared and leveled a large patch of land, and then apparently abandoned it. Various wild shrubs were growing up on the cleared patch, and among them were hundreds of *E. revolutum x oregonum*

hybrids (p. 31). There was no doubt that Applegate had been right. I found all sorts of interesting malformations among the hybrids. The most remarkable was a hybrid with a rather large, upward-facing, pale pink flower that had the stamen filaments fused to the tepals so the anthers seemed to be growing on the tepals. As Murphy's Law dictated, I found that remarkable flower on a day with pouring rain and was unable to take a photograph. A conspicuous and quite common aberration was a flower with extra tepals. On an average day I would see about half a dozen of those. Less conspicuous and less common were flowering plants that had one very large leaf instead of the usual two. There was one extraordinary flower with two pistils, a large one with four stigma lobes, and a small one with one lobe. None of these extreme malformations occurred year after year in the same plant, though the plants that displayed abnormalities tended always to be somewhat abnormal. Upward-facing flowers were the most common aberration. I must confess that I was somewhat disappointed when a plant which had a showy eleven-tepalled flower one year had a perfectly normal flower the next.

In spite of Applegate's suggestion that malformations were to be expected in hybrid groups, I was a little surprised at the number I encountered at Skutz Falls. However, that swarm of hybrids had obviously been there for a considerable time, and there had been much pollen exchange between hybrids and some backcrossing to the parent species; and I learned from raising my own groups of hybrids that it is just such a situation that produces the greatest number of abnormal plants. Groups of first-generation hybrids that I raised from crossing the two parent species included very few plants with abnormalities.

For the person interested in taxonomy, the occurrence of numerous malformations in a group of hybrids is much more than an interesting natural phenomenon. In the past some taxonomists have suggested that *E. revolutum* and *E. oregonum* are merely two different color forms of the same species. The occurrence of a large number of abnormal plants in the Skutz Falls population proves to me that they are two different species with chromosomes that do not pair up properly in the hybrids.

Erythronium hybridization can be of special interest to the gardener.

For those who wish to produce interesting hybrids in their gardens, the Myrmecochorous Subgenus has little to offer. The four species of the Eurasian Section probably could be crossed with each other, but the species are so similar that the hybrids would not be very exciting. In the Eastern North American Section there are four different chromosome numbers among six species, and as there is little chance of a successful cross between species with different chromosome numbers, there are few possibilities for hybridization in the section. *E. umbilicatum* likely would cross with *E. rostratum*, but with both species so alike, one would scarcely know the offspring were hybrids. *E. propullans* is known to be able to

cross with *E. albidum*, but apparently the offspring are very weak and do not survive for long. In the wild the two species grow together, but there seem to be no reports of groups of hybrids. A report published in 1993 by Thomas Morley, a researcher at the University of Minnesota, described research in which he crossed the two species, collected the seeds, and planted them, but got very poor germination and very poor survival of the offspring, with only two living for any worthwhile length of time. He did get flowers and was able to confirm that the plants were hybrids, but they soon died. Clearly no one is going to do much hybridizing in the eastern section.

Those who want to do exciting hybridizing must go west to Applegate's Subgenus. Even there, the Grandiflorum Section has little to offer, but by accident I did get one splendid plant from an *E. grandiflorum* cross between two of the very different forms that some call varieties. I was trying to grow a naturally small form of *E. grandiflorum* with cream anthers from the Washington Cascades, but I had not been very successful. One plant did flower and produced seeds, and in the hope of having better success with new plants, I collected and planted the seeds. The plants I got from those seeds were a pleasant surprise. Evidently an enterprising bee had carried pollen from one of the large-growing plants with dark red anthers and deposited it on the stigma of the little pale-anthered plant. I lost many of the seedling plants in the recent chaos of moving my garden, but those that survived have started to flower and have turned out to be intermediates between the two different forms. One gives promise of being as large as its pollen parent, and its first flower had anthers of the most brilliant red one could imagine. If it is happier in garden conditions than its seed parent, it should be a very showy addition.

The Multiform Section will always be the happy hunting ground for hybridizers. The possibilities seem almost unlimited. Any two diploid species in the section might cross with each other, but some species have evolved protective barriers to hybridization which may prevent that happening. I have found, for example, that when crossing *E. revolutum* with *E. oregonum*, when I used *E. revolutum* as the seed parent, I got full capsules of seed, but every attempt failed when I tried to use *E. oregonum* as the seed parent. It seems that at least some forms of *E. oregonum* have a barrier to hybridization, and it is possible that even some populations of *E. revolutum* may have evolved a barrier. Hitchcock (1969) reported that he had grown *E. revolutum* and *E. oregonum* intermixed for nearly 20 years and had seen no intermediates. My experience with the two species has been very different. I have already mentioned my observations at Skutz Falls, and every spring I visit the beautiful large garden of friends, where under the trees there are masses of white *oregonum* and pink *revolutum* and a delightful blending of the two produced by thousands of hybrids of various shades of pink. In addition there are small patches of violet *E. hendersonii* and yellow *E. tuolumnense*, and here and there hybrids of each of those with *E. oregonum*. It is interesting that Hitchcock, in commenting on his *E. revolutum* and *E. oregonum* not hybridizing, wrote "for which reason I am inclined to regard them as distinct species rather than geographic races of one." Had he seen the numerous aberra-

tions at Skutz Falls, he would have known that their presence was proof the two taxa were distinct species, even though some populations hybridize readily.

Almost all my hybridizing efforts have been part of taxonomic experiments, so I have much to learn about the possibilities for the activity. I have hybrids in my garden, but most are either the byproduct of an experiment or arrived by accident. I was rather fond of an accidental *E. hendersonii* × *oregonum* cross (p. 32), but I fear I lost it in moving my garden.

The accidental hybrids that have turned up in my garden seem insignificant compared with three that I was shown in a friend's garden. My friend had been there for years and it was a well-established garden when she bought it, so the origin of the *Erythronium* in it is unknown, but it has great numbers of *E. oregonum* and of an especially bright pink form of *E. revolutum*. Recently three especially large *Erythronium* had caught my friend's attention, and she pointed them out to me. They were all somewhat different, but it was obvious from their bright pink flowers with reddish markings near the base of the tepals that they were all *E. revolutum* × *oregonum* hybrids. They were tall, with two or three flowers each, and one of them had the largest leaves I have ever seen on an *Erythronium*. I wondered if they could be polyploids and decided to test them with a "poor man's chromosome count" by applying pollen from each of them separately to three *E. quinaultense* in my garden. All three produced full capsules of seed, so I believe my friend's three remarkable *Erythronium* are all tetraploid. I look forward to seeing what I can grow from the seeds from the three test capsules. The offspring should have genes from *E. oregonum, E. montanum,* and a double allotment from *E. revolutum*. It is an interesting thought that what happened in my friend's garden is the same kind of event, except for one different parent species, as must have happened sometime in the past near Lake Quinault and on Mt. Hebo. If the three remarkable garden plants were in a suitable bit of wild forest land, they could pollinate one another and start a unique new species.

Being an amateur botanist can be a dangerous activity.

I have made one attempt to use hybridization to produce a new garden plant. I had read of a number of hybrid cultivars produced by crossing *E. tuolumnense* with a white-flowered species, and I even had two such cultivars in my garden. I decided to join the throng, but to produce something just a little different, so I crossed *E. tuolumnense* with *E. helenae*. The cross didn't take very readily and I got very few seeds, and only one germinated. However, that one grew up, and now many years later has formed a large clump of bulbs. It won't win any prizes, as the flowers, though a nice bright yellow, are rather small and are widely spaced on tall, lanky stems. Nevertheless, I am fond of my creation; in early March the large leaves, mottled with bright green veining on brown, form the showiest plant in my *Erythronium* garden. The plant had to have a name, and surely it deserved to have a name as absurd as that of any cultivar on the market. Remembering that

one of its parents was *E. helenae*, I decided to call it 'Helen's Baby'. The fact that *E. helenae* was the pollen parent added a nice extra touch of absurdity.

I have found that the most difficult, and certainly the most hazardous, part of being an amateur botanist is getting published. I wrote an article on my discovery that the genus *Erythronium* divides naturally into two subgenera, and in the hope of getting it published, sent it to a botanist who has his own publication. He sent it to another botanist who is senior author of at least three papers on *Erythronium*. The first botanist told me bluntly that my discovery was of absolutely no importance, and he published my article only after deleting all references to subgenera. After I had spent some 15 years doing the research, that was rather crushing. The second botanist commented on my article in an e-mail to someone else, which was passed on to me. In it he wrote that he "found the article of interest" and that he was "totally unaware of the role of ants in moving seeds for some members of this genus." Coming from a person with extensive knowledge of *Erythronium*, I found that very encouraging.

Apparently the botanist who published a shortened version of my article believed that a subgenus does not exist until it has been given a scientific name. As in practice scientific names are generally published in professional botanical journals, which usually do not publish the work of amateurs, he evidently believed that the subgenera could not exist because as an amateur I could not name them, and therefore I should not have written that I had discovered them. By publishing my article with my conclusions deleted, he had in effect invited any professional botanist in need of an important topic for a paper, to name the subgenera based on my information, which would mean that the professional botanist would get credit for the discovery. I contend that with *Erythronium,* evolution has so clearly separated the two groups, there can be no doubt they are subgenera. Also, as I mentioned near the beginning of this article, I am not the first person to suggest that the two groups are subgenera. Shevock et al. (1990) described the two groups as "perhaps corresponding to subgenera," so I was simply proving what had previously been considered a possibility.

I was especially interested in the experienced botanist's statement that he had been totally unaware of the role of ants. It confirmed my belief that an amateur botanist with a garden—providing he or she has basic botanical knowledge and considerable expertise at gardening—can make important contributions to botanical knowledge. No botanist working in a laboratory could have learned what I have learned in a garden, and it would have been virtually impossible for a botanist working in the field to find all the various *Erythronium* species at the right time to observe ants collecting the seeds. My point is that botanists at universities are not the only people who can contribute to botanical knowledge. Those who raise plants in a garden can contribute too. I am confident that in the future every author writing about the genus *Erythronium* will divide it into the two subgenera that were discovered in my garden. That is my garden's contribution to botanical science, though it remains to be seen who gets the credit.

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For many years Art Guppy, who gardens on Vancouver Island of British Columbia, has grown and observed members of the lily family and has carefully studied the genera *Erythronium* and *Scoliopus*. He has made a serious hobby of exploring the gaps in the understanding of these plants reflected in the published literature.

A Few Chinese Alliums

Mark McDonough

Out of an estimated 850 taxa (species, subspecies, and varieties) within the genus *Allium* in the Northern Hemisphere, China ranks as a significant center of speciation, with approximately 150 taxa. Relatively few of those that are endemic to China are in cultivation. Many Chinese alliums are desirable ornamental onions, often of short stature, and with a definite propensity for summer and autumn flowering. Accordingly, I seize opportunities to grow new or different Chinese alliums whenever they arise.

Four years ago I received bulbs of a few Chinese alliums from Chen Yi [a China-based plant supplier; see "The Chinese Grab Bag" by Jim McClements in the Fall 2005 *Rock Garden Quarterly.—Ed.*]. I was eager to give them a try in spite of the likelihood they would be misidentified. Of several bulbs received as *Allium aciphyllum* (the species name indicating it has needle-like leaves 1 mm wide), two different species resulted, both having broad leaves. One has flat, arching leaves ⅝ inch (15 mm) wide, tapering to narrower width at both ends. Florets and pedicels are true red, held in small, few-flowered, rounded heads on stems of 12–14 inches (30–35 cm). It is *Allium prattii*, a variable species also found in Nepal and India, flowering here in July.

The second species has a pair of 2-inch (5-cm) wide hosta-like leaves, keying to *Allium ovalifolium*. The stem is shorter, to 8 inches (20 cm), with white florets in July following *A. prattii*. Both species inhabit high mountain forests, scrub, and meadows in moist situations. In the garden they prosper in bright open shade, in sandy humus-enriched soil, with regular watering.

A second Chen Yi allium came as *A. songpanicum*. However, its true identity is unmistakably *A. mairei*, a delicate species familiar in cultivation, although usually under the synonymic names *amabile* and *yunnanense*. This modest onion has fine thready foliage; in August it throws 6- to 8-inch (15- to 20-cm) stems that splay outward, each sprouting 3 to 7 tiny white trumpets speckled pink inside, doing a fair impression of a small *Lloydia*. It is reported to have pink to purple flowers, and lovely pale pink to near white forms seem prevalent in cultivation, as with the subject plant. For an open shady spot or choice niche, *A. mairei* can provide an August vignette that is sure to please.

The last from Chen Yi came labeled as *Allium cyathophorum*, the rare "type plant," not to be confused with the variety *farreri*, so ubiquitous an impostor in cultivation. Consistent with the other Chen Yi alliums, the identification is certainly incorrect. The deep green leaves are flat, to 5 mm broad, fairly short and arching gracefully. The flower head atop a 9-inch (22-cm) stem has the disposition of a stiff fireworks burst, an irregular few-flowered arrangement of starry, light purplish-blue florets with exserted stamens. It comes closest to *Allium henryi* according to the online *Flora of China* botanical keys.

For a much better blue-flowered species, none can surpass *Allium beesianum*, a species endemic to China that has enjoyed cultivation for decades, yet is frustratingly difficult to secure true to name. The fine-leaved upright clumps are attractive all season; the nodding buds appear months ahead of their opening, telegraphing their eventual arrival in late August and throughout September. The drooping true blue flowers have stamens shorter than the tepals, thus not protruding as in "the other" familiar blue Chinese allium, *A. cyaneum*, with which *A. beesianum* is frequently confused. The individual florets are rather large, 11–14 mm long, compared to yet another blue-flowered Chinese allium with which it gets confused, the rather similar *Allium sikkimense*, which has smaller flowers (6–10 mm). All of these species are refined onions for late summer or early autumn blue color in the rock garden.

From Darrell Probst, the "Epimedium Man," come a few interesting alliums originating from his botanical explorations in China. My favorite by far is *Allium listera*, one of the handful of whimsical alliums with hosta-like foliage, this one coming into bloom late July. I grow this next to several small hosta varieties, and whenever I quiz visitors as to the identify of the plant, even when it is in bud, none have guessed correctly that it is an allium, all believing it to be a hosta. This year my plant produced five flowering stalks, to 16 inches (40 cm) tall, with open globes of tiny white florets, green ovaries, and lavender-pink pedicels. The pastel color of the pedicels lends a magic quality to the modest bloom heads. It's equally fun in the spring when the new foliage unfurls with a shiny waxy texture, imbued a strong ruddy brown-red color, looking fleshy and improbable.

Once available from Collector's Nursery is a species that keys to *Allium hookeri var. muliense*. It's a refreshing color break in a genus dominated by pink and lavender hues: its small but brilliant yellow heads of bloom appear in late July and into August, topping 24–30 inch (60–75 cm) stems. The foliage is broad, long, numerous, and neatly arranged, giving the impression of a small, well-behaved daylily rather than an onion. Thus far it has not set any seed, so I worry about how long it will persist in my garden.

Another beautiful onion that is unfortunately mired in confusion is *Allium macranthum*, the species epithet referring to its large flowers. The species is native to China, Bhutan, and Sikkim. My plant is from seed distributed in 1990 from plants collected in Bhutan, proof that it can be long-lived in the garden even if it has never set seed here in all those years. The flower color is reportedly variable, from deep red-purple to rose, although paler shades occur too. Above leafy clumps of grayish, channeled foliage appear stems 18–24 inches (45–60 cm) tall,

with informal mops of drooping flowers in late July and August. The large, opalescent flowers remain in a closed oval shape (hence one if its synonyms, *A. oviflorum*), with the filaments just poking through the white pink-tinged tepals. The flowers age deeper pink, and finally to a ruddy purplish color. Happiest when growing in full sun in good garden soil with adequate water, the type of position I currently grow it in, it has persisted and flowered in a much shadier location previously. In cultivation, the plant is invariably confused with the North American nodding onion, *Allium cernuum*. While it is true both have nodding flowers, the stems of *A. macranthum* are not nodding or crooked as they are in *A. cernuum*. The foliage is rather different too: distinctly channeled (V-shaped in cross-section) in A. macranthum, while in the nodding onion the leaves are basically flat, or slightly convex-concave or keeled in cross-section.

In discussing Chinese alliums, I would be remiss in not mentioning *Allium senescens*, and in particular *Allium nutans*, two well-known rhizomatous onions from China and adjacent regions. They are the major ingredient in a two-decades-long hybridization effort and selection process in my garden. These plants are better thought of as garden perennials than as bulbs, with handsome clumps of silvery or dusty gray to shiny green leaves all season long, often spiraling and twisting in one direction to amusing effect. They are extremely long-lived, relishing full sun and good drainage, but not really fussy as to soil or moisture, even taking a good deal of shade, prospering in most any situation.

As with other Chinese alliums, the tendency for these two species and their hybrids to fill the late summer and early autumn months with a profusion of bloom is a tremendous asset for any garden. The flowers present themselves in an infinite variety of spheres and hemispheres, of various heights, diameters, density, and disposition, and of course color, from white to rose to purple, and all shades in between. They have two back-to-back seasons of interest: the developing bud stage for a month or more, and the true flowering stage. The former stage is far more interesting, lasting a very long time, with evenly spaced buds shot out from the center like perfect firework blasts frozen in time, the color on the backs of the tepals often intense and highly saturated. When the buds open, the mixed colors of the other floral parts—the stamens, pistils, ovaries, and interior of the tepals—can either diminish or enhance the floral effect.

Alliums are nectar-bearing plants, powerfully intoxicating to insect life, so a garden full of alliums is one full of buzzing bees, butterflies, moths, and nectar-feeding wasps, all in astonishing profusion. A garden graced with Chinese alliums, or alliums from other parts of the world, can fill the hot summer and temperate early autumn months with texture, color, aroma, beneficial insect life, sound and movement, and visual felicity. What more could one ask?

Mark McDonough gardens in Pepperell, Massachusetts. His great enthusiasm for the genus *Allium* has drawn many gardeners to the ornamental onions during recent decades. He co-authored the chapter on North American *Allium* species in the NARGS/Timber Press book *Bulbs of North America*.

The Geoffrey Charlesworth Writing Prize

Geoffrey Charlesworth has been a frequent contributor to this journal over many years. His essays have been collected in his books *The Opinionated Gardener* and *A Gardener Obsessed*. The distinctive gardens, rich in thousands of species, that he and the late Norman Singer made at their home were famous among plant enthusiasts, many of whom were able to visit there on tours associated with NARGS meetings.

He has generously endowed a fund to provide an annual prize for the best article published during the preceding year in the *Rock Garden Quarterly*. The Geoffrey Charlesworth Writing Prize will be awarded by a panel of judges to be appointed by the NARGS president and will consist of $100 worth of books to be selected by the winner from the catalogue of the NARGS Book Service. The only limitation is that the prize shall not be awarded to the same person in two consecutive years.

We thank Geoffrey for recognizing the importance of good writing about rock gardens and their plants. The first annual award will be given to an article published in the 2007 volume and will be announced at the 2008 annual general meeting.

NARGS Annual Meeting 2008

June 12 – 15, 2008

Ottawa, Ontario - Canada's Capital

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Speakers

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Michael Runtz, Field Naturalist, Photographer & Author
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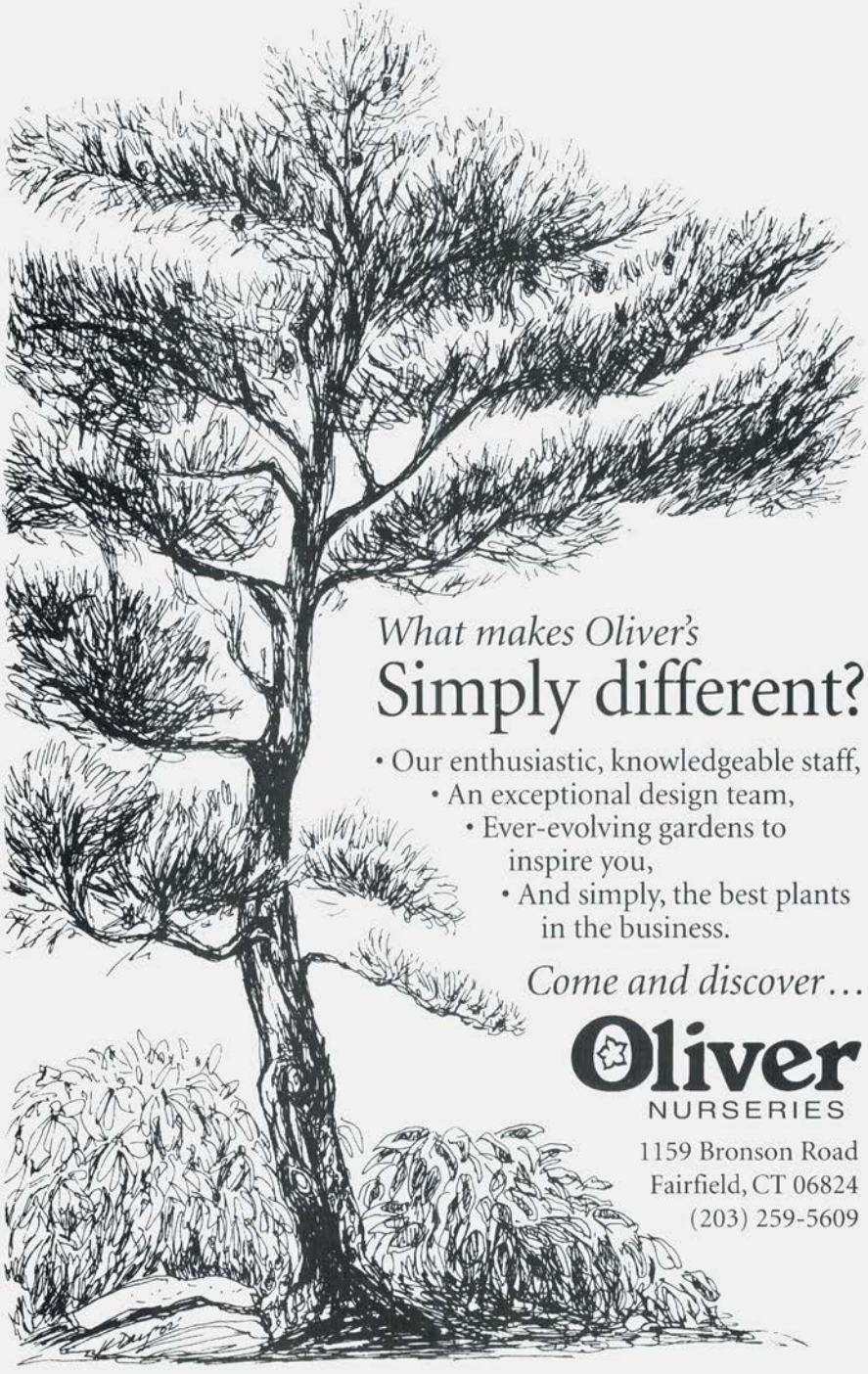
NARGS Coming Events

Western Winter Study Weekend: February 29–March 2, 2008. "Plant Treasures for the New Millennium." Hosted by Alpine Garden Club of British Columbia. Delta Richmond Inn, Richmond (near Vancouver), B.C. Registrar: Moya Drummond, 3307 W. 6th Ave., Vancouver, BC V6R 1T2; 604-738-6570; moyadrummond@shaw.ca

Eastern Winter Study Weekend: March 28–30, 2008. Hosted by the Berkshire Chapter. Marriott Hotel, Farmington, CT (near Hartford). For details, visit www.nargs.org.

2008 Annual General Meeting: June 12–15. Ottawa University, Ottawa, Ontario, with field trips to unique vegetation communities. Hosted by Ottawa Valley Chapter. Registrar: Randy Mason, P.O. Box 9504, STN-T, CSC, Ottawa, ON, Canada K1G 3T7.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Recent Books by NARGS Members

Cutting Edge Gardening in the Intermountain West, Marcia Tatroe and Charles Mann. Johnson Books. Basic introduction to designing, planting (including plant selection) and maintaining gardens in the Intermountain area. Chapter on rock gardens applicable to many areas. 224 pp. **$24.00**

Prairie Plants of the University of Wisconsin–Madison Arboretum: Including Horsetails, Ferns, Rushes, Sedges, Grasses, Shrubs, Vines, Weeds, and Wildflowers, T. Cochrane, K. Elliot and C. Lipke. University of Wisconsin Press. The Arboretum is a pioneer and leader in preservation and restoration of native Midwest prairies since the 1930s. This guide illustrates and describes more than 360 species on the Arboretum prairies and found throughout the upper Midwestern U.S. and adjacent southern Canada. 365 pp. **$30.00**

Chasing Wildflowers, Scott Calhoun. What can possess a man to drive across state lines, mountain ranges, and international borders with little more than a ragged guide book, an old map, and a wild look in his eyes? Wildflowers! Join Scott on his adventure through the southwestern U.S. and northern Mexico searching for elusive wildflowers. 128 pp., 36 color photos. **$14.00**

New from Timber Press

Bringing Nature Home: How Native Plants Sustain Wildlife in Our Gardens, Douglas W. Tallamy. Accelerating habitat disruption by development pressures on wildlife populations. When native plant species disappear or are replaced by exotics, insects disappear, impoverishing the food source for birds and other animals. Learn how to reverse this trend and sustain biodiversity by favoring native plants. 280 pp., 308 color photos. **$17.00**

Viburnums: Flowering Shrubs for Every Season, Michael A. Dirr. With abundant flowers, handsome foliage and fruits, and robust constitution, viburnums are versatile hardy shrubs. A wealth of information on species and worthy cultivars, plant height, spread, foliage, habit, floral characteristics, fruits, special traits such as fragrance or attractive bark, hardiness, origin, cultural needs, and overall garden appeal. 264 pp., 424 color photos. **$32.00**

Impatiens, The Vibrant World of Busy Lizzies, Balsams, and Touch-me-nots, Raymond J. Morgan. The genus *Impatiens* comprises 1000+ species, many, although highly desirable, little known to Western gardeners. Physiology, morphology and seed dispersal mechanisms. Over 200 gardenworthy species from widely diverse habitats. 288 pp., 162 color photos. **$24.00**

N·A·R·G·S BOOK SERVICE

Basic Books on Rock Gardening

The Crevice Garden and Its Plants, Zdenek Zvolanek. Alpine Garden Society. Crevice gardens, long used by Czech gardeners, are becoming popular elsewhere. This small book provides basics for building, selecting plants, and planting natural-looking features. 68 pp. **$12.00**

Rock Garden Plants: A Color Encyclopedia, B. Mineo. Timber Press. **$48.00**

Creating and Planting Alpine Gardens, R. Murfitt. **$18.00**

Creating and Planting Garden Troughs, J. Fingerut and R. Murfitt. **$18.00**

Rock Garden Design and Construction, McGary, ed. Timber Press **$23.00**

Handbook on Troughs, NARGS. **$5.00**

Rock Garden Handbook for Beginners, NARGS. **$5.00**

Alpine Plants: Ecology for Gardeners, John E. G. Good and David Millward. Timber Press **$28.00**

Natural Stonescapes: The Art and Craft of Stone Placement, Dube and Campbell. Storey Press. 176 pp. **$20.00**

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