

ROCK GARDEN *Quarterly*



Volume 62 Number 4

Fall 2004

Front cover: *Arisaema triphyllum* in fall. Painting by Diane Crane

Back cover: *Leiophyllum buxifolium* on Grandfather Mountain, North Carolina; photo by Dick Redfield

All material copyright ©2004 North American Rock Garden Society
Printed by Allen Press, 800 E. 10th St., Lawrence, Kansas

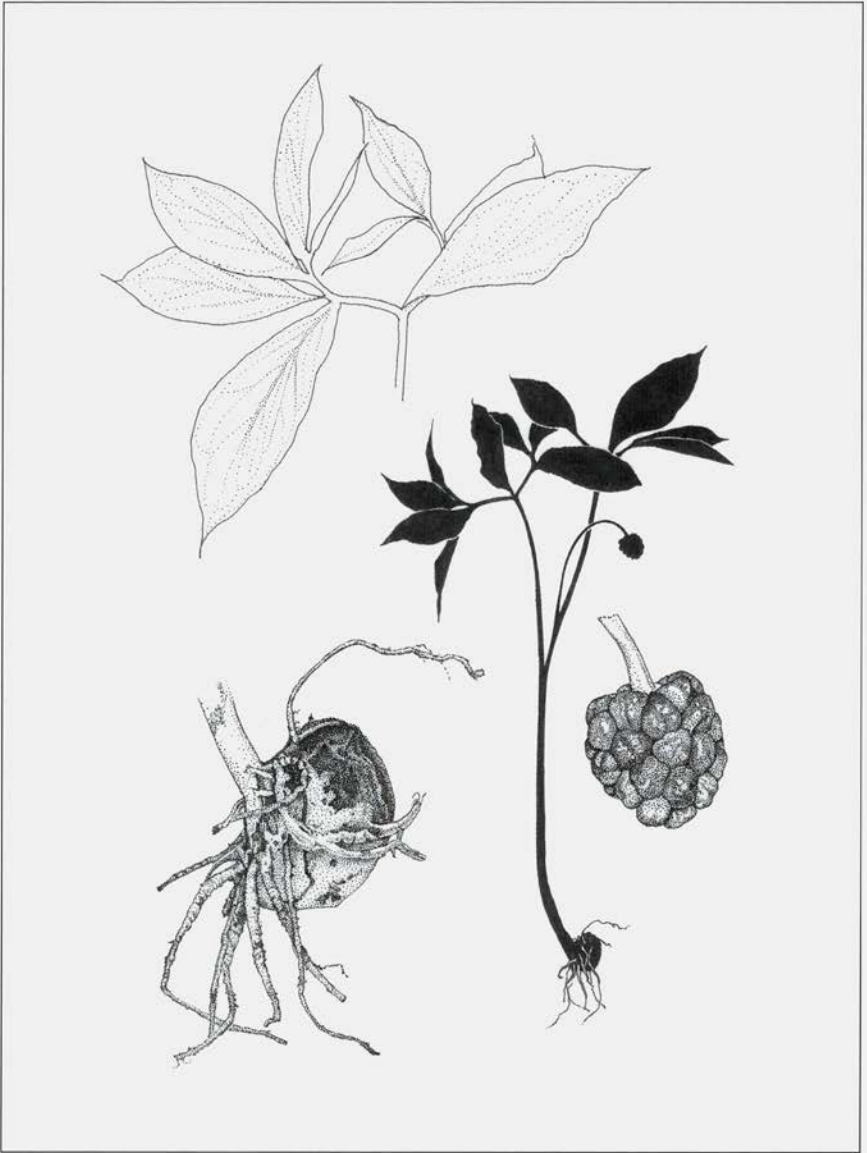
ROCK GARDEN *Quarterly*

BULLETIN OF THE NORTH AMERICAN ROCK GARDEN SOCIETY

Volume 62 Number 4 Fall 2004

Contents

A Review of <i>Biarum</i> : Small Aroids of the Mediterranean, PETER BOYCE	244
<i>Arisaema triphyllum</i> : Great Variation Under One Name, MICHAEL SLATER	254
About the Artist: JEAN LECLUYSE	257
<i>Pinellia</i> , MARGE TALT	258
A Miscellany of Aroids, JOHN GRIMSHAW	262
Reticulata Irises: Creating a Rainbow, ALAN MCMURTRIE	266
Rock Gardening in Southern Ontario, ANNA LEGGATT & ANDREW OSYANY	291
NARGS NATIONAL AWARDS	
Le Piniec Award: Dan Hinkley	293
Award of Merit: Bobby J. Ward	294
Award of Merit: Charles Griffith	295
PLANT PORTRAITS	
<i>Arisaema dracontium</i> , Gene Bush	297
<i>Arisaema consanguineum</i> , Ellen Hornig	298
<i>Podophyllum delavayi</i> , Jim McClements	300
<i>Dudleya nesiotica</i> , Jack Muzatko	301
Annual Index	315



Arisaema flavum. Drawing by Jean LeCluyse.

From the Editor

Once again the cover artist's work has inspired the focus for an issue of the *Rock Garden Quarterly*. For fall, Diane Crane chose to depict the colorful fruit of the widespread native North American aroid *Arisaema triphyllum*, a favorite with those who do at least part of their rock gardening in the shade. The well-known variability of this plant is discussed in Michael Slater's article in this issue.

There are other aroids in our rock gardens, some well known and some unfamiliar to most North American gardeners. I particularly sought information on a favorite small aroid adapted to sun and drought, *Biarum*, and was fortunate to elicit an article from an expert on the genus, Peter Boyce, whose review leads off this issue. Marge Talt contributed comments on the small, *Arisaema*-like genus *Pinellia*, another woodland specialist. John Grimshaw, well known for his wide-ranging plant exploration and expertise with bulbs, addresses several of the smaller genera.

To help readers through these articles, here is a brief glossary of botanical terms applied to aroids, particularly to their remarkable inflorescences. Jean LeCluyse's drawing (p. 242) helps to elucidate these.

Tuber: the enlarged subterranean storage organ, loosely called the "bulb."

Petiole: the "stem" of a leaf.

Blade: the broad part of a leaf.

Inflorescence: the entire floral structure, including the spathe and spadix (see below).

Peduncle: the stem that supports the inflorescence.

Spathe: the hoodlike or leaflike outer part of the inflorescence.

Tube: The lowest part of the spathe, typically cylindrical.

Throat: The part of the spathe just above the tube, often constricted.

Limb: The expanded part of the spathe above the throat—the showy part of the inflorescence in most species.

Spadix: The spike-shaped central part of the inflorescence, on which the tiny true flowers are situated. Depending on genus and species, an individual plant's spadix may have separate sections of male and female flowers, or flowers of only one sex.

Appendix: A narrower portion at the top of the spadix, without flowers; may produce scent or generate heat. Some *Arisaema* species also have long appendices on the leaves, known as "drip tips."

A Review of *Biarum*: Small Aroids of the Mediterranean

Peter Boyce

Introduction

The genus *Biarum* Schott comprises 20 species of dwarf tuberous-stemmed herbs which occur in semi-arid and seasonally dry areas of southern Europe, North Africa, and the Near and Middle East. The genus's center of diversity is the Middle East, where 75 percent of the species occur as endemics.

Biarum species have a strongly seasonal growth regime; the plants begin growth in late summer or early autumn with the onset of winter rains and continue into late spring, when they become dormant with the onset of summer heat and drought. The majority of species blossom in autumn and early winter, and this, together with the often striking appearance of the inflorescence, has resulted in growing popularity of *Biarum* species among alpine garden enthusiasts.

All *Biarum* species have a tuberous stem (or in common growers' parlance, a tuber) with a relatively thin, somewhat papery skin. There are two types of roots, contractile and feeding. At the beginning of the growth season, the plant produces a small number of relatively thick, unbranched roots from the shoot base. These roots generally go down straight into the soil, anchoring the tuber, which has spent the previous four or five months rootless and thus insecure. Once the tuber is in a firm position, the much finer feeding roots start to develop. The feeding roots do not necessarily grow downward but instead form a dense mat, perhaps in response to the heavy but short-lived rains common in the areas where many species grow. The root mass is also doubtless very effective in taking up nutrients from the sparse soil in rock crevices and on stony hillsides, or when the *Biarum* is competing with other actively growing plants. Toward the end of the growth season, the feeding roots start to wither as the soil begins to dry out. At the same time, the tough central core of tissue inside the spongy contractile roots begins to contract. By this time, the root tip can be half a meter (20 inches) below the soil surface and is well secured, and so the new tuber that has formed during growth is pulled down more deeply, bringing it to approximately the same depth as the parent tuber was at the beginning of the growth period. This protects the tuber from undue heat and dryness during the dormant phase.

The main growth point (from which the above-ground parts emerge in fall) is central on the upper surface, either slightly raised or in a shallow depression. The growth is subtended (surrounded from below) by a single prophyll and a number of papery cataphylls—i.e., two layers of reduced leaf structures (similar structures are familiar at the base of *Crocus* leaves and flowers). On expansion the prophyll, the cataphylls, and the tuber apex are coated with a waxy, mealy substance. The leaves of the various species range from linear to spatulate and appear from late winter to early spring, their bases protected by a few cataphylls that are at first fleshy and later papery.

The inflorescence is typical of the Araceae, with the spathe divided into two regions: an upper, free, basically ligulate (strap-shaped) spathe limb, and a lower, cylindrical to globose spathe tube enclosing the true flowers. While the form of the spathe limb is important in species identification, it is the features of the spathe tube that are central to the classification of the genus—in particular, the degree of fusion of the spathe tube margins.

The spadix bears fertile flowers toward the base and a sterile appendix above. In all *Biarum* species, the fertile female flowers are borne in a hemispherical to weakly cylindrical cluster at the base of the spadix, while the fertile male flowers are carried in an oblong to cylindrical cluster approximately 1–2 cm above this. The fertile flowers are always separated by an interstice, which is usually provided with sterile flowers in the form of bristles or hooked structures, but is occasionally devoid of any floral traces. In some species, a further zone of fertile flowers is situated above the male flowers at the base of the sterile appendix. The form of the sterile appendix is useful in determining species. In many it is cylindrical or fusiform (spindle-shaped), but in a few taxa it is hairlike or stout-conical. All species but *Biarum ditschianum* have a naked appendix at the tip of the spadix; in that species, the base of the appendix is clothed with adpressed (lying flat against the appendix) to slightly prominent, transparent processes.

Biarum infructescences (“fruits” in common usage) are dense, globose to hemispherical heads of leathery berries carried at or partially below ground level. The berries ripen pale purple or grayish, and each contains a single leathery seed with a large oily caruncle at one end, which presumably attracts insects or other animals that distribute the seed away from the parent plant.

Classification

Biarum is divided into two subgenera: *Biarum* and *Ischarum*. Subgenus *Biarum* is defined by having anthers with thecae (pollen sacs) dehiscent by ventral, longitudinal slits; a beaklike connective structure that extends beyond the anther; and hooked, rarely peglike or filamentous staminodes (stamenlike structures without anthers) that are mostly present above and below the male flower zone and only rarely present below only the male flower zone. There are two species in this subgenus: *B. tenuifolium*, the most commonly cultivated *Biarum* species, and *B. rhopalospadix* (often cultivated under the synonym *B. spruneri*).

The other subgenus is *Ischarum*, in which the anthers have thecae dehiscing by apical pores (openings on the tips) and a connective structure barely prominent or flush with the anther surface. Staminodes, where present, are filamentous and occur below the male flower zone.

The Species

1. *Biarum tenuifolium* (L.) Schott

Biarum tenuifolium is a widespread and variable species with discrete populations throughout the Mediterranean. For convenience, it can be divided into no fewer than six distinct subspecies.

The typical subspecies, subsp. *tenuifolium*, has a long-exserted, slender spadix appendix and densely arranged, well-developed, simple, curving staminodes. Early in the growing season, its leaf blades are elliptic-lanceolate; later-emerging leaves are linear-lanceolate. In immature plants, the leaf blade is always elliptic-lanceolate. The typical subspecies occurs from southern Italy to the southern Balkans and is the common *Biarum* in mainland Greece.

Two subspecies occur in the Iberian Peninsula: subsp. *arundanum* and subsp. *galianii*. Though clearly defined by their ecological requirements—subsp. *arundanum* a plant of terra rossa soils (reddish-brown residual soils over limestone bedrock), while subsp. *galianii* is restricted to loose sandy soils—they are difficult to separate morphologically in the absence of ecological data. Subsp. *arundanum* has the staminodes always strictly whorled, but they are irregularly scattered in subsp. *galianii*.

Subsp. *arundanum* is widespread in southwestern Spain, occurring in the regions of Cádiz, Córdoba, Granada, Málaga, and Seville, and is often extremely abundant, forming extensive colonies alongside cultivated land and beside paths; it is also found in southern Portugal, Gibraltar, and northern Morocco. The freshly opened spathe emits a particularly offensive odor similar to cattle dung. Subsp. *galianii* occurs in the Spanish regions of Badajoz and Huelva near the Portuguese border, where it is restricted to loose sandy soils.

The central Mediterranean is home to subsp. *abbreviatum*, which is distinguished by erect, short spatulate leaves, usually with undulate (wavy) to rarely somewhat crispulate (slightly curled) margins. The spathe limb averages 9 by 1.5 cm in size and is notable for its bicolored interior, deep purple-brown below with a striking green apical (upper) portion. The spadix appendix is generally only slightly longer than the spathe limb and rather broad compared with its length. The staminodes are rather poorly developed and peglike. Subspecies *abbreviatum* occurs in Italy (where it has been called *B. cupanianum* Guss. ex Paglia), Yugoslavia, the former Yugoslavian Republic of Macedonia, northern mainland Greece, and Corfu. It has yet to be recorded from Albania, where the typical subspecies occurs, but the presence of subsp. *abbreviatum* to the south of Lake Ochrid, close to the Albanian frontier, suggests that it does occur there.

Subsp. *idomenaeum*, from Crete, is notable for its strongly undulate-crispulate leaves that are closely adpressed to the ground. The spathes are generally similar in size to those of subsp. *abbreviatum*, but the staminodes are densely arranged and slender.

The easternmost subspecies, subsp. *zelebori*, is distinguished by large, bulky inflorescences, with the spathe limb averaging 20 by 3 cm, as well as by a robust, moderately exerted spadix appendix and rather sparse but substantial staminodes. The leaves do not display the marked heteromorphy (different shapes in early and late leaves) found in the typical variety, and the leaf blade is spatulate-lanceolate, often with gently undulate margins. Subspecies *zelebori* is restricted to southwestern Turkey, Rhodes, Cos, and a few scattered sites on Crete.

2. *Biarum rhopalospadix* C. Koch

The hitherto obscure, but prior name *Biarum rhopalospadix* must now be used for what had been known as *B. spruneri*. *Biarum rhopalospadix* is superficially similar to *B. tenuifolium*, especially to subsp. *abbreviatum*. It may be readily distinguished by its lack of staminodes, the stigma borne on a short style, the narrow, parallel-sided spathe limb, and the considerably stouter spadix appendix. The spring-flowering pattern is also useful in distinguishing *B. spruneri* from the majority of the Greek mainland populations of *B. tenuifolium*. To date, *B. rhopalospadix* has been found only in southern Greece (Attica, the Peloponnese), where it grows on terra rossa in grazed fields, open hill slopes, abandoned olive groves, and field margins at elevations up to 450 meters (1460 feet).

3. *Biarum carduchorum* (Schott) Engler

Biarum carduchorum is fairly widespread, occurring from southern and southeastern Turkey to southern Iran on bare terra rossa hill slopes, in open situations, field margins, and long-fallow fields up to 2750 meters elevation (9020 feet). It is most readily separated from *B. angustatum* by the upward-directed staminodes and the considerably wider leaves; in addition, *B. carduchorum* is found farther inland than *B. angustatum*.

4. *Biarum angustatum* (Hook.f.) N.E.Br.

This large-flowered species, although fairly common in the wild, is decidedly rare in cultivation. *Biarum angustatum* is outwardly very similar to *B. carduchorum* when in flower but is easily distinguished by the downward-directed staminodes and narrower leaves. Another point of separation concerns the distribution of the two species. *Biarum angustatum* is essentially a "coastal" species, restricted to Syria and Israel on terra rossa in open, grazed, sometimes almost completely bare fields up to 350 meters elevation (1148 feet), while *B. carduchorum* is an inland and not infrequently upland species, distributed from southeastern Turkey and northwestern Syria through Iraq and into Iran.

5. *Biarum aleppicum* Thiébaud

Biarum aleppicum is related to *B. carduchorum* and *B. angustatum* but is readily dis-

tinguished by having the spathe tube margins free almost to the base and by the sessile stigmas. Plants of *B. aleppicum* individually carry many more leaves than either *B. angustatum* or *B. carduchorum*, although the leaf shape approaches that of *B. angustatum*. In the wild it is restricted to northeastern Syria, where it is a rare plant. It has nonetheless proven comparatively easy to grow, although to my knowledge it is currently grown only in a few botanic gardens.

6. *Biarum eximium* (Schott & Kotschy) Engler

Biarum eximium differs from all other species of subgenus *Ischarum* in that the staminodes are evenly distributed over the entire length of the interstice between the male and female flower zones. The spathe is very broad, almost oblong. For a long time *B. eximium* was considered to be restricted to southern Turkey, but recently populations have been discovered in Jordan.

7. *Biarum crispulum* (Schott) Engl.

Biarum crispulum has been almost universally treated as a synonym of *B. bovei* despite being readily separable by its narrow, incurved, and heavily crispulate spathe margins, and a spadix appendix smelling of sour milk (as compared with the dung odor in *B. bovei*). This is the commonest *Biarum* in northwestern Syria, forming extensive colonies in bare red soil to the north of Aleppo, and it is widespread in the provinces of Adana and Hatay in southern Turkey and in northern Syria. There is also a western extension to Cappadocia.

8. *Biarum bovei* Blume

Biarum bovei has been confused with *B. kotschyi* and *B. pyrami*. Part of the trouble appears to stem from the scarcity of true *B. bovei* in cultivation: most plants being grown under this name are *B. dispar* (some are *B. crispulum*), and confusion with the Afro-Iberian *B. dispar* has led to the belief that *B. bovei* is consistently variable throughout its range when, in fact, the variation has a clear geographical basis. For distinctions, see the next entry. The true *B. bovei* is very little cultivated.

9. *Biarum dispar* (Schott) Talavera

This interesting species (photo, p. 273) has been much confused with the closely allied *B. bovei* from the eastern Mediterranean. It can be distinguished readily by the interstice, which is approximately twice as long as the staminate flower zone, by the presence of fewer and more scattered staminodes, and by the narrower mature leaf blade. The overall size of the inflorescences has been used previously as a diagnostic feature, *B. dispar* having a smaller inflorescence than *B. bovei*. While this appears to be true for the North African populations of *B. dispar*, it does not necessarily hold true for Spanish populations, which are often as large as, if not larger than, typical *B. bovei*. However, part of the apparent size overlap between the species appears to be due to confusion with a previously overlooked species, *B. mendax*, which displays dimensions in excess of both *B. dispar* and *B. bovei* and is readily separable from either.

10. *Biarum olivieri* Blume

Biarum olivieri is a curious species that, although allied to *B. bovei*, *B. dispar*, and *B. crispulum*, is separable by its linear to linear-lanceolate leaves, its much thinner, almost papery spathe texture, its fully connate (united) spathe tube margins, and its filamentous spadix appendix. The floral odor produced by *B. olivieri* is also distinctive: both *B. dispar* and *B. bovei* produce a dunglike odor which, although unpleasant, is not nauseating; *Biarum olivieri* produces a disgusting smell of sour milk when in blossom, similar to but considerably stronger than that produced by *B. crispulum*. The habitat favored by *B. olivieri*, consolidated sand, is quite different from the heavy red terra rossa favored by *B. bovei*, *B. dispar*, and *B. crispulum*.

To date *B. olivieri* is known from only three wild locations. The original locality is an area of sub-coastal sands on the Egyptian coast, where it forms extensive colonies in association with *Arisarum vulgare* Targ.-Tozz. and *Eminium spiculatum* (Blume) Schott. A second, more recently discovered site is in the Negev Desert in southern Israel; and in 1995 Chris Lovell collected *B. olivieri* in Jordan on the road from Ibría to Rauble.

11. *Biarum straussii* Engler

The distinctive appearance of *Biarum straussii* in flower—the inflorescence emerging from the middle of a mature leaf rosette—leaves little chance of confusing it with any other species, except perhaps *B. syriacum*, from which it differs by the much broader leaf blade. Confusion might occur with species of *Eminium*, especially with the entire-leaved forms of *E. intortum*, but the entirely free spathe margins and different arrangement of the staminodes in *Eminium* should readily separate them. In the sterile state, however, *B. straussii* is quite similar to *B. bovei*, and they are often confused in herbaria.

12. *Biarum syriacum* (Spreng.) H.Riedl

If its unusual spring flowering period is ignored, *Biarum syriacum* would appear, on the basis of floral morphology, to be related to *B. bovei* and *B. kotschyi*. The rather oblong spathe tube and the arrangement of the staminodes are similar to those of *B. bovei*. However, the foliage of *B. syriacum* is quite different and, in fact, no other species of subgenus *Ischarum* has similar clumps of grassy leaves. *Biarum syriacum* is restricted to the seasonally dry clay plains in northern Syria, where it is rare.

13. *Biarum carratracense* (Haenseler) Font Quer

Biarum carratracense (photo, p. 273) has been associated with *B. bovei* and *B. tenuifolium* but is quite clearly distinguishable from either. The oblong, slightly inflated spathe tube with the margins connate for over half their length and the fusiform spadix appendix suggest an affinity to *B. kotschyi* and *B. fraasianum*, although *B. carratracense* is geographically isolated from either species. Vegetatively, *B. carratracense* would appear to be closest to *B. kotschyi*, which has a similar lanceolate-elliptic leafblade; however, *B. kotschyi* has the petioles free to the

ground whereas in *B. carratracense* the petiole bases are often imbricated to form a weak pseudostem. Further, the staminodes are far fewer in *B. carratracense* than in *B. kotschyi*; some material of the Spanish species almost lacks pistillodes except for a couple of vestigial bristles on the upper part of the interstice. To date, *B. carratracense* has been found only in southwestern Spain, where it is common in dry mountain pastures, field margins, and tracksides in terra rossa soils.

14. *Biarum kotschyi* (Schott) B.Mathew ex H.Riedl

Biarum kotschyi can be regarded as intermediate between *B. bovei* and *B. pyrami* on the basis of the shape of the spathe tube, spadix appendix, staminodes, and foliage. *Biarum kotschyi* and *B. carratracense* are also similar in their rather slender spathe limbs, fusiform spadix appendices, and arrangements of the staminodes, but they can be readily distinguished by the degree of connation of the spathe tube margins (three-quarters free in *B. kotschyi*, half free in *B. carratracense*) and by their distinct geographical distributions.

Biarum kotschyi is a common species in parts of southeastern Turkey, and a search of a dry hillside will usually reveal this species. Schott's citation of the type locality (as in some other cases) must be regarded as suspect. *Biarum kotschyi* has never been found in Lebanon or Syria, and it appears to be restricted to a few provinces in Turkey. It is most likely that the type of *B. kotschyi* originated in the southeastern Turkish provinces of Bitlis, Diyarbakir, Urfa, Gaziantep, and Maras.

15. *Biarum fraasianum* (Schott) Nyman

Biarum fraasianum is most similar to *B. bovei*, *B. kotschyi*, and *B. carratracense*, particularly in the degree of spathe tube inflation and the fusiform spadix appendix. The arrangement of the staminodes in *B. fraasianum* is closer to that found in *B. dispar* than to that of *B. carratracense* and *B. kotschyi*, but its geographical distribution and the greater overall similarity to *B. kotschyi* leads me to suspect that the closest relationship lies with the latter species.

Until recently *Biarum fraasianum* was a species about which very little was known. Carl Nicolaus Fraas's original collection occurred more than 150 years ago, and the plant had not been refound. However, in the mid-1990s *B. fraasianum* was rediscovered in several different localities in Greece, and as result it revealed numerous hitherto unknown characteristics, including spring flowering and a sweet smell at anthesis (onset of flowering). The latter feature is particularly uncommon in *Biarum*, shared only with *B. davisii*.

16. *Biarum pyrami* (Schott) Engler

This large, showy species (photo, p. 273) is perhaps the most readily distinguishable of the autumn-flowering *Biarum* species owing to the globose, strongly inflated spathe tube, large spathe, and greatly attenuated spadix appendix. The usually bullate (heavily veined and "blistered") leaves are also unusual in the genus and provide a ready means of identifying *B. pyrami* in Turkey, where no

other species shares this character. In Turkey, *B. pyrami*, *B. bovei*, and *B. kotschyi* form an apparently closely related group of species, but they are readily distinguishable from one another.

Israeli material of *B. pyrami* is rather distinct from that of Turkish and Syrian origin, and some authorities recognize it as a separate variety, var. *serotinum*, on the basis of its much later, winter flowering period and smooth (not blistered) leaves.

17. *Biarum mendax* P.C. Boyce

Biarum mendax is endemic to southeastern Spain and has been variously assigned to *B. bovei* Blume, or *B. dispar* (Schott) Talavera, on the basis of its overall similarity to them. However, *B. mendax* is readily separable by its greater size, exceeding that attained by *B. pyrami*. Indeed, *B. mendax* bears the largest inflorescence yet recorded in *Biarum*. It can be distinguished from all three of the abovementioned species by its completely fused spathe tube. *Biarum mendax* belongs to a group of species defined by spadices bearing sterile flowers only between the male and female flower zones, and by the inflated lower spathe. The specific epithet is from the Latin *mendax* "deceitful," in allusion to the similarity between the dried herbarium specimens of this species, *B. bovei*, and of *B. dispar*, which has resulted in its being hitherto overlooked.

18. *Biarum auraniticum* Mouterde

Biarum auraniticum is unique in its genus in possessing a white spathe limb. There is no doubt that this is a most singular species, not only for its coloration but also because of its remarkably wide, bottle-shaped ovaries. These two characteristics make it difficult to envisage a close relationship for this species. The lack of pistillodes, the ovate-elliptic, long-petiolate leaves and slightly inflated spathe tube support a link to *B. bovei* or *B. kotschyi*. *Biarum auraniticum* is endemic to southwestern Syria, where it is known only from the area around the town of Sanamein.

19. *Biarum ditschianum* Bogner & Boyce

Biarum ditschianum has an extraordinary appearance in flower compared with most other *Biarum* species. The spathe limb is reduced to a narrow rim on the spathe tuber, and the most notable feature is the relatively massive, dark yellow spadix appendix. Two other *Biarum* species have unusual inflorescences: *B. davisii* has pinkish-white spathes, a purple spadix appendix, and a sweet odor at anthesis; and *B. auraniticum* has a greenish-white spathe and a yellow spadix, but its odor is unknown. Both species lack a zone of sterile flowers (staminodes) on the interstice separating the male and female flower zones, a feature also seen in *B. ditschianum*.

Perhaps the most unusual feature of *B. ditschianum* is the presence of hairlike processes on the base of the spadix appendix. Such structures are otherwise unknown in the genus and are uncommon in the Araceae. Their function is not clear, although it is possible that they play a role in pollination. The inflores-

cence of *B. ditschianum* is also notable for being exceptionally foul-smelling, with a powerful odor of carrion and excrement which attracts carrion flies.

20. *Biarum davisii* Turrill

Biarum davisii (photo, p. 273) is an attractive species which, until the discovery of *B. ditschianum*, ranked as the most unusual in the genus. Apart from its remarkably small size, characteristics such as the basically ovate foliage, deeply urceolate (urn-shaped) spathe tube, pinkish-brown spathe, and sweet lilac-like smell when in blossom are all unique in the genus. It is well established in cultivation.

Biarum davisii is a plant of limestone screes and terra rossa pockets on calcareous hillsides and is widespread but rather local on Crete and in southwestern Turkey. Where it occurs it is often abundant, forming extensive colonies; however, its small size together with the fleeting appearance of the inflorescences means that *B. davisii* is much overlooked, and this has led to the belief that it is rare. More recent observations, together with data on herbarium sheets, suggest that this is not the case and that it occurs in most parts of Crete. The Cretan populations of *B. davisii* are remarkably uniform, plants from opposite ends of the island being virtually indistinguishable morphologically.

Cultivation

Biarum species fall into three groups for the purpose of cultivation. Some species, notably *B. tenuifolium* and *B. rhopalospadix*, are easy to grow and are hardy outdoors in the milder gardening regions if planted in sheltered positions. However, the majority of species require some winter protection, ideally frost-free, and are best grown in pots in a cool greenhouse or alpine house, or planted directly into a sheltered coldframe. Last, there are a few species that tax the grower's skills and require cossetting in a cool greenhouse; *B. olivieri* is typical of this third group.

Outdoor cultivation

The tubers require quite deep planting (8–10 cm/4.5 inches from the soil surface to the top of the tuber) and rich, well-drained soil. If the soil tends toward clay, then the addition of sharp sand and grit, particularly as a cushion beneath the tuber, is beneficial. In warm areas the tubers can be planted in open places, in a rockery for example, but in less ideal situations a planting site at the base of a west- or south-facing wall will provide the best chance of success. When happy, *B. tenuifolium* will spread freely both by offsetting and from seed. Not all subspecies of *B. tenuifolium* are equally successful outdoors; subsp. *tenuifolium* and subsp. *abbreviatum* are the easiest. *Biarum rhopalospadix* grows well in conditions similar to those for *B. tenuifolium*. In particularly sheltered places with a Mediterranean-like climate, other species that are worth experimenting with outdoors include *B. crispulum*, *B. davisii*, *B. dispar*, and *B. kotschyi*.

Cultivation under glass

Cultivation in a frost-free greenhouse gives perhaps the best success. A narrow but deep clay pot with a compost of equal parts sterilized loam, humus, and sharp grit should be used, with annual repotting into fresh compost. When growth begins in autumn, water should be given sparingly until the plant is growing well. Too much water early on can result in root loss. Under glass the plants should be given as much light as possible during the winter to prevent leaf etiolation. Ventilation must be given on all but the coldest days, and water applied regularly but carefully, since moisture remaining lodged in the leaf sheaths can result in rotting. The plants should continue growing throughout the winter, with a balanced soluble fertilizer given weekly given to maintain vigor. Toward early spring growth will slow down, and by mid-June the leaves will turn yellow and wither. At this time direct watering should be stopped; the soil should be kept just moist by plunging the clay pot to the rim in sand and keeping the sand damp. The inflorescence will emerge soon after the foliage dies. Once flowering is over, the soil should be allowed to dry out and the plant rested. Care should be taken not to allow the pot to become too hot, as this can cause desiccation of the tuber. Repotting should be carried out annually in July or early August.

Propagation is best effected by sowing freshly collected seed on the surface of a mixture of equal parts sterilized loam, humus, and sharp grit, then covering the seed with 1 cm (1/2 inch) of sharp grit. Germination occurs in late fall and winter; stored seed may germinate erratically after two or three years. The seedlings should be kept growing until the leaves wither in summer, and then the little tubers can be transplanted into larger pots; care must be taken not to desiccate these tiny tubers, for instance by keeping their pots in a shaded site in the greenhouse or frame.

After 14 years in the Herbarium, Royal Botanic Gardens, Kew, working on the taxonomy and phylogeny of Araceae with particular interest in the wet Southeast Asian tropics and the European Mediterranean, and two years as freelance biological consultant based in southwestern France, Peter Boyce is presently based in Kuching, Sarawak, Malaysia, managing a federal government-funded project for a biotechnology company studying aroids and gingers with a view to evaluating their suitability for commercial horticulture, and also to evaluate the level to which they are threatened in the wild by illegal exploitation. Current horticultural and research interests include *Homalomena*, *Alocasia*, and *Schismatoglottis*, along with numerous non-aroids including Zingiberaceae, *Hoya*, *Begonia* (collaborating with Ruth Kiew, Singapore B.G.) and *Hanguana*.

Arisaema triphyllum: Great Variation Under One Name

Michael Slater

We only have two species of *Arisaema* in North America north of Mexico—nothing like the many species found in Asia. The two Americans are *Arisaema triphyllum* and *A. dracontium* (see Plant Portraits in this issue). We are fortunate, however, in the great variation found in *Arisaema triphyllum* in its native range in eastern North America, even within a single population. *Arisaema triphyllum* is separated by botanists into three or four subspecies based on characteristics other than color of the flower parts and stems, the parts that most gardeners notice first. (Photos, pp. 274–276.)

Arisaema dracontium and *A. triphyllum* are easily distinguished. *Arisaema dracontium* usually has 7 to 15 leaflets (rarely 5), and the spadix is long and pointed and projects above the spathe limb (see p. 243 for specialized terms). *Arisaema triphyllum* has three leaflets, except in a southern subspecies recognized by some botanists, subsp. *quinatum*, which has five. The spadix of *A. triphyllum* is always blunt cylindrical or club-shaped and does not extend beyond the spathe limb.

Taxonomists have found some variations useful for identifying species or subspecies, and others of no help. Not all the characteristics mentioned below are easy to see in herbarium specimens; some are much more easily distinguished in live plants. The following description applies to all subspecies of *A. triphyllum*. This article follows currently accepted nomenclature in *Flora of North America* (FNA) and/or *Flora of the Carolinas, Virginia and Georgia, Working Draft*, 17 March 2004 (FCVG-wd 3/17/04).

Plants may be diploid ($2N=28$) or tetraploid ($2N=56$) (Treiber 1980); some triploids ($2N=42$) have been reported, but these are presumably sterile. They are often stoloniferous.

The leaf consists of three leaflets arranged palmately (five in subsp. *quinatum*). The sterile part of the spadix (the appendix) is club-shaped, bluntly cylindrical, or slightly narrowed at the tip, projecting at least slightly above the spathe tube. It is 3.5–8 cm long and varies in color—usually black, or very dark red-purple, sometimes green, and sometimes speckled. All these colors can be observed within a single population.

The flowers are situated at the base of the appendix, hidden within the tube. Male and female flowers are produced on separate plants, but the "sex" of a plant can change during its lifetime. Smaller plants produce male flowers, and larger plants, female; sometimes plants of intermediate size have both male and female flowers on the spadix and thus can self-pollinate. A plant can revert from female to male if the available food reserves diminish.

The spathe limb, the showy part of the inflorescence, may be long, drooping down over the opening and hiding the spadix from view, or it may be held up and gape widely, exposing the sterile appendix. Some plants seem to hold their spathe limbs in the same way from year to year, but others exhibit variation in the length (and presumably the weight) of the spathe limb, so that their appearance varies from the wild to the garden, and probably from year to year. I have noted that variation particularly in subsp. *pusillum*. The spathe flange—the "rim" of the tube—may be wide (in subsp. *triphillum*) or narrow (subsp. *pusillum*, subsp. *stewardsonii*); this seems to be a reliable, easily seen characteristic.

The spathe may be striped, solid, or even speckled. Striped spathes may have a smooth texture or be fluted, with raised ribs as in subsp. *stewardsonii*. The white or light-colored stripes are often translucent, which may lure pollinators in and trap them as they attempt to fly out the "windows." Colors found on the spathe, in addition to white, include light to dark green, mid to dark reddish brown, and near-black. The underside of the spathe limb in subsp. *pusillum* is usually blackish. The peduncle, or stem, may be green or reddish, often with a whitish farina or "bloom" that can be rubbed off.

Treiber (1980) writes: "Pollination in all of the subspecies is effected by fungus gnats of the family Mycetophilidae. The efficiency of the pollination system and fecundity in plants of the *A. triphyllum* complex is generally low compared to artificial pollination; however, seed germination frequencies are high."

The following summary of distinguishing characteristics of each taxon was distilled from the two floras mentioned above and from Huttleston's (1984) key published in *Aroideana*.

***Arisaema triphyllum* subsp. *triphillum*:** Tetraploid, $2N = 56$ (FCVG); three leaflets; leaflets glaucous (whitish) underneath at maturity; spathe flange broad (3–9 mm), often recurved; generally more robust than other subspecies; spathe limb green, green striped with dark red/purple, or white and red/purple striped; sterile spadix (appendix) club-shaped or cylindrical; sterile spadix 4–10 mm in diameter; lateral leaflets relatively asymmetrical (seems true, but difficult to define; the leaflet is much wider on the basal side of the midrib than on the other side, and widest at different points on the midrib).

***Arisaema triphyllum* subsp. *pusillum*:** Diploid, $2N = 28$ (FCVG); three leaflets; leaflets green underneath at maturity (usually a little lighter than the upper surface, but not whitish); spathe flange narrow (1–3 mm); generally smaller than subsp. *triphillum*; spathe limb green outside; inside, usually solid dark purple, often sharply demarcated from green interior of the spathe tube (some plants appear to lack dark pigment but are otherwise identical to their neighbors); sterile spadix cylindrical or slightly tapered; sterile spadix 4–10 mm in diameter; lat-

eral leaflets relatively less asymmetrical; generally later-blooming than subsp. *triphyllum*; usually in wet habitats, seeps and low spots in the woods which may be wet only in spring.

***Arisaema triphyllum* subsp. *stewardsonii*:** Diploid, $2N = 28$; three leaflets, green underneath at maturity (usually a little lighter than upper surface, but not whitish); spathe flange narrow (1–3 mm); spathe tube green or dark purple/red with fluted white stripes; most northerly distribution; generally later-blooming than subsp. *triphyllum*; wet or peaty habitats.

In addition, the following subspecies is accepted by some authorities (including the *Flora of Carolinas*), but not by *Flora of North America*; Treiber (1980) includes it in subsp. *pusillum*. Beyond the obvious five leaflets, it seems to be a confusing mixture of characteristics of other subspecies. ***Arisaema triphyllum* subsp. *quinatum*:**

Diploid, $2N = 28$; five leaflets, the lateral leaflets of the main leaf usually lobed or divided; leaflets glaucous (whitish) underneath at maturity; spathe flange broad (2–5 mm) and often recurved; sterile spadix 1–3 mm in diameter.

I often find *Arisaema triphyllum* subsp. *pusillum* and subsp. *triphyllum* growing in close proximity. Plants of *pusillum* are always in a lower, wetter situation, even if only a few feet away. The areas where subsp. *pusillum* grows usually have some standing water or at least completely saturated soil in the spring wet season. Both subspecies prefer shady deciduous woodland. I have occasionally found plants with characteristics intermediate between the two, but never a whole population that appears to be of hybrid origin. This fits with the information that subsp. *pusillum* is diploid and subsp. *triphyllum* tetraploid; any hybrids would likely be sterile triploids. The difference between flowering times would also tend to keep the subspecies distinct, even though the periods do overlap. I assume the same is true of subsp. *stewardsonii* and subsp. *triphyllum* in respect to both ploidy and bloom time. I don't know whether subsp. *pusillum* and subsp. *stewardsonii* hybridize. It seems that they could if they grew in the same area, but I haven't heard of such occurrences. Now that I have *stewardsonii* in our garden, I'll have to experiment sometime with cross-pollinating the two.

Beyond taxonomy, we as gardeners are always on the lookout for interesting forms. In *A. t.* subsp. *triphyllum*, the color of the spathe and spadix seem to vary more than in subsp. *pusillum*, and there doesn't seem to be any correlation between the color of the spathe and spadix. I have seen all possible combinations in a small geographic area. There are several noteworthy clones of *A. triphyllum* in cultivation that have been named, at least informally. At least one has noticeable white leaf veins; the one I've seen is called 'Mrs. French'. In some plants the spadix is dramatically striped with blackish-red and white, and these have been called 'Zebrianus'. They are among my favorites of all arisaemas. I don't believe either of these names has been registered.

At the NARGS Annual Meeting in spring 2004 in Raleigh, North Carolina, we saw a beautiful *A. triphyllum* called 'Black Jack' in Tony Avent's Juniper Level Botanic Garden. It has chocolate-brown leaves. Avent's Plant Delights Nursery hopes to have this variety for sale in a year or two, and I look forward to buying one!

In addition to the flower color variation, I find the plants with red petioles (leaf stems) very attractive. This coloration sometimes continues into the center vein of each leaflet. I have heard reports of plants with even more extensive red veining and would love to see one.

Michael Slater and his wife, Jan, garden in Pennsylvania. Mike is very active in his regional chapter and has also served on the NARGS national board of directors. Jan is the manager of the NARGS Book Service. Mike also wrote the chapter on "Sand Beds" in the recent NARGS book *Rock Garden Design and Construction*.

References

- Flora of North America*, vol. 22, online at <<http://flora.huh.harvard.edu>> or <<http://www.efloras.org/>>.
- Flora of the Carolinas, Virginia and Georgia*, Working Draft of 17 March 2004, pp. 13–14; online at <<http://www.herbarium.unc.edu/17acocymMar2004.pdf>>.
- Gusman, G. and L. Gusman. 2003. *The Genus Arisaema*. Königstein: Koeltz Scientific Books.
- Huttleston, Donald C. 1984. The North American Species of *Arisaema*. *Aroideana* 7(1).
- Rhoads, A. F. and T. A. Block. 2000. *Plants of Pennsylvania*. Philadelphia: University of Pennsylvania Press.
- Treiber, Miklos. 1980. Biosystematics of the *Arisaema triphyllum* complex. Ph.D. dissertation, University of North Carolina at Chapel Hill.

About the Artist

Jean LeCluyse, whose drawings illustrate this issue's focus articles, is a natural science illustrator and an avid gardener. She has a degree in drawing and painting from the University of Kansas. Her love for subjects from nature was inspired by time spent sketching the prairie landscape and plants of the Flint Hills. She now resides in Chapel Hill, where she is working toward a certificate in botanical illustration at the North Carolina Botanical Garden. She is also an active member of the Guild of Natural Science Illustrators. Her work has been exhibited at the Chapel Hill Town Center, the North Carolina Museum of Natural Sciences in Raleigh, the North Carolina Museum of Life Sciences in Durham and the Carrboro Arts Center. Her drawings in this issue are from her sketches and photos at Plant Delights Nursery/Juniper Level Botanic Garden. She can be contacted at jlecluyse@nc.rr.com.

Pinellia

Marge Talt

Compared to their close cousins, the genus *Arisaema*, species of *Pinellia* “don’t get no respect.” This is unfair. Although most pinellias don’t have the exotic beauty of many arisaemas, they add their own charm to the shady garden, especially if placed near a path so people can see the inflorescence and enjoy the foliage. Commonly called “little green dragons” (I’ve also seen “false dragon”), they thrive in shade in the U.S. Southeast but can take more sun in northern climates. A moist, fertile soil is best, with good drainage because they prefer a relatively dry winter rest period. According to the “Pinellia Page” on Roy Herold’s *Arisaema* website < <http://www.head-crash.com/~rrh/Pages/pinellia.html>>, there are as many as ten species, found primarily in China, Japan, and Korea. Four are commonly in cultivation in North America and Europe. These, listed with known hardiness zones and known low-temperature survival from the International Aroid Society’s (IAS) “hardy aroid” list, are *Pinellia cordata* (Zone 4b, Ithaca, NY; -10°F/-23°C), *Pinellia tripartita* (Zone 4b; -25°F/-31°C), *Pinellia pedatisecta* (Zone 4b; -10°F/-23°C), and *Pinellia ternata* (Zone 4b; -10°F/-23°C).

Named for Giovanni Vincenzo Pinelli, a sixteenth-century Italian who founded the Botanic Gardens of Naples, the genus has also been called *Atherurus* or *Hemicarpurus* in the past. Although it seems very similar to *Arisaema*, there are differences. *Pinellia* never has more than one seed per fruit. *Pinellia* seedheads always flop to the ground (some arisaemas do this occasionally, but it’s not usual). *Pinellia* fruits are green when ripe rather than red or orange as in *Arisaema*. *Pinellia* peduncles (stems supporting the inflorescence) always rise directly from the tuber and have no leaves; this is infrequent in *Arisaema*. *Pinellia* bears both male and female flowers on the same spadix, separated by a membrane, while individual *Arisaema* plants are either male or female, depending on their age and growing conditions. The spadix is fused to the spathe for some distance.

If you have one pinellia, wait a season and you’ll have more. They are easily propagated by offset tubers removed in autumn or early spring. Seed should be sown as soon as it’s ripe in a cold frame and left there over winter for spring germination, or given a three-week moist chilling at 39°F/4°C, then warmed to 68°F/20°C, after which it should germinate in a few weeks. You can also

plant the small bulbils that form on the junction of leaf blade and stalk in late summer.

Of the commonly available species, the Japanese native *Pinellia ternata*—commonly called “crowdipper”—appears to be the one most used in herbal preparations. It’s also the one you want to avoid planting in your garden, because it has major plans for world domination, accomplished via spreading rhizomes and dropping leafbulbils. It has become naturalized in California, Connecticut, New Jersey, Ohio, Pennsylvania, West Virginia, and Maryland, and it has made the Maryland list of invasive exotic plants. It will grow in sun or part shade; while preferring rich, moist soil, it will grow in woodlands, forests, on grassy banks, and in fields. It has many botanical synonyms, including *Arisaema* (or *Pinellia*) *cochinchinense*, *Arum dracontium* (probably some confusion with *Arisaema dracontium*, an American native), *Arum ternatum*, *Pinellia tuberifera*, and *Pinellia wawrae*. It is offered by a number of nurseries (which ought to know better), but save your money for the better species.

Pinellia pedatisecta

Of the three species I grow, *Pinellia pedatisecta* (photo, p. 283), from northern and western China and Japan, is the most vigorous. It loves its bed of rotted wood chips and reproduces speedily via seed. In the soft medium, it’s easy to scoop out unwanted plants. I’ve put a couple in less salubrious soil, and so far it has curbed their enthusiasm a bit. Although I enjoy this species in my woodland garden, I would not recommend it for the small garden unless a watchful eye is kept on it. The pedate leaves with seven to eleven lanceolate leaflets are quite decorative, providing good textural contrast.

This is the tallest of the *Pinellia* species, reaching nearly 15 inches (35 cm). The central leaflet is always the longest and can attain about 4 inches (10 cm) in length. The inflorescence is the largest of the four *Pinellia* species in common cultivation, reaching 4 to 7 inches (10–18 cm) in length. The yellowish spadix is filiform (threadlike) and extends well past the spathe. The spathes emerge before the leaves unfold, springing up like odd little soldiers at attention. New inflorescences are formed continuously during the growing season. Each is capable of producing viable seed, so this is an enthusiastic spreader in a favorable location. “Fan-leaf Chinese green dragon” is the only common name I’ve run into for this species, and it may have been dreamed up by the nursery listing it, since the catalog is the only place I found it.

Pinellia tripartita

Pinellia tripartita (photo, p. 283), from southern Japan, is much better behaved in the same bed as *P. pedatisecta*. It has seeded around a bit, but by no means excessively. The distinctive polished foliage remains pristine all season. Give it a path-

side spot so you can enjoy it. Leaflets range from 3 to 8 inches (8–20 cm) in length on plants up to 18 inches tall (45 cm) when fully mature, but generally closer to a foot (30 cm) tall. The 3–4-inch (8–10 cm) spathe is often somewhat hidden by the foliage, unlike that of *P. pedatisecta*, but the spadix rises another 6 to 10 inches (15–25 cm) until late summer, when it droops back to the ground.

There are two forms of *P. tripartita* on my “lust list.” ‘Atropurpurea’ differs from the species only in the marvelous purple color of the interior of the spathe. ‘Polly Spout’ features a delicate pink spathe interior that George Schmid, in his *Encyclopedia of Shade Perennials*, says “stands out like a pink flag.” One source notes that the main difference between ‘Atropurpurea’ and the typical species is ‘Atropurpurea’s’ “strong affinity to attracting gnats (or small flies) as pollinators, which seem to perish once entrapped in the lower chamber” of the spathe. I wonder if this is related to the red interior color?

Pinellia cordata

I just acquired *Pinellia cordata* ‘Yamazaki’ this spring from Ellen Hornig’s Seneca Hill Perennials, as a dormant tuber. Native to China and Korea, *P. cordata* (photo, p. 283) is considered by many to be the best species in wide cultivation. ‘Yamazaki’, named in honor of its originator in Japan, is said to be larger than the species with better-patterned leaves. As soon as it started to awaken, I fell in love. Two cravings—purple foliage and variegated foliage—were satisfied in one neat package. From tiny tubers arise shiny, deep purple, tightly rolled leaves on dusky petioles. As the leaf unfolds, the white veins become visible. Fully open, the dark green, glossy, heart-shaped (cordate) leaves resemble those of some cyclamen or one of the Asian hardy *Asarum* species. The leaves reach 3 to 5 inches (8–13 cm) long and about half as wide. The relatively long leaf petioles—to 8 inches (20 cm)—remain dusky purple. Some sources claim that *P. cordata* is the only species with an undivided leaf, but *Pinellia peltata* has a similar leaf shape without the vein markings.

Dan Hinkley, in *The Explorer’s Garden*, notes that he has some seedlings of *P. cordata* with entirely green leaves. Charming, I’m sure, but I want the variegation! Even more exciting is the underside of the leaf: deep purple with green veins. This plant thrills me to the core. Unfortunately, it’s said to be much slower to increase than other species. I’m hoping that’s incorrect, because I can’t have too much of it. I’ll be looking for the leaf stem bulbils to plant out and increase it as quickly as I can, since it’s said to be reluctant to set seed in the garden. This may not be quite as hardy as some of the other species, even though it’s reported to be grown outside with no mulch in Milwaukee, Wisconsin (Zone 5b), where temperatures have reached –10°F/–23°C.

The tiny spathe, only about 3 inches long (7–8 cm), peeks out from beneath the leaves and pops up between them. The thread-like spadix curves out from the mouth of the spathe for almost 4 inches (10 cm) and then points upward. On one of my plants, the spadix corkscrewed away from the spathe. “Cute” is an apt

adjective for this tiny tot. The inflorescence is said to have an apple, pineapple, or bubble-gum fragrance, but I didn't notice it; however, often spathe scent is elusive or lasts only a few hours at anthesis (when the inflorescence opens).

I'm glad that my plants were in a pot when they first emerged. Had I planted the dormant tuber in the garden, it's likely that, in the hurly-burly of spring gardening, I would have missed seeing the foliage unfold and watching the progress of leaf growth—both fascinating processes.

Marge Talt has been gardening in the Maryland shade for nearly 35 years. As a contributing editor for the website Suite101.com, she has written more than 200 articles on plants and gardening. She has recently combined 30 years' experience in commercial architecture with her knowledge of plants to start another business, Shadyside Garden Designs.

Sources

Yucca Do Nursery, P.O. Box 907, Hempstead, Texas 77445, <http://www.yuccado.com>

Seneca Hill Perennials, 3712 Co. Rt. 57, Oswego, NY 13126,

<http://www.senecahill.com>

Plant Delights Nursery, 9241 Sauls Rd., Raleigh, NC 27603,

<http://www.plantdelights.com>

Collector's Nursery, 16804 N.E. 102nd Ave., Battle Ground, WA 98604,

<http://www.collectorsnursery.com>

Paul Christian Rare Plants, P. O. Box 468, Wrexham LL13 9XR, U.K.,

<http://rareplants.co.uk>

Fraser's Thimble Farms, 175 Arbutus Rd., Salt Spring Island. V8K 1A3 B.C. Canada

Crownsville Nursery, P.O. Box 309, Strasburg VA 22657,

<http://www.crownsvillennursery.com>

Asiatica Nursery, P.O. Box 308, Lewisberry, PA 17339, <http://www.asiaticanursery.com>

A Miscellany of Aroids

John Grimshaw

I have been fascinated by the extraordinary plants of the family Araceae for as long as I can remember, and over the years I have attempted to grow as many different hardy species as possible. The larger species make a distinct contribution to the garden, whether in flower, with their fascinating spathes and spadices, in fruit, or in leaf—the winter-green foliage of *Arum italicum* or the umbrellas of *Arisaema* are conspicuous features in their own right.

One aroid that has absolutely no garden merit at all is *Ambrosinia bassii*—and yet I am rather fond of it! The name commemorates Signor B. Ambrosini (1588–1657), a Bolognese botanist, and one wonders what he did to deserve so lowly a commemorative plant. In full growth and flower my plant stands barely 1 centimeter above the ground, with the green oval leaves all but concealing the tiny spathes; others suggest that the plant can be up to 7 cm in height, so the stock I grow may be particularly diminutive. The spathe sits on the ground and is no more than 2 cm (3/4 inch) in length; the tube forms a rounded portion at the base, with the limb elongated into a backward-curved prong. In color it is pale green with darker, reddish spots on the inner surface. A tiny spadix is hidden inside. This miracle of unobtrusiveness grows from a small tuber that can have several growing points, emerging in autumn and flowering in late winter and early spring. A native of Sardinia, Italy, Sicily, and the North African coast, it is a typical Mediterranean winter-growing plant, and I find that it does very well for me in a just frost-free alpine house along with all my other Mediterranean winter-growing bulbous plants. It is kept dry from the time it goes dormant in late spring until I get round to repotting in September or so, but it does not need annual repotting.

Also winter-growing, but rather more visible, are *Arisarum vulgare* and *Arisarum simorrhinum*. Of these, *A. vulgare*, sometimes called “friar’s cowl,” is found throughout the Mediterranean basin, while *A. simorrhinum* is confined to southern Spain, Portugal, and Morocco. Both emerge with autumnal rain and flower in late autumn or early winter—probably depending on the arrival of the rains. In 1995 I spent a lengthy Christmas holiday in Andalucía; the autumn had been dry but December was very wet, and while I was there the ground below the olive

trees became progressively greener, mostly with the leaves of *Arisarum vulgare*, unfurling rapidly with the rain. Their abundance is almost certainly due to the light plowing of the olive groves breaking up the long, brittle tubers, each fragment of which can regenerate and produce a leaf or two. Elsewhere, on heavily grazed hillsides, similar greenery was contributed largely by *Biarum* species. Inflorescences of *Arisarum* also began to appear about this time, usually green with white stripes, but sometimes the ground color is brownish. The pointed, *Arum*-shaped leaves are either plain green or have a scattering of grayish spots over their surface, sometimes being rather attractively mottled. Similar variation may be seen in southern Greece.

The spathe of *Arisarum vulgare* stands erect on the peduncle and is usually held well above the foliage (for botanical terms relating to aroids, see the editor's introduction in this issue). The spathe tube is erect with the limb folded over the opening, from which the down-curved spadix appendix is exerted. Quite different in shape is the inflorescence of *A. simorrhinum*, in which the peduncle spreads horizontally below the leaves and bears the spathe at an angle to the ground. The tube is short and slightly inflated, while the limb is also short and forms a round mouth, inside which a swollen, rounded, spadix appendix is visible. The tube is whitish, with dark stripes leading into the solid purplish-black of the tube. I became aware of the existence of *A. simorrhinum* while walking in the hills above the coastal town of Nerja, as I realized that not all the abundant *Arisarum* plants visible were just *A. vulgare*. That was there as well, and in places intermediates have been recorded, suggesting hybridization, but I did not see intermediates in that locality.

Arisarum simorrhinum is interesting but not as attractive as *A. vulgare*—although, frankly, neither is a great garden plant. I find that both are too tender for outside cultivation even in my parents' comparatively mild garden in Maidenhead, just west of London, and I maintain them in pots in the alpine house. Even there I do not find them generous with inflorescences in most years, but occasionally they will put on a moderate display. A hot summer seems to help. The tubers of both are surprisingly elongated and become very contorted in a pot; if repotting is missed for a couple of years there will be much more tuber in the pot than soil! These are the only two winter-growing *Arisarum* species recognized by botanists, but it is possible that further segregates could be recognized. Rannveig Wallis in Wales sells a possible new species through her Buried Treasure bulb list, but I have not had it long enough to make useful comments.

The third *Arisarum*, a spring-and-summer grower, is *A. proboscideum*, known to the gardening public as the "mouse plant." This name is remarkably apt: the brown, hunched "backs" of the spathe, coupled with the elongated "tail" of the spathe limb, do indeed suggest huddled mice. In full flower, a pot of this is a good seller on plant stalls, as children of all ages love these little mice. The spathe tube is white, and the pale spadix appendix is concealed within the spathe. The spathes and leaves appear almost simultaneously in spring, so by the time of peak flowering the spathes are almost entirely concealed by the dark green, glossy leaves, necessitating a gentle parting to see the mice. The tubers are rather

slender and very brittle, and they should not become desiccated. Planting is best carried out while the plant is in growth, whereas the other two species are best dealt with when dormant. *A. proboscideum* is winter-hardy here and prefers a cool, shady place that remains moist for much of the summer, reminding us of its habitat in woodland in southwestern Spain and central and southern Italy.

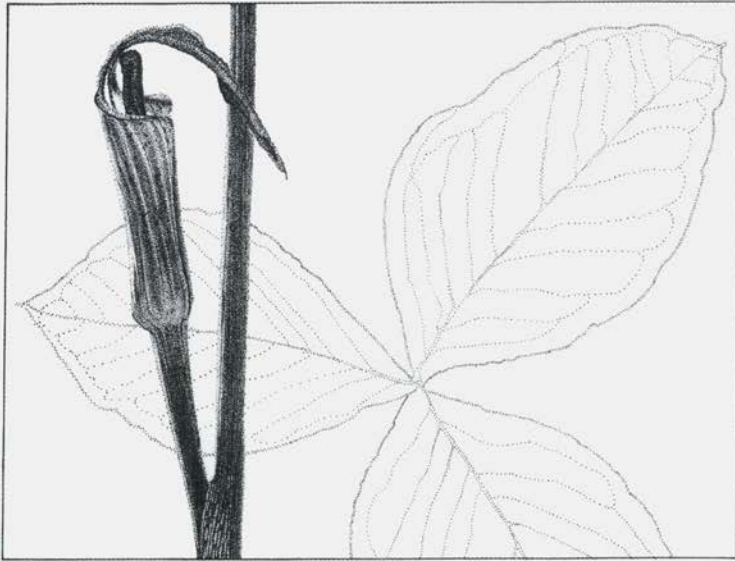
Similar conditions of humus-rich, moist ground are suitable for most *Pinellia* species, of which my favorite is *P. cordata* ‘Yamazaki’, with its handsome silver-marked foliage and pineapple-scented inflorescences (see Marge Talt’s article in this issue). It achieves its full potential in a shaded greenhouse but will grow well outside if slugs do not find it.

I have never noted slug damage on another summer-growing aroid for moist ground, *Typhonium diversifolium*. The genus *Typhonium* is essentially Southeast Asian in distribution, with extensions to Australia, and most species are tender, but *T. diversifolium* is from the Himalaya, growing between 2500 and 4300 meters elevation, and is hardy in southern England. I remember it best from the overgrazed hillsides above Namche Bazar in the Khumbu district of Nepal, where presumably it is avoided by domestic livestock. Here it grows as a diminutive plant, about 5 cm in height, with an erect, *Arum*-like green spathe variously mottled in reddish-brown. It has the fecal stink that tends to bedevil members of this family. The leaves, as the name suggests, can be variously shaped, from broadly hastate to very strongly lobed; in the clone I grow, the leaves are broadly hastate with rather insignificant basal lobes. It flowers in cultivation, as in the wild, in June and July. *Typhonium giganteum* is also sometimes grown in English gardens, but it would prefer a hotter, steamier climate to flourish. In bad years it does not appear above ground at all; even in warm seasons it appears in July and usually produces no more than a single large leaf. On the rare occasions that it musters strength to flower, the spathe is dark brown and the stink noxious.

My final species for mention here is *Sauromatum venosum* (syn. *S. guttatum*), the “voodoo lily,” and as I write, I can hear the murmurs that this is not a rock garden plant. It is not, but neither are most arisaemas, and they are regarded as fully acceptable in rock-gardening circles! *Sauromatum* is very like an *Arisaema* in many respects, notably the single large leaf, which can be a handsome feature in the summer garden. The inflorescence, strongly mottled reddish-brown over cream, is notoriously fetid, but despite this the tuber is often sold as a novelty to be “grown” by standing it on a saucer until the inflorescence appears without benefit of water. This routine is best skipped if you want to see the plant at its best in the garden. The inflorescence appears before the leaf in late spring or early summer and is usually heralded by the smell. This lasts only for one day, however, but it does its job, as there is often a fertilized infructescence to be found in autumn. As with *Biarum*, this fruit develops below ground and emerges above the surface only as it matures. In *Sauromatum venosum* the berries are dark red. The leaf is pedate, with a connective between each lobe, a feature that is helpful in field recognition where confusion with *Arisaema* is possible, for example in the Himalaya or Kenya. The spottiness of the petiole is quite variable, but some are magnificently mottled. The width of the leaf lobes varies slightly. The

distribution of *S. venosum* is interesting in that it extends over much of tropical Africa and the mountains of Yemen, with a gap over the arid lands of Arabia and the Persian Gulf; in Asia it grows throughout India and the Sino-Himalayan region as far as Yunnan in western China and into southern Burma. Despite this rather tropical distribution, it is remarkably hardy and forms an excellent late-appearing plant to follow early spring bulbs; the deep planting this implies also helps to protect the tuber from heavy frost.

John Grimshaw, an English botanist and gardener, has done fieldwork in several far-flung regions, notably in East Africa, has worked in the seed industry, and has published his coauthored book *Snowdrops* under the imprint of the Griffin Press, which he founded to produce fine plant books. He is currently garden manager at Colesbourne Park, the historic Elwes estate, which he is renovating for opening to the public.



Arisaema triphyllum

Reticulata Iris: Creating a Rainbow

Alan McMurtrie

The first irises to grace the rock garden in spring are the “Reticulatas,” or members of subgenus *Hermodactyloides*: the species *I. reticulata*, *I. danfordiae*, *I. histrio*, *I. histrioides*, *I. bakeriana*, *I. hyrcana*, *I. kolpakowskiana*, *I. pamphylica*, *I. vartanii*, *I. winkleri*, and *I. winogradowii*. I started hybridizing them in 1983 and have since opened up a whole new world. I did this by crossing *Iris sopenensis*, a diploid form of *Iris danfordiae*, and an unnamed species I had collected near Çat, Turkey. *Iris sopenensis*, originally described by Foster as a variety of *I. reticulata*, was raised to species status by Dykes in 1930; Brian Mathew in 1981 reclassified it as *I. histrioides* var. *sopenensis*. The Çat Reticulata (photo, p. 279) is illustrated in Mathew (1981, plate 34), and is still under study at Kew. All three are quite prone to “shattering”: producing lots of rice-grain-sized bulblets, along with main bulbs too small to bloom the following year. The new crosses, however, show hybrid vigor, with most blooming consistently year after year.

Until now, Reticulata irises have been available mainly in shades of blue, violet, and purple. In the 1970s, William van Eeden produced the near-white ‘Natasha’, which many find weak, but the best white commercially available. The commercial clone of lemon-yellow *Iris danfordiae* is a triploid, with three rather than the normal two sets of chromosomes, and thus is sterile. Many rock gardeners grow E. B. Anderson’s ‘Katharine Hodgkin’, whose parents are pale yellow *I. winogradowii* and blue *I. histrioides*. Its dark blue spotting on cream ground with yellow flash is stunning. The cross has since been repeated in such clones as ‘Frank Elder’ and ‘Sheila Anne Germany’. All are sterile even though both parents have the same chromosome count ($2n = 16$), so hybridizers can take them no further.

When Wim de Goede, a commercial bulb grower in Holland, saw my first-generation hybrids between *sopenensis* and *danfordiae* in 1997, he said they were nice, but “just blues.” Now I have moved well beyond blues. I’d like to tell you how I got to where I am today, and why.

Reticulata Facts

Bloom starts as soon as the snow disappears, or around mid-February in snowless temperate gardens. The flowers emit a wonderful perfume on warm days. They grow best if lifted, separated, and replanted every two years. They are susceptible to ink spot disease, a fungal infection; damage from it can be prevented by providing good drainage, particularly when the leaves are dying down. These species come from eastern Turkey, Syria, Iran, and the Caucasus, growing in mountains where it's very dry in summer.

The flowers, which look stemless, rise 2.5–4.5 inches (about 6–12 cm) tall and are typically 2.25 inches (6 cm) in diameter. The leaves are square to octagonal in cross-section and elongate to 18–24 inches (45–65 cm) by the time they die down in early summer. The bulbs have a netted (“reticulate”) covering called a tunic. Typically, plants take five years from seed to first bloom. Most species have the chromosome number $2n = 20$; *histrioides* and *winogradowii* are $2n = 16$. The three species I used are all $2n = 18$.

For additional information, including numerous pictures, visit my website, <www.Reticulatas.com>. I'd be glad to hear which are your favorites, and which ones you'd like to see commercially available.

A Door Starts To Open

In 1994, my first *sophenensis* × *danfordiae* hybrids (hereafter sxd), started to bloom—16 clones from 3 crosses. I expected them to be sterile because of the parents' chromosome counts, but I just had to try intercrossing them. To my pleasant surprise, I got 130 seeds from 11 successful crosses. I knew fellow iris enthusiasts would be skeptical. Although the seed appeared to be good, it might die when it tried to germinate. For example, out of more than 300 crosses and more than 4800 seemingly good seeds from diploid *danfordiae*, only four or five have produced blooming bulbs (with the exception of those involving *sophenensis*, Çat, and of course selfed *danfordiae*).

The first F2 (second-generation) hybrid bulbs flowered five years later, in 1999. 94-HW-1 (named 'Starlight'; photo, p. 281) is white with lovely blue accents and a touch of yellow. (I had expected the veining of *sophenensis* would be a dominant feature that would take generations to eliminate.) Moreover, 'Starlight' is proving a good doer.

The next year more 1994 F2s bloomed, along with a couple from 1996. Surprisingly, many of these were whites with a similar pattern to 94-HW-1. I refer to this group as “white-blues” or “white with blue accents.” The white of 96-DZ-1 is absolutely pure, its petals glistening in sunlight like fresh snow. That year my first yellow hybrid also bloomed, appearing rather like a more green-spotted *danfordiae*. Most amazing was a beautiful new pattern that I'm calling “spotted light blue-green,” coming from a back-cross to *danfordiae*. 96-BN-1 is breathtaking: large blue-green spots on its fall blade, with a predominant yellow blotch

in the middle. The style arms have a blue ridge, with the inner portion being light yellow-green.

In 2001 another 13 new F2s bloomed, many of them yellow-blue combinations. One of special interest was 94-AT-2 (photo, p. 280): its falls are dark brown on a rich yellow background. The yellow shows through mainly around the similarly colored central ridge. Its style arms are several shades of dark blue.

In 2002 the number of new F2 sxd hybrids jumped to 57. Of particular interest were: 97-CQ-1, which is sea-green, becoming intriguingly bluer just as the flowers finish; three more "spotted light blue-green" (one without any yellow, making it a gorgeous spotted powder blue); and two cream hybrids without much blue influence. In addition, there were three special second-generation clones involving the Çat Reticulata. One of these I've tentatively named 'Storm' (98-NP-2) because its falls have dense black veins over a bright yellow background, and its style arms are dark blue. In sharp contrast, a sibling is cream with bright yellow around the fall ridge. The third clone (97-VS-1) is a slightly lighter yellow than *danfordiae* with black (or very dark green) markings on the fall and dark green style ribs.

Color Breaks Involving Çat

In 2003, 68 new F2 sxd hybrids bloomed, and in spring 2004 there were 100 more. Most amazing was the number of color breaks. In the past I wrote, "I would classify my second most promising line as involving Çat x *danfordiae*: 88-AX. I believe their biggest potential is in intercrossing with *sophenensis* x *danfordiae* hybrids." The 98-NP group realizes that potential, with 11 clones ranging from white, to plum, to pale yellow, to rosewood, and one I can only describe as "chameleon." All are of pretty good size, too, even though both the parents are small, and all appear to be good doers. A dozen other crosses with high potential are on the small side, but this means they're great for rock gardens. For the mass market, where it seems "bigger is better," a few more bulbs would be needed for a showy display.

Of particular interest, several of these hybrids are halfway between yellow and orange. In many, the color lightens toward yellow as the flowers age. The most steadfast is 98-ND-2, whose fall is unmarked except by a few light dots near the fall ridge. It's quite striking, especially blooming alongside the bright yellow 98-ND-1. If you want more than pure color, 98-OO-4 (photo, p. 282) fills the bill. I personally like 98-OO-6, which is less orange but has dark-green style ribs and nearly black variably sized spots on its otherwise evenly colored fall blade. Now that yellow-orange has been accomplished in just two generations, the question is no longer "Is orange possible?" but "How soon will we have a large-flowered orange?"

Other unusual things starting to show up include very dark colors, such as solid dark violet with yellow in the areas around the fall ridge that would typically be white. There's a gray, yellow, and black combination that I refer to

as 'Evil' (98-GZ-3). There are also several different patterns of fall dotting and veining.

Sophenensis × *danfordiae* Color Breaks

I hope to determine that *danfordiae*'s lemon yellow is actually made up of a number of different carotenes. This would increase the range of expression possible in the offspring. We know pale yellow is possible in *Reticulata* irises because of *I. winogradowii*. To increase the color range requires the genetic capability to produce the chemical compounds that give the other colors, along with the genes ("switches") to turn those expressions on or off. You can cross two blue or two purple *Reticulatas* until you are blue in the face but you'll never get a yellow, because in all parents the yellow switches are off. Even though the genes to produce yellow are there, they can never express themselves. Thus, my goal has always been to shake up the genes as much as possible by working with widely varying clones from the wild. To pull out recessive characteristics takes more than two or three generations. We'd all like to create the *pièce de résistance* right away, but I'm quite pleased with what I've achieved so far.

Carotenes are fat-soluble pigments in plant cell walls that give the yellows, oranges, and pinks we see. A number of my hybrids hinted more was possible. One of the first hints was the amoena 98-MN-1. The term "amoena," to iris specialists, means its styles and standards are white (here, with pale greeny-yellow style markings), and its falls are a color, in this case pale yellow. The similar 98-JI-2 bloomed this year, slightly smaller with more dotting. I intercrossed the two and was rewarded with 54 seeds, an unusually high number.

You may notice in the photos that the standards are "missing" on some of the sxd hybrids. If you look carefully you will see them; they've just been reduced significantly in width: 0.3–3.0 mm, versus typical *Iris reticulata* standard width of 7–10 mm. Most F1 standards are 30 mm in length, compared to more typical ~40 mm. F2 hybrids are much more variable at 5–35 mm. This is due to *danfordiae*, which has just short bristles for standards. Personally I don't really care whether a flower has standards or not; I'm more concerned with how it looks overall.

Genetic Switches and Color Depth

Now that I have a reasonable number of F2 sxd progeny, I can start to analyze the high-level genetic switches that are at work. If I had tried this earlier, I would have come to the wrong conclusions. Fundamentally, flower color is made up of anthocyanins (blues and purples), which are water-soluble pigments in each cell's vacuole, and carotenes (yellows, oranges, and pinks), fat-soluble pigments in the cell's walls. True red is also an anthocyan, but unfortunately, it doesn't appear that irises can produce the chemical compounds that reflect fire-engine red back

to our eyes (as in geraniums or roses)—specifically, the compounds paeonidin (crimson), pelargonidin (scarlet), and rosinidine (crimson). Reds of a sort are possible in bearded irises; these maroon or brownish reds come from combining the right shades of purple and yellow, which to our eyes gives the illusion of red. This is what makes 94-AT-2's falls appear dark brown.

Moreover, various shades of blue and purple contribute to the exact coloring we see. Each is controlled by one or more switches. Think of the flower as a chemical factory. The genetic switches control what compounds are produced, and hence what colors are reflected back to our eyes, from light to dark blue, to violet, through various shades of purple. With yellows, too, there are a number of switches at work, though with *danfordiae*'s yellow-orange being so dominant one might think there was only one. It's a nice color, but I'm now starting to break its dominance so I can get at the others. A beautiful pink *reticulata* or a rich orange would certainly be nice (perhaps I'm dreaming, but it turned out to be possible in bearded iris). If these anthocyanins and carotenes don't combine just right, you end up with a muddy mess.

Detailed analysis of my hybrids has shown that two dominant genes B_1B_2 are required to turn blue on, and a recessive gene y is required to turn yellow on:

<i>sophenensis</i>	$B_1B_1B_2B_2\text{--}y\text{--}$
<i>danfordiae</i>	$b_1b_1b_2b_2yy$

This doesn't explain why three of the 56 F1s had a reasonable amount of yellow on their falls. Is there a second path for synthesizing yellow, involving several genes? At some future point I hope to understand what's behind the "spotted light blue-green" pattern, as well as the yellow streaking or blotching effect seen on some clones. Of course, by that time there will be other mysteries.

The velvety surface effect that seems to accompany some *reticulata* colors, particularly dark ones, is due to papilla-shaped epidermal cells. It is a physical, not a chemical phenomenon. If you take a velvety fall blade such as that of *I. bakeriana* and turn it, it shows pure color at every angle. You never see any solid white light bouncing off it as you would if the surface were flat. With iris petals, you see a glistening effect when each of a multitude of cobblestone-shaped cells reflects white light. The back of a fall is duller, while the top of the fall is "alive," because the depth of the cobblestone cells is less on the back of the fall. Additionally, the light we see is saturated with color. Before reaching our eyes, it has been bounced around several times among the papilla-shaped cells, in the process "picking up" more and more color. This can be seen by the fact that the intensity of color changes as you change the angle of the blade.

More Noteworthy Hybrids

98-OK-1 (91-FC-1 \times *danfordiae*) was the sixth "spotted light blue-green" to bloom. This pattern only occurs occasionally in back-crosses to *danfordiae*. When

my wife Lynda saw it, she called it “icy green,” so I named it ‘Green Ice’ (photo, p. 281).

‘Tiger’ (97-AG-6; photo, p. 279) has dark green stripes on a lemon-yellow background—not quite the black stripes on orange ground the name evokes, but close enough. There are green dots around the fall ridge, and the arm portion of the style arms is wholly dark green. 94-AT-2 (photo, p. 280) has falls of dark brown on a rich yellow background and style arms in shades of dark blue.

Perhaps most interesting of all is ‘Sea Green’ (97-CQ-1; photo, p. 280). It is an evenly colored blue-green with yellow tones. The area beside the fall ridge is bright yellow with dark blue-green dots. Its style arms are much bluer. Just as the flower finishes it becomes bluer. Without question, it’s unique.

97-DG-1 is a unique purple with blue tones, striking for its blue flush around the yellow fall ridge. The purple and blue contrast is quite distinct. This characteristic comes from a Reticulata I collected near Van, Turkey; it shows up best in contrast with “redder” purple falls.

Bulblet Production

A common characteristic of *I. danfordiae*, *I. sophenensis*, the Çat Reticulata, and their hybrids is that each blooming-sized bulb typically produces about eight bulblets. If left alone, many of these will die because they can’t get their leaves above the soil surface—they use up all their energy trying. It’s best to replant the bulblets close to the soil surface. In four years they will bloom. Thus, they can be used to increase a given clone faster than with most other Reticulatas. The problem with the species themselves is that their main bulbs (which dwindle to almost nothing during the flowering phase of their annual cycle) don’t regenerate large enough to bloom again soon. This is why people say *danfordiae* “shatters”: they find only bulblets and medium-sized bulbs when they dig up bulbs planted in previous years. What’s needed is plants that regenerate blooming-sized bulbs year after year. The optimal practice is to plant several bulbs widely spaced and leave them to form clumps. These will reach equilibrium, giving five or six blooms year after year. Thus, one of my F1 hybrids left behind in a replanted seedling patch, finally dug up in 2001, contained 6 blooming-sized bulbs, 5 medium, 23 small, and 163 bulblets.

A blooming-sized bulb can produce as many as 25 bulblets. The main difference between Holland and Toronto is that bulblets attain blooming size much faster in Holland, blooming in just three years, or even two. Rate of increase of a given hybrid is not really an issue in your and my gardens—the clone just needs to give consistent bloom year after year. Before you know it, you have a nice large display. Rate of increase is an issue for a new hybrid intended for use in hybridizing or showing. It is much more important when you want to build up stock to sell, especially on the Dutch scale: I’ve been told 25,000 blooming-sized bulbs are needed before starting sales.

In Holland, large bulbs tend to give two blooms per bulb. Some of my F1 bulbs I got back from Dutch grower Wim de Goede in 1999 were even large enough to give three, though the third flower was much smaller than the first two. In my own garden, I now get just one flower per bulb. These days my bulbs are planted too close together, and I don't have the space to practice crop rotation and give the soil a "rest.". In Holland, *Reticulatas* are replanted in the same soil about every seventh year.

A Goal for the Garden

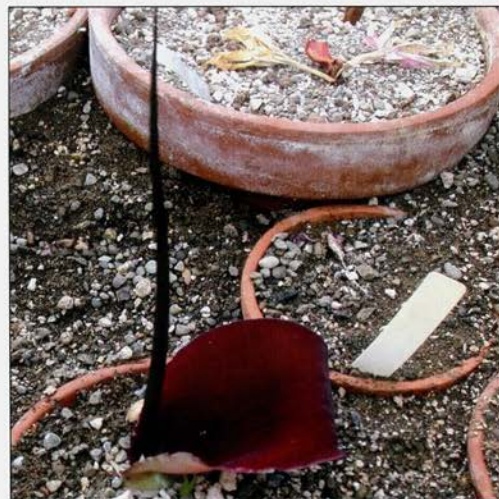
My goal is to create interesting new hybrids that do well in many North American gardens. I've often heard people complain that they've bought named varieties, only to have just a few leaves come up after a couple of years. More than six years ago I bought a dozen bulbs each of *I. danfordiae* and *I. reticulata* hort. (the purple clone sold under the species name) from a local garden center. As expected, they all bloomed. The following year each group produced 24 flowers; the third year, and essentially every year since, only about 6 flowers of *reticulata* hort., and none of *danfordiae*. This might seem good from a bulb grower's perspective because it essentially means people have to keep buying imported bulbs, but in truth it isn't. Buyers likely end up disappointed and won't buy more irises, preferring something else that lasts longer.

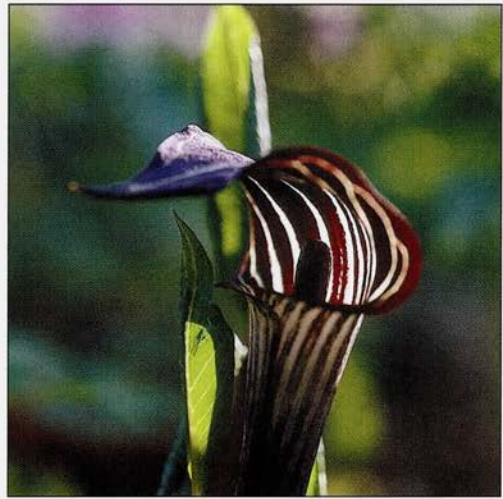
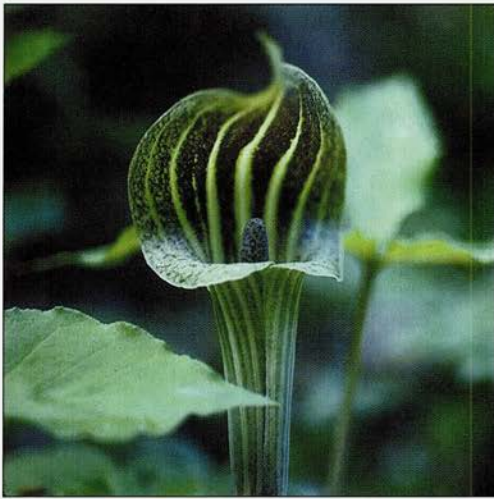
I really don't know exactly where I'm going with all of my crosses—I just know the general directions. With 5 years from seed to flowering, like the captain of a huge cargo ship I need to make course corrections well in advance. This is why I make so many crosses. Of course, one could easily make thousands of crosses and get absolutely nowhere. The key is to know the theory behind the practice, then work in several directions at once; you never know exactly which is going to be the most important. Starting with widely different clones from the wild is critical; currently available commercial clones are too similar to one another genetically.

Working with two parents that are widely different is like opening up the potential expression of a two-dimensional plane, as shown in Figure 1. If the two parents are pure species, then the first-generation progeny will all be very similar (the "X" in between) because the genes on each parent's set of chromosomes are essentially uniform. In the second and future generations, after intercrossing the offspring plus back-crossing to the parents, the possible range of expression is the whole plane. It's up to the skill of the hybridizer to bring out this full expression. For example, a recessive gene from one species and a dominant gene from the other will always give a dominant expression in the first generation. In the second generation, there's a 25% chance that the recessive characteristic will be expressed. In the case of *sophenensis* × *danfordiae*, the first-generation hybrids are all "just blues." The second generation yielded whites, yellows, blues, yellow-blues, and "spotted light blue-greens." Now other expressions are starting to appear, such as pale yellow and brown. With three widely dif-



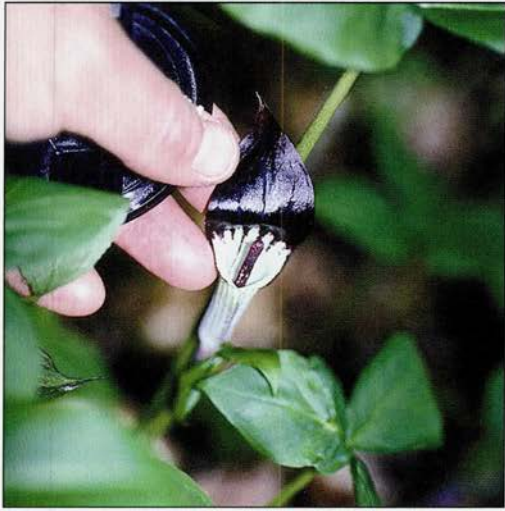
Species of *Biarum* (p. 244) growing in a bulb frame, most in 6-inch pots: above left, *Biarum carratracense*; above right, *B. davisii*; below left, *B. dispar*, probably subsp. *marmarisense*; below right, *B. pyrami*. (Photos, J. McGary)





These striped variants of *Arisaema triphyllum* subsp. *triphyllum* (p. 254) are sometimes called “zebrinus”: above left, near Shenk’s Ferry, Lancaster County, Pennsylvania; above right, in North Carolina; below left, cultivated plant; below right, in Ohio State Park, Pennsylvania. (Photos, Michael Slater)





Arisaema triphyllum subsp. *pusillum* variants (p. 255) in Berks County, Pennsylvania, growing in a wet area. (M. Slater)





Arisaema triphyllum subsp. *triphyllum* variants (p. 254) at Shenk's Ferry, Lancaster County, Pennsylvania: a pale green form and one with a long spathe hood. (M. Slater)

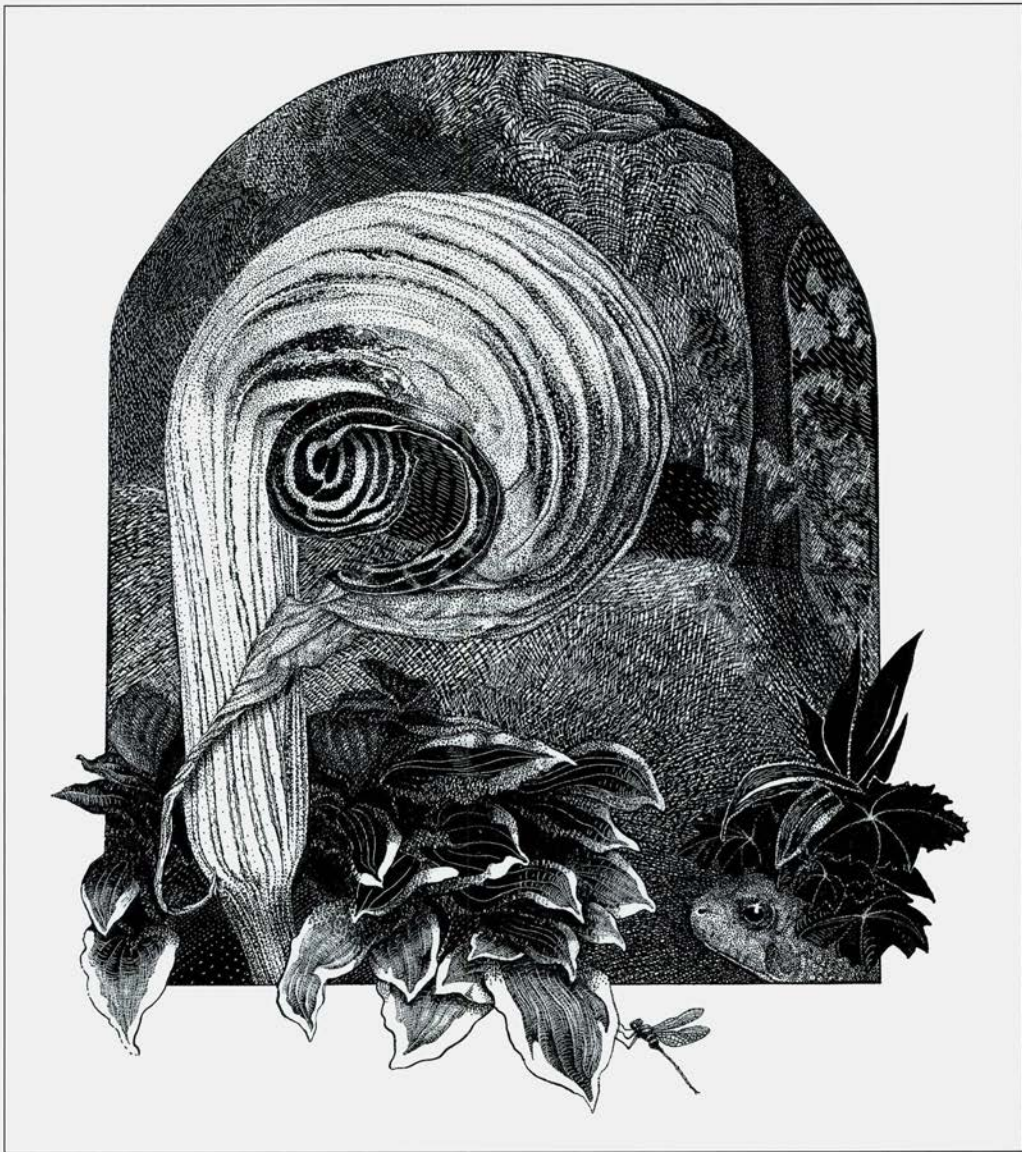
Arisaema dracontium plant and infructescence (p. 297; photos, Gene Bush).





Arisaema consanguineum (p. 298) forms grown at Seneca Hills Nursery. Above, a variegated form in the garden; note how the variegation becomes more pronounced as individual plants of the clone become larger. Below, inflorescence and mottled stems. (photos, Ellen Hornig)





Arisaema fargesii, scratchboard drawing by Jean LeCluyse (p. 257), from a plant at Plant Delights Nursery in North Carolina.



A rainbow of Reticulata irises hybridized by Alan McMurtrie (p. 266). Above left, the Çat Reticulata, one foundation of the breeding program; above right, 'Tiger'; below left, 'White Caucasus'; below right, 95-FB-1.





Unusual colors appear in McMurtrie's hybrids (p. 266). Above left, 89-A-3; above right, 94-AT-2; below left, 'Sea Green'; below right, 97-CC-2.





Additions to the white and light color range (p. 266). Above left, 'Starlight'; above right, Green Ice'; below left, 94-AK-1; below right, 98-NP-4.





Reticulata irises bring color to the late winter garden. Above left, 98-OO-1; above right, 98-OO-4; below left, 96-WR-1; below right, 98-OO-2.





Pinellia cordata (pp. 260, 264) at Juniper Level Botanic Garden in North Carolina. (Photos, Petra Schmidt)

Pinellia pedatisecta (left) and *Pinellia tripartita* (right; p. 259).





Podophyllum delavayi (p. 301), photographed by Jim McClements in his garden, received honorable mention in class 3 of the 2003 Photo Contest.

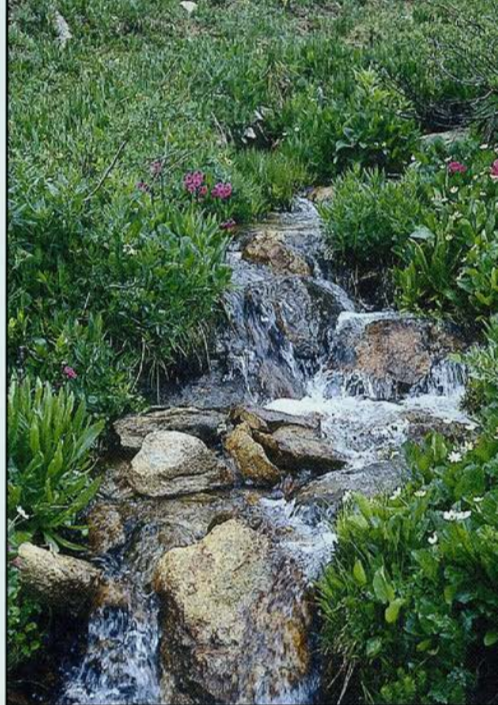
Dudleya nesiotica (p. 302) in cultivation (photo, Jack Muzatko)





Award-winning photos from Class 2 of the 2003 Photo Contest. Above, a field of *Arnica* at Crested Butte, Colorado, by Graham Nicholls, third. Below, *Xerophyllum tenax* by Dick Redfield, second.



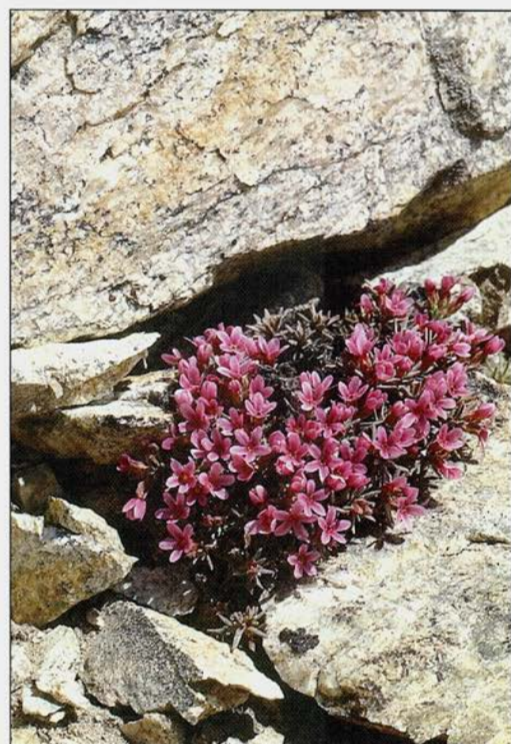


More from the 2003 contest: Left, *Gentiana lutea* above Pontrecino, by Margaret Taylor, fourth, class 1; right, stream at Loveland Lake, Dianne Huling, HM, class 2. Below, *Soldanella pusilla* in the wild, by Margaret Taylor, HM, class 1.





2003 award winners "on the rocks." Above, *Sempervivum* and *Vitaliana primuliflora* grown and photographed by Michael Peden, third, class 4. Below right, *Polemonium confertum* by Yoko Arakawa, HM, class 1. Below left, *Douglasia nivalis* in the Sawtooth Mountains, Washington, by Doris Taggart, HM, class 1.





More 2003 award winners. Above, color variants in wild *Lewisia tweedyi*, by Roger Simpson, HM, class 1. Below left, *Celmisia verbascifolia* on Gertrude Saddle, New Zealand, by Dick Redfield, HM, class 1. Below right, *Claytonia megarhiza* and *Trifolium nanum* on Mt. Evans, Colorado, by Dianne Huling, HM, class 2.



ferent species in play, the range of expression expands tremendously: it's three-dimensional (Figure 2).

Commercial Cultivation

Currently there are over 40 hectares of *Reticulatas* under cultivation in Holland, which produce some 50 million bulbs for sale annually. Sales for cultivation in pots have become a significant portion of the market, influencing which varieties sell in large numbers.

I now have six Dutch bulb growers testing my hybrids. One is solely interested in Juno irises, which I also experiment with. It would be nice to get something back for all my hard work and expense. Following the 2003 bloom, Wim de Goede proposed to introduce four of my hybrids. It will still be a few years before enough stock is built up to begin sales, and a number of years more before you'll be able to buy them in your local nursery.

My pure white *Reticulata* was registered last year as 'White Caucasus' (photo, p. 279). It's from the Lake Sevan region of Armenia, hence the reference to the Caucasus mountains. The typical form is pinkish-purple, with various clones containing differing hues and tones. It will be years before there is enough stock to introduce this lovely form commercially. To speed things up, I started having it increased by tissue culture in a laboratory late in 2002. A few hundred bulbs were delivered at the beginning of this year, with more ordered for early next year.

Reticulata Culture

Reticulata irises like well-drained soil such as sandy loam or other sandy topsoil, with lots of moisture in early spring (in the wild and in the colder parts of North America, this comes from melting snow). However, the soil should be fairly dry around the time the leaves are starting to turn brown. They should have at least half a day of sun. It's a good idea to replant them every two or three years, preferably into a new spot in the garden.

In Toronto, *Reticulatas* generally start blooming at the end of March and continue for about three and a half weeks, with individual flowers lasting seven days or longer, depending on temperature. *Sophenensis* × *danfordiae* hybrids tend to bloom at the beginning of the season. If your garden has reliable winter snow cover, I suggest planting several varieties both where the snow first melts, and in a shaded area where it lies later. That way, you'll extend your bloom season, and even get to enjoy each variety twice.

Remember, the bulbs need to regenerate, so the last thing you want to do is disturb them while they're in growth. Some people find daffodil leaves messy so they either cut them shorter or tie them up. It's bad for the daffodils, and I certainly don't advise it for *Reticulatas*, either. Wait until the leaves start to turn

brown, then do what you will. Otherwise you're only ruining next year's bloom. A little bit of low-nitrogen fertilizer at the beginning of the bloom season is good for bulb regeneration; some growers advocate fertilizing more heavily.

Alan McMurtrie lives in Toronto, Canada, and has been hybridizing *Reticulata* rises for more than 20 years. In 1985 and 1986 he traveled extensively in Turkey, studying both *Reticulata* and *Juno* irises. He is an electrical engineer specializing in computer software applied to the electrical utility industry. During the summer, he can be found canoe camping in Algonquin Park with his two sons.



Arisaema dracontium

Rock Gardening in Southern Ontario

Anna Leggatt

[The following notes were provided as an introduction to the site of the 2005 NARGS Eastern Winter Study Weekend, to be held in Toronto on January 28–30.]

I consider southern Ontario one of the best places for general gardening, in spite of some drawbacks. We have a winter. We can rest and stop weeding. Occasionally we have sweltering hot days in summer; then we can relax in the shade with a drink and admire our plants or plan for changes.

Alpines can be more of a challenge than many perennials and “woodies.” Few plants classified as alpines grow wild in southern Ontario. *Primula mistassinica* could count; it grows in wet places on the edge of the Niagara escarpment on the Lake Huron shore. Other candidates, such as *Potentilla trifoliata*, grow on limestone alvars, or “pavement” formations. The Old World species *Corydalis solida* has naturalized on the edge of a sloping woodland in a park in St. Thomas on the north shore of Lake Erie, growing with *Erythronium albidum* and *E. americanum*. Our closest truly native alpine is probably *Saxifraga oppositifolia*, which grows in a cold canyon near Thunder Bay on Lake Superior.

For alpines, our topography is against us, as is the climate. We have no mountains, although the higher hills have been named as “mountains.” Our winters are variable, and often quite mild. I remember once seeing someone mowing a lawn on December 26. The next year, we had 126 cm of snow in three days early in January! Both these conditions are welcomed by alpine gardeners—as long as they come in different years.

We can grow a good range of alpines, in spite of uncertain winters and steamy summers. Our worst problems occur when we have a warm fall followed by rapidly falling temperatures with no snow cover. This happened in fall 2003, resulting in dieback to the ground of many previously problem-free roses and other shrubs. Surprisingly, my *Daphne genkwa* only died back halfway. It was getting too tall for the rock garden anyway. However, a minute grafted plant of *Daphne petraea* flowered outside!

We eagerly check our plants in March when the snow melts, relieved to see everything emerging healthily. Unfortunately, the ground is probably still

frozen. An evergreen plant's internal leaf temperature at this time may reach 20°C/68°F, leading to desiccation because the roots cannot absorb frozen water. Worse still, it may rain and freeze. Many of us scavenge Christmas trees and use these to cover plants that will suffer from too early a spring. Of course, we will have seedlings from our seed exchange to replace any losses. Then our April and May plant sales will entice us to find yet more spots for plants. The mail brings parcels of more alpiners that we ordered back in the depth of winter. Perhaps some of us may wish for more dieback!

We are hosting the NARGS Eastern Study Weekend in Toronto at the end of January. Come and hear international and local speakers, and visit the plant sale and the silent auction. Above all, come and meet us and learn about our successes. We also confess to failures. This is all part of our learning process and improvement of our gardens.

Anna Leggatt, a botanist living in a Toronto suburb, is a frequent contributor of both articles and photographs to this journal, and also contributed to the NARGS book *Rock Garden Design and Construction*.

**NARGS Eastern Winter Study
Weekend**



Host: Ontario Rock Garden Society

Registration:
Norm & Lynne Limpert
R.R. #1, Acton, Ontario
Canada L7J 2L7
limps@sympatico.ca

For more information:
www.onrockgarden.com

FEATURING:

- John Good**—“What Makes Alpines Tick” & “Plant Portraits: Alpines from Around the World”
- Jim Jermyn**—“The Challenge of Growing the Cream of European Alpines” & “Going East - Gardening with Asiatics”
- Erich Pasche**—“Exploring the Wonders of the Tien Shan” & “Botanical Adventures around the Mediterranean”
- Marion Jarvie**—“Early Goodies”
- Barrie Porteous**—“Ontario—Great Place to Grow Alpines, Eh?”
- René Giguère**—“Exciting Alpines at the Montreal Botanic Garden”
- David Tomlinson**—“Growing Wildflowers—Conservation or Rape”
- Plus a Selection of Workshops**

NARGS National Awards, 2004

Marcel LePiniec Award: Dan Hinkley

The Marcel LePiniec Award is “given to a nursery person, propagator, hybridizer or plant explorer who is currently actively engaged in extending and enriching the plant material available to rock gardeners”; it is one of the Society’s most prestigious awards.



Dan Hinkley

The 2004 recipient, Dan Hinkley, richly deserves it. He is a plant explorer who has traveled to the far corners of the world searching for the best plants to propagate and sell at his Heronswood Nursery. The wonderful rock garden plants he has made available include a *Rhodiola* he found in Asia, the California *Scolioopus* I first saw in his woodland, innumerable Asian woodland plants for those of us gardening in shady situations, and many other tiny

bulbs and plants brought back from his trips. His catalog includes *Anemonella*, *Hepatica*, *Cyclamen*, *Epimedium*, and *Galanthus*, as well as an extensive list of *Arisaema* species and selections. His woodland garden is a great place to see what the plants will look like when they are well grown in the garden, and as such is a wonderful teaching tool.

Dan has always graciously shared his plants with other growers who have an interest in whatever family or genera he has brought back. It is truly the mark of a dedicated grower to want to share and learn more about new plants by disseminating them as rapidly as possible.

Dan led the seed collecting expedition to China mounted by the Alaska Rock Garden Society (see the summer 2004 issue of the *Rock Garden Quarterly*), making new and interesting alpine seed available to NARGS members, and he has frequently spoken to NARGS groups about his plant explorations and the won-

ders he has found. George Schmid, in his book *Shade Plants*, refers to Dan as “the indefatigable explorer,” and Dan recently was awarded the Garden Club of America Medal of Honor for his accomplishments as a plant explorer, collector, writer, and educator. The plant world has been greatly enriched by Heronswood Nursery, as well as by Dan’s writing.

Dan’s catalog is a joy to read, not only for his descriptions of rare plants but also for the wit and wisdom he imparts in his introductory essays. I keep a copy of the catalog next to my computer so I can quickly access his website, where almost every plant has an accompanying picture. The catalogs are like encyclopedias, to be kept for future reference. His discoveries have led to his writing two books, *Winter Ornamentals* and *The Explorer’s Garden: Rare and Unusual Perennials*.

For his greatly enriching our palette of rock garden plants through exploration and propagation, we take great pleasure in presenting the Marcel LePine Award to Dan Hinkley.

—PAT BENDER

Award of Merit: Bobby J. Ward

Bobby Ward’s service to the North American Rock Garden Society and to the Piedmont Chapter makes him highly deserving of the Award of Merit. From the first day of joining the chapter, he was an actively participating member. One of his biggest contributions has been editing the newsletter, *The Trillium*, which has raised the bar for excellence in chapter newsletters. Gardeners join the Piedmont Chapter just to receive this informative publication. In addition, he has been extremely generous with his talents and time—presenting programs, hosting garden tours, and procuring speakers for chapter meetings.

His organizational skills resulted in the Piedmont Chapter’s hosting a highly successful Eastern Winter Study Weekend in 1999, and he was instrumental in arranging the speakers for the 2004 Annual Meeting in Raleigh, North Carolina. He networks continuously with garden writers, speakers, plant explorers, and nursery owners. Thus, he has been a driving force in the development of excellent programs for both the chapter and the Society as a whole.

Bobby is well known and respected for his botanical knowledge and his writing ability. He is the author of two books pub-



Bobby J. Ward

lished by Timber Press: *A Contemplation Upon Flowers: Garden Plants in Myth and Literature*, and *The Plant Hunter's Garden: The New Explorers and Their Discoveries*. Through his willingness to share his talents, he has also supported the career development of others as a mentor to young gardeners and writers.

Soon after joining the Piedmont Chapter, Bobby also became active in national NARGS affairs, and his service to our organization has been extensive: he has served on a number of committees, on the Board of Directors and Administrative Committee, as vice president, and most recently as president. As chairperson of the Publications Committee, he skillfully assisted in the creation of two award-winning books, *Bulbs of North America* and *Rock Garden Design and Construction*. He identified the need for NARGS to offer plant-hunting expeditions and volunteered to chair an Expeditions Committee. Under his guidance, the first two expeditions—to the Ruby Mountains of Nevada and in Alaska—provided an enjoyable and educational experience to participants at reasonable cost.

As president of NARGS, Bobby has conducted the business of our organization in a positive and efficient manner. He has the ability to work with anyone and everyone. His combination of patience in pursuit of excellence and willingness to work toward a goal of contribution, rather than a personal agenda, has resulted in highly effective leadership. He has set standards of service to NARGS that will continue to inspire and challenge future members and leaders. All these things were done with a ready smile and a bit of Southern charm, and the rock gardening community has been greatly enriched by both his service and his friendship. It is with great pride and appreciation that we present Bobby Ward with the North American Rock Garden Society Award of Merit.

—ED GLOVER

Award of Merit: Charles Griffith

The North American Rock Garden Society is proud to present to Charles “Chuck” Griffith the Award of Merit. Chuck is an accomplished rock gardener. His first rock garden in an older section of Minneapolis, Minnesota, included one of the earliest crevice gardens in the United States. His present suburban rock garden is considerably larger than the first, with a very broad selection of alpiners and other rock garden plants. Both gardens have displayed an excellent eye for design and both have been featured on tours during NARGS annual meetings. His garden contains a wide variety of unusual rock plants from the upper central United States in addition to a worldwide range of hardy alpiners.

He has assumed roles in the Minnesota Chapter as newsletter editor, secretary, and board member. He has been an integral part of the teams that made the national NARGS meetings in Minnesota such successes. He is chairperson and a dirty-hands working member of the committee that built, supplied, and maintains the Minnesota Chapter’s impressive display rock garden in the University of Minnesota Arboretum.

For at least 5 years, Chuck maintained and greatly expanded much of the NARGS website. More than half of the new members now joining NARGS come through our website, and more than half of the Book Service's non-meeting sales do as well. Chuck has helped make our website a major horticultural asset. I urge all of you visit www.nargs.org to gain some appreciation of the enormous amount of work (estimated at over 1000 hours) that Chuck has done for us. Each month he continues to receive the Plant of the Month feature, for which he does the page layout, computer preparation, and uploading. He has also authored two Plants of the Month himself: *Chamaecyparis obtusa* 'Kosteri' (December 2000), and *Aethionema oppositifolium* (April 1999).

Chuck has provided heroic service to the North American Rock Garden Society. Larry Thomas states: "I well remember the perilous situation several years ago when the seed exchange distribution was threatened as the computer programs broke down. His willingness to fly East [and reconstruct the software] helped that Phase One chapter deliver the seed to our Phase Two chapter in time for us to make our distribution deadlines—barely—but his work saved the Exchange from breaking down completely." As Tom Stuart says, "He brought a fine set of skills for the benefit of the society. . . . We are very lucky to have had Chuck's expertise."

—IZA GOROFF

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

(Required by 39 U.S.C. 3685) 1. Publication title: Rock Garden Quarterly. Publication number: 1081-0765. 3. Filing date: 15 October 2004. 4. Issue frequency: quarterly. 5. Number of issues published annually: four. 6. Annual subscription price: \$30.00. 7. Address of known office of publication: NARGS, P.O. Box 67, Millwood NY 10546-0067. 8. Address of headquarters or general business office of publisher: NARGS, P.O. Box 67, Millwood NY 10546-0067. 9. Names and addresses of publisher, editor, and managing editor: Publisher: NARGS, P.O. Box 67, Millwood NY 10546-0067. Editor: Jane McGary, 33993 S.E. Doyle Rd., Estacada OR 97023. Managing editor: None. 10. Owner: North American Rock Garden Society, P.O. Box 67, Millwood NY 10546-0067. 11. Known bondholders, mortgagees, and other security holders: None. 12. The purpose, function, and nonprofit status of this organization has not changed during preceding 12 months. 13. Publication title: Rock Garden Quarterly. 14. Issue date for circulation data below: July 2003. 15. Extent and nature of circulation. A. Average number of copies each issue during preceding 12 months: 4,200; No. copies of single issue published nearest to filing date: 4,100. B. (1) Paid/requested outside-county mail subscriptions stated on form 3541: average during preceding 12 months, 3,941; issue nearest filing date, 3,873. (2) Paid in-county subscriptions stated on Form 3541: average during preceding 12 months, 0; issue nearest filing date, 0. (3) Sales through dealers, carriers, street vendors, counter sales, and other non-USPS distribution: average during preceding 12 months, 0; issue nearest filing date, 0. (4) Other classes mailed through the USPS: average during preceding 12 months, 167; issue nearest filing date, 186. C. Total paid and/or requested circulation: average during preceding 12 months, 4,108; issue nearest filing date, 4,053. D. Free distribution by mail: average during preceding 12 months, 0; issue nearest filing date, 0. E. Free distribution outside mail: average during preceding 12 months, 0; issue nearest filing date, 0. F. Total free distribution: average preceding 12 months, 0; issue nearest filing date, 0. G. Total distribution: average preceding 12 months, 4,108; issue nearest filing date, 4,053. H. Copies not distributed: average preceding 12 months, 92; issue nearest filing date, 41. I. Total: average, 4,200; issue nearest filing date, 4,100. J. Percent paid and/or requested circulation: preceding 12 months, 100%; issue nearest filing date, 100%. 16. Publication Statement of Ownership required, will be printed in the October 2004 issue of this publication. Jane McGary, Editor; Jacques Mommens, Executive Secretary.

Plant Portraits

Arisaema dracontium: The Other American

GENE BUSH

The name “green dragon” conjures up images of forbidden parts of the forest, the smell of brimstone (all fundamentalists know the smell of brimstone), and drifts of smoke upon the still air.

The green dragon of eastern North America is not at all terrifying, but it is a formidable garden plant.

Arisaema dracontium (photo, p. 276) is a late riser that does not emerge until well after Jack-in-the-pulpit (*Arisaema triphyllum*). In my garden, that’s around the very end of April, with the warmer winters and springs we have been having recently, or sometimes in the first part of May. Emerging arisaema plants look like umbrellas. Completely formed in all parts, the inflorescence pushes up first, with the foliage unfolding along each side. The spathe matures, with the foliage then rising up and over it.

The size of the plant can vary greatly in response to genetic makeup, environment, and cultivation practices. Generally, the plant ranges from about 15 to 30 inches (37–74 cm), or a bit more. The tall, stout stalk rising from the shallow tuber bears no foliage except at the tip, where there are 5 to 15 leaflets extending around the outer edge of a half-circle structure that some liken to a horseshoe. The half-circle sits centered upon the stalk.

When mature, the green dragon’s inflorescence rises about one-third to one-half the height of the leaf stalk. On a slender stem, or peduncle, the spathe consists of a fleshy tube with a long, pointed limb, or “tongue,” reaching upward alongside the leaf stalk. The spathe tube can be 2 inches (5 cm) or longer, with the “tongue” extending 6 inches (15 cm) or more. I have seen various color patterns in the spathe, ranging from the same green as the rest of the plant to orange-yellow.

The green dragon contributes not only great architecture to gardens, it also lends a sense of uniqueness. There’s color too, in the fruits. After blooming and seed set, come late August and September, the shiny green clusters of seeds turn

to waxy scarlet berries lying across the green of nearby plants. I find the fruiting show as colorful as any perennial bloom.

While you're walking the woods seeking *Arisaema dracontium*, the best places to look are wet, shaded areas. I found my first plant growing in my own backyard, in a drainage ditch at the edge of the woods. Seepage areas, floodplains, and the margins of small streams are primary places to discover it. However, the plant doesn't demand that kind of environment in the garden. I have some at the base of a mature tree in rocky soil. The ones that lack plenty of moisture simply do not get as large as the ones that have it. Good rich humus and leafy loose mulch that decays produce a finer plant in the garden too. If you choose to use fertilizer, which I do not, be very careful: arisaemas do not need a lot of nitrogen and can easily burn if overfed.

I have a "giant" form of *Arisaema dracontium* that appeared in my garden some years back. I noticed a single green dragon rising out of a drift of *Begonia grandis*. Somehow it appears different from the others in my garden—it resembles Asian *A. heterophyllum*. All parts are more substantial than the typical species. I moved the plant to a different location, and it has been attaining a height of 5 to 6.5 feet (around 2 m) each year for several years now. It is also a very heavy producer of seed and does a decent job of producing offsets. There are now several mature plants, along with immature offsets, on a steep hillside with Christmas ferns and large limestone rocks as company.

Arisaema dracontium always looks good with ferns as companions. It can rise out of a drift of almost any shallow-rooted perennial. The groundcover partridge berry (*Mitchella repens*) is probably my favorite companion for it.

Gene Bush is owner/operator of Munchkin Nursery and Gardens in southern Indiana. The plants described are grown in his hillside garden. See his website, www.munchkinnursery.com, or write for a catalog (\$3) at 323 Woodside Dr. NW, Depauw, IN 47115-9039.

Arisaema consanguineum

ELLEN HORNIG

There are reasons why some plants are common in the wild: they're hardy, they're adaptable, and they reproduce quickly and bountifully. *Arisaema consanguineum*, a Sino-Himalayan species with a vast natural distribution, has all these characteristics; but more to the point for the gardener, it is a stunningly beautiful plant, and its finer leaf forms are without equal in the horticultural world.

According to Guy and Liliane Gusman in their book *The Genus Arisaema* (pp. 313–318), the natural range of this species extends from Uttar Pradesh in the west, eastward across western China, and south into Meghalaya, Myanmar, Thailand, Hong Kong, and Taiwan. Found at relatively high altitudes (1000–3000 meters, roughly 3300–10,000 feet), in forests, scrub, and open slopes, it is adapted to well-drained soils and high light levels. I find that it prefers between

several hours and a full day of direct sun; grown in the shade, it stretches pitifully toward the light and slumps across neighboring plants. Usually over 4 feet (1.3 m) tall, each mature plant has two large radiate leaves up to 2 feet (60 cm) across, each with up to 22 leaflets (my current record is 19). The inflorescence, with its attractive purple-brushed green spathe ending in a long appendix, is held below the leafy umbrellas; the nodding, conical spadix, densely packed with small berries (red when ripe), produces hundreds of little seeds. These plants are late emergers: mine come up anytime from late June to late July. They compensate for that by providing foliar enchantment (“interest” being too weak a term here) well into fall. They are perfectly hardy here in Oswego, New York, in a USDA Zone 5 climate with unusually good snow cover. Reports suggest that elsewhere, without snow cover, they are reliably hardy in most Zone 6 climates.

Arisaema consanguineum (photos, p. 277) is effective in the garden either as a single specimen or in opulent drifts. With enough sun, they will stay sturdily upright: the base of the husky pseudostem can be as much as 2 inches (5 cm) in diameter. Staking may be advisable in windy or low-light conditions. They offset freely, forming dense stands that eventually benefit from thinning. I try to site mine among relatively low-growing plants the space they don't fill before they emerge is occupied by other greenery, but so that when they do develop, at least parts of their handsomely mottled pseudostems are visible.

Nine years ago I purchased seed of this species from the Seed Guild, which had acquired it from Kunming Botanic Garden. The seeds came, I assume, from already-selected parents, possibly from a broad geographic range, and they yielded plants of such stunning variety that I'm still making selections today. There are solid-green-leaved forms, forms with pronounced silver centers on each leaflet, narrow- and broad-leafleted forms, simple- and ruffle-edged forms, glossy- and dull-surfaced forms, and all possible permutations of these. One plant, introduced by Seneca Hill Perennials as 'The Perfect Wave', has glaucous bluish leaflets with broad silver centers and wavy edges. This year we're introducing another form, one with unusually broad deep blue-green leaflets, ruffled edges, and strongly contrasting wide silver centers. Some forms have long “drip tips” on each leaflet, some shorter. Most have glorious “snakeskin”-marked pseudostems. Because it takes the plants 6 or 7 years from seed to show their true mature form, selection is a slow process. Today, for example, I “edited” a collection of approximately 250 three-year-old seedlings of 'The Perfect Wave'. Out of those, I kept 65; and if I am honest about it, there are only two that are so outstanding that I should name them 'My Retirement Fund' (both have leaflets in which the silver center has become so broad that the green is reduced to a fine narrow border). All the others will have to be grown on for another two or three years to judge their merits; possibly one or two will be worth naming, and the others will go into the garden or be sold as “silver centered, mixed.” Any that are selected will have to be “bulked up” for several more years before we have enough to sell. So I'll never actually get rich this way, but I'll certainly have fun.

Good selections are easily reproduced vegetatively via the offsets which form prolifically on the “shoulders” of the parent tubers. These may be removed dur-

ing dormancy, but only if they separate easily from the parent; if they don't, they need an additional season to mature. One of the quirks of this species is that the foliage of the young offsets looks nothing like the parental foliage: narrow-leaved parents may have wide-leaved offsets, silver-leaved parents may have plain green offsets, and so forth. It's always a little disconcerting, when you're trying to multiply an excellent selection, to find that the juveniles look completely wrong—but rest assured that the mature plants will all look exactly like their parents. A small offset will generally begin to bloom 2 or 3 years after being removed from the mother plant, and will have mature foliage within 4 or 5 years.

Should you wish to grow these from seed, they are, like most arisaemas, easy to propagate. If your seeds are still in berries, free them from the pulp and rinse them clean (as far as I can tell, the widely circulated advice to rinse them repeatedly, perhaps by suspending them in a net bag in the toilet tank, is completely without merit). You may sow them fresh in fall, or dry them and sow them in spring; either way, they will germinate when spring warms to summer. They do not require a cold period to initiate growth.

First-year seedlings are small, with a single cordate leaf. Once they go dormant, store them in their seed pots, keeping them cool to cold and just barely moist. If they're crowded, separate them in spring while still dormant, move them to larger community pots, and grow them on. If they aren't crowded, leave them alone. By the end of the second growing season, they should be between one-quarter and 1 inch (1–2.5 cm) in diameter: large enough to plant out in the garden if you like. During the third growing season, you'll get a pretty good idea of which ones are likely to be spectacular; and after a few more years, with luck, your fondest dreams will be fulfilled, and you'll have a garden full of this glorious arisaema.

Ellen Hornig earned a Ph.D. from Cornell in Agricultural Economics (International Trade Theory and Policy), taught economic theory for 13 years at SUNY Oswego while helping her husband raise their four children, then threw in the towel in 1998 and devoted herself to the full-time pursuit of farming as the owner of Seneca Hill Perennials. See their website at www.senecahill.com.

Podophyllum delavayi

JIM McCLEMENTS

Podophyllum delavayi, previously known as *Dysosma veitchii*, is one of the Chinese species that have surfaced in the past decade, largely as the result of one or more Chinese sources making plants of this genus readily available to North American and European gardeners.

The taxonomy of *Podophyllum* has been updated over the past several years by Julian Shaw of Nottingham, England, in the magazine *The New Plantsman* and more recently in Stearn's book on the genus *Epimedium* in a section on the

other herbaceous Berberidaceae. As more and more plants of this genus come into our gardens, it appears that there are many forms that don't quite fit into the published keys, and that much more sorting out is to come.

Podophyllum delavayi (photo, p. 284) is a somewhat variable species, particularly in the pattern and color of the foliage. The "better" forms are spectacular as the plant emerges, with reddish-brown and black leaf patterns, occasionally mixed with yellow and tan, gradually becoming greener as the season progresses. The typical plant is a lightly patterned green from the start.

The flowers, usually two or three per stem, are borne in the junction of the two leaves and are blood-red, occasionally pink, or very rarely white. As is true of our native *Podophyllum peltatum*, plants don't flower until they are mature enough to have two leaves.

As is also true of podophyllums in general, most clones are self-sterile. My best forms of *P. delavayi* have flowered for four years and have yet to fruit. Others of the species have fruited, but so far not as readily as some of the other Chinese species.

As anyone who grows *P. peltatum* knows, it spreads vigorously by stolons (actually, adventitious root buds), to the point of being a pest in the garden. Some of the Chinese species that I grow are giving indications of having that potential, with "pups" emerging up to 10 feet (3 m) away from the parent, but thus far *P. delavayi* has not spread beyond the original plant.

I grow most of my Chinese podophyllums in the peat/sand raised beds that I've been using for six or seven years. However, the few that I've planted directly into my woodland soil have done well, and there's no doubt that *P. peltatum* does so! They all seem hardy here in Zone 7a, although an occasional late spring frost can damage them, particularly *P. difforme*. They are a group of interesting and often beautiful plants.

Jim McClements gardens in Dover, Delaware, with a particular interest in woodland plants. He described his peat/sand woodland beds in an earlier issue of this journal and has contributed numerous photos to the *Quarterly* and other NARGS publications.

Dudleya nesiotica

JACK MUZATKO

with contributions by John Trager

Have you ever gotten a new plant for your garden, stuck it in the ground without much thought, and then watched it grow into a beautiful surprise? That was my first experience with *Dudleya nesiotica* (photo, p. 284).

Dudleya nesiotica is different from many other dudleyas in several ways. Most species of the genus, native to far western North America, bear perennial rosettes of succulent leaves, often with a glaucous or waxy coating. *D. nesiotica*, however, is one of a small number of geophytic species in the genus. These have non-glau-

cous, succulent foliage both in a rosette and, under favorable conditions, on longer decumbent stems that grow only during the winter rainy season. In summer these dry and fall away, leaving a perennial subterranean tuber.

Some dudleya flowers are tubular and yellow, orange, or red, attractive to hummingbirds. Those of *D. nesiotica* have spreading petals and attract bees or nectar-feeding flies. The white-petaled flowers of *D. nesiotica* make a particularly worthy floral display in a rockery.

Dudleya nesiotica is classified as rare (by the state of California) and as threatened (by the federal government). It was first described in 1950, and its entire natural habitat is limited to Santa Cruz Island off Southern California. It is a good example of a species that evolved in a specific habitat over millenia of isolation.

I obtained a seedling from John Trager, Curator of Desert Collections at the Huntington Botanical Gardens. The Huntington received surplus plants from an ongoing research project of the Santa Barbara Botanical Garden and produced seedlings from controlled pollination. These will soon be available through the Huntington's plant introduction program, the International Succulent Introductions (ISI) published each year in the March-April issue of the *Cactus and Succulent Journal*.

My own *D. nesiotica* started out in the spring looking like a lot of other small succulents. However, by late April a long stem of flowers started to form, and by June the garden was alive with a floral display. A few weeks later, the entire inflorescence began to dry up and spiral around like miniature tumbleweed, ready to blow away and spread its dustlike seeds across the landscape (fortunately, I was able to grab it for my own purposes before it could satisfy its natural impulse). After the whole plant broke off above ground, it went into summer dormancy with no visible clue of its presence. In October, it robustly came back to life.

So far, *D. nesiotica* seems to be quite well adapted to growing outdoors in my garden in the San Francisco Bay area. It is a small plant only about 2 inches (5 cm) high, with a floral display only about 4 inches (10 cm) across. It could easily become lost in many rock gardens devoted to larger plants. However, in a garden designed for miniatures, *D. nesiotica* is a spectacular addition.

Jack Muzatko, an engineer, gardens in Pinole, California, specializing in very small plants. He has also contributed to this journal on lewisias.



NARGS COMING EVENTS

Annual Meeting: July 14-17, 2005, "Newfoundland and Labrador: Rock Garden of the North Atlantic." Host: Newfoundland Chapter, Holiday Inn, St. John's, Newfoundland. Registrar: Bodil Larsen, 141 Lower Rd., Outer Cove, NL A1K 4B7, Canada; <blarsen@mun.ca>; info: <http://www.nfldrockgardensociety.homestead.com/Introduction.html>

Eastern Winter Study Weekend: January 28-30, 2005, "Ontario—Multicultural." Host: Ontario Chapter, Toronto Airport Marriott, Toronto, Ontario. Registrar: Norm & Lynne Limpert, RR #1, Acton ONT L7J 2L7, Canada; (905) 878-1243; <limps@sympatico.ca>

Western Winter Study Weekend: February 25-27, 2005, Host: Northwestern Chapter, Everett, Washington. Registrar: Alice Lauber, 18922 45th Pl. NE, Lake Forest Park, WA 98155; <aelauber@juno.com>

MT. TAHOMA NURSERY

28111 112th Ave. E., Graham, Wa. 98338

Alpines for the Enthusiast

Rick Lupp [253] 847-9827 rlupp@aol.com

Alpines, Trough Plants, Dwarf Shrubs & Woodland Plants

Classic Alpines as well as the Newest Introductions

Choice androsaces, dwarf campanula, gentiana, penstemon, primula, saxifraga

Daphne, dwarf rhododendron and much, much more!

Send \$2.00 for our list or visit us at www.backyardgardener.com/mttahoma



Alpines Mont Echo

www.alpinemtecho.com

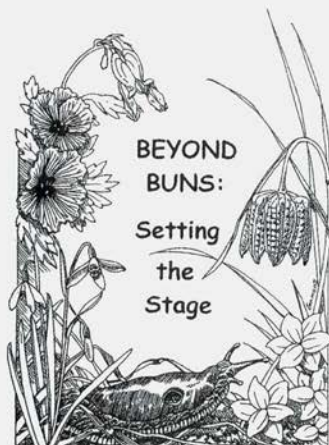
We offer a wide range of choice Alpine and Rock Garden plants with a particular emphasis on Primulas, Saxifragas, Woodland Plants and Dwarf Shrubs.

1182 Parmenter Road · Sutton, QC Canada J0E 2K0

P.O. Box 663 · Richford, VT U.S.A. 05476-0663

Tel. (450) 243-5354 · Mail order catalogue \$2.00.

WESTERN WINTER STUDY WEEKEND



BEYOND
BUNS:
Setting
the
Stage

February 25–27, 2005
Howard Johnson Plaza Hotel
Everett, Washington

Hosted by the Northwestern Chapter,
NARGS

Speakers:

Robert Fincham, Jerry John Flintoff,
Rick Lupp, Jane McGary,
Baldassare Mineo, Darrell Probst;
Photo Presentation: Mark Turner

Alice Lauber, Registrar
18922–45th Place NE
Lake Forest Park, WA 98155
206-363-7357; aelauber@juno.com

Plant and Book Sales
Silent Auction
Self-guided Garden Tours
Premiere of an Original Rock Melodrama

Enhance Your Landscaping With Nature's Wonder – Garden Rock

TUFA

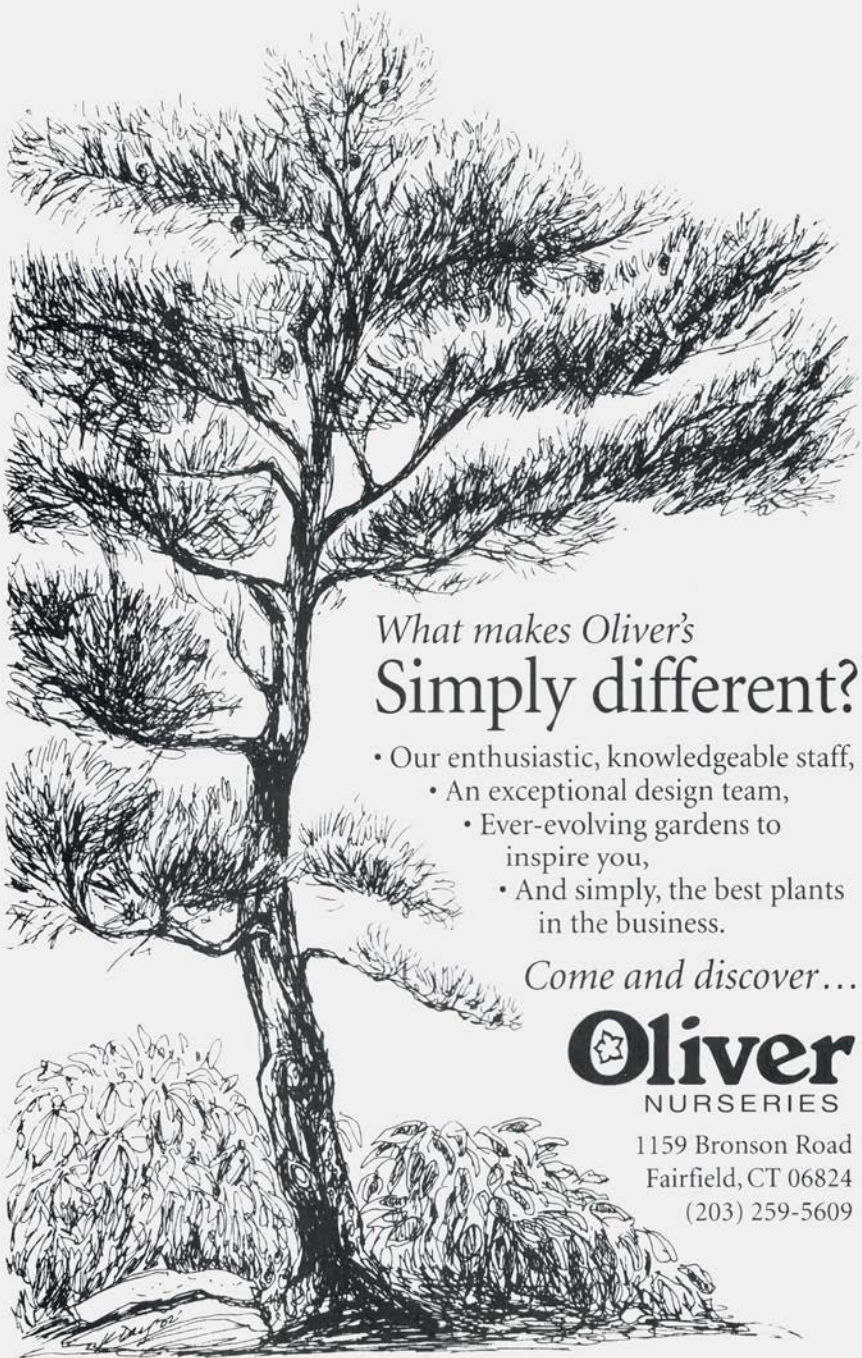
- Benefits from the beauty & unique properties of Tufa
- A must for alpine & rock gardeners
- Porous (absorbs water)
- Lightweight, easy to handle
- Blends naturally to all yard settings
- Ideal for water features

SLATE

- Royal purple slate
- Layer of quartz makes it harder
- Weather & Stain resistance
- No Maintenance
- Great for walkways, wall facings, dry packs, fireplaces, patios, etc.

ROCKY MOUNTAIN TUFA LTD.

Ph: (250) 346-3216 • 347-9381 • Fax: (250) 346-3212
www.tufa.bc.ca • E-mail: info@tufa.bc.ca



What makes Oliver's
Simply different?

- Our enthusiastic, knowledgeable staff,
- An exceptional design team,
- Ever-evolving gardens to inspire you,
- And simply, the best plants in the business.

Come and discover...

Oliver
NURSERIES

1159 Bronson Road
Fairfield, CT 06824
(203) 259-5609

Offer for 2004/05

Seeds of Alpine plants - wild collected from Siberia region, Himalaya - Sikkim state and IRAN mountains! Garden seeds too.

Cypripediums - flasks, young seedlings and mature plants.

Catalogue for US\$2,- in bills or visit my c

web sites:

www.webpark.cz/cks-alpinus

www.webpark.cz/cks-ecypripediums



PS-74

708 00-OSTRAVA-8
CZECH REPUBLIC

Pacific Horticulture

a magazine about
plants and gardens of the west

illustrated color quarterly

annually, in US currency: US \$25
Canada & Mexico \$29; overseas \$31

write to:

Circulation Department
PO Box 680, Berkeley, CA 94701

HYPERTUFA TROUGHS

Call or write for list:

Betsy Knapp

796 South Ave.

Rochester, NY 14620

(585) 271-0324

eeknapp@rochester.rr.com

*Exhibitor at 2004 EWSW &
2004 National Meeting*

American Primrose Society

*Invites everyone who enjoys
primroses to join our society.*

*Members receive quarterly magazine
and seed exchange privileges.*

*Dues (individual or household) \$28
per calendar year, checks preferred.*

Julia Haldorson, Treasurer

P.O. Box 210913

Auke Bay, AK 99821 USA



Purveyor of alpine fertilizers, micronutrient
supplements, Italian clay pots, pumice stone,
and other supplies for growers and hobbyists.

Visit us online at: www.illaherockerries.com
PO Box 86185, Portland, OR 97286



Iris iberica Ixontis
By Tom Yador Little

Aril Society International

Devoted to the Oncocyclus and Regelia Irises

**Membership includes the beautiful Yearbook, three
Newsletters and access to the annual Plant Sale
(an excellent source for aril and arilbred irises).**

Send \$10 for one year or \$28 for three years to:

Reita Jordan

3500 Avenida Charada NW

Albuquerque, NM 87107 USA

Three year membership includes \$12 credit for the Plant Sale.

The Primrose Path

www.theprimrosepath.com

921 Scottdale-Dawson Rd
Scottdale Pa 15683

PHONE (724) 887-6756

FAX (724) 887-3077

E-MAIL: primrose@a1usa.net

Choice and unusual perennials, mainly woodland and shade plants, all nursery propagated.

Specializing in our hybrids & selections of

Tiarella,

Heuchera,

Heucherella, and *Primula*.

Catalog \$2. Wholesale and retail.



Heuchera 'Silver Scrolls'



Sunsclapes

Rare Plant Nursery

Unusual Plants for Rockeries & Dryland Gardens, Hardy Africans, Native Perennials

Descriptive Catalog \$2.00

Bill Adams
330 Carlile Ave.
Pueblo, CO 81004

719-546-0047 tel/fax
www.sunsclapes.net
sunsclapes@attbi.com

A Distinguished Collection

Over 1500 hard to find and useful varieties

ROSLYN NURSERY

211 BURRS LANE, DEPT R
DIX HILLS, N.Y. 11746

Descriptive mail order catalog \$3.00

Beaver Creek Greenhouses

Rock Garden Plants - Alpines, Drylanders, Dwarf Shrubs, Rhodos, Conifers

www.rockgardenplants.com

email: bvcreek@netidea.com

Plant & seed catalogs: \$3 ea. or \$5 for both

In Canada: Box 129 Fruitvale, BC V0G 1L0

In US: 4155 Deep Lake Boundary Rd
PMB#364 Colville, WA 99114



Saxifraga x 'Gloriana'

WRIGHTMAN ALPINES NURSERY

www.WrightmanAlpines.com

Shop On-Line
Printed Catalogue: \$2

Grower and Supplier of Alpine Plants
Hand-carved Stone Troughs



Phone/Fax: (519) 247-3751

RR#3, Kerwood, ON Canada N0M 2B0

SISKIYOU

RARE PLANT NURSERY

An ever growing collection of over 1,000 varieties of
Perennials, Alpines, Ferns, Dwarf Conifers, Northwest Natives,
and other hardy plants for the Border, Woodland and Rock Garden.

For Full-Year Catalog and Fall Catalog . . . send \$3.00

2825 Cummings Road, Medford, Oregon 97501

Phone (541) 772-6846

siskiyourareplantnursery.com • Shipping to U.S. and Canada only

Jelitto

Perennial Seeds

Catalogue + Shop
www.jelitto.com

STAUDENSAMEN · PERENNIAL SEEDS · GRAINES DE PLANTES VIVACES

Production · Breeding · Seed Technology

USA Office: 125 Chenoweth Ln. · Suite 301 · Louisville, KY 40207

Phone: (502) 895-08 07 · Fax (502) 895-39 34 · www.jelitto.com · abush@jelitto.com

German Headquarters: Jelitto Staudensamen GmbH · P.O. Box 1264 · D-29685 Schwarmstedt
Phone ++49 50 71/98 29-0 · Fax ++49 50 71/98 29-27 · www.jelitto.com · e-mail: info@jelitto.com



Kirk Fieseler Karen Lehrer

1950 Laporte Avenue
Fort Collins, CO 80521
Tel/Fax 970-472-0017

Laporte Avenue Nursery
Rocky Mountain Alpines,
Western High Plains Plants &
Rock Garden Plants
Catalog \$1.00

Hansen Nursery



Wide variety of species CYCLAMEN
and Northwest Native Bulbs

Retail / Wholesale
Catalog \$1.00

P.O. Box 1228, North Bend, OR 97459
<Hansen.nursery@verizon.net>
Tel.: 541-756-1156

SEEDHUNT

Seed of California and
uncommon annuals, perennials
and many Salvias.

Send \$1.00 for descriptive list to:
Seedhunt

P.O. Box 96, Freedom, CA 95019-0096
www.seedhunt.com

SPECIES CYCLAMEN

From *africanum* to *wellensiekii* with
more than 30 others in between - the
widest selection of species, varieties,
and forms available.

*100% seed raised

*shipped established in pots or
bare root where required, US only
*limited quantities

December price list, \$1 to:
David Fischer, PO Box 96
Wiscasset, ME 04578



Evermay Nursery

Alpines & Primula species and hybrids

Grown in and for the northeastern U.S.

We ship mature plants in their pots

Visit our web site at www.evermaynursery.com

Mailorder catalog available in January

**84 Beechwood Ave.
Old Town, Maine 04468**

**Richard May, proprietor
207-827-0522**

Narcissus

EXTENSIVE LISTING OF
VEGETATIVELY PROPAGATED BULBS

Nancy R. Wilson
SPECIES & MINIATURE NARCISSUS

CATALOG \$1

6525 BRICHLAND-THORN ROAD
GARBERVILLE, CALIFORNIA 95542

e-mail: nwilson@asis.com

VISIT OUR WEBSITE: www.asis.com/~nwilson/



South Africa - Explore the Drakensberg range with Rock Garden personality, Panayoti Kelaidis and his South African botanist colleague Dr. Koos Roux FEB 1 - 14, 2005.

GEOSTAR

Since 1977, specialists in botanical & natural history expeditions.

1-800-624-6633

www.geostartravel.com

WESTONBIRT PLANTS

Bulbs for the Autumn

Arisaema, Arum, Corydalis, Crocus, Erythronium, Fritillaria, Juno and Reticulata Iris, Lillium, Trillium and Tulipa

We offer over 300 different bulbs and woodland plants many unavailable elsewhere. All with free postage and packing worldwide.

Send 3 US\$ bills for our catalogue published in the Spring to:

**Westonbirt Plants - 9 Westonbirt Close, Worcester
WR5 3RX
England**





Wildflowers of the World

FRANCE

GARDENS OF THE FRENCH RIVIERA

May 2005 • (Limit 18 people)

One hundred and fifty years ago, northern gardeners discovered the unspoiled paradise on the French Riviera. There many, like Lawrence Johnston of Hidcote, Lady Aberconway of Bodnant and Ellen Willmott of Warley Place, created gardens and perfected the art of living. Join us as we visit some of the regions spectacular gardens and also enjoy the famous wines and cuisine of France.

Leaders—Bruce Scott has been chief horticulturalist and manager of the superb gardens at Casa Loma, Toronto, for many years. He holds a diploma in horticulture from Guelph University, Ontario. Christine Hughes is an excellent gardener who has more than twenty years experience in organizing and guiding tours to Europe.

PATAGONIA

WILDFLOWERS OF THE SOUTHERN ANDES

November 2005 • (Limit 14 people)

Patagonia is a wonderland of glacial lakes, towering granite peaks, beech forests and spectacular wildflowers. On this perfectly timed trip, we will spend nine days in Southern Patagonia, followed by ten days in the Argentine Lake District to maximize the range of flowers we will enjoy.

Leader—Captain Peter Erskine has been a member of the Alpine Garden Society for fifty years and has accompanied numerous trips to Patagonia. He is a highly experienced leader and a superb plantsman.

Contact us at 1-800-387-1483 or e-mail sean@worldwidequest.com for more information or to reserve your place.

Quest

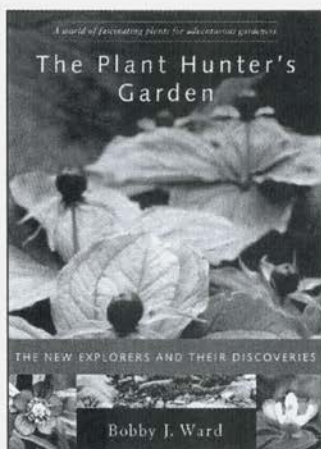
NATURE TOURS

www.questnaturetours.com

Presented by Worldwide Quest International Inc. Ontario Reg. No. 2667946

NEW FROM TIMBER PRESS:

THE PLANT HUNTER'S GARDEN
The New Explorers and Their Discoveries
By Bobby J. Ward



ISBN 0-88192-696-5

340 pp, 250 color photos

3 line drawings

7 3/8 x 10 3/8"

hardcover, \$39.95

To be published October 2004

Bobby Ward profiles 32 of today's more prolific plant hunters. From the Czech Republic to the Rocky Mountains, Ward has sought out those explorers in the private sphere who are collecting plants specifically for horticultural introduction, not just as scientific specimens for botanical collections. While providing interesting details on the lives and careers of these new explorers, the real focus of the book is on the plants themselves. Ward asked each of the hunters to choose the very best treasures from their years of collecting, and has sumptuously illustrated these jewels in stunning photos.

Praise for the author and the book...

"There is a wealth of interest here for keen gardeners and botanists. Numerous exciting new plants are mentioned and illustrated, their origins and behavior in cultivation are recorded, and the whole is laced entertainingly with many a travelers' anecdote."

—From the foreword by **Brian Mathew**

Available from N.A.R.G.S. Book Service

THE SCOTTISH ROCK GARDEN CLUB



www.srgc.org.uk

offers you "THE ROCK GARDEN" - our twice yearly journal. An ANNUAL SEED LIST with over 4500 different choices and a twice yearly BOOKLIST.

SUBSCRIPTION
FAMILY £18 / \$30
SINGLE £15 / \$25
JUNIOR (under 18yrs.) £6 / \$10

Details from:-
SRGC Membership Secretary,
P.O. Box 14063,
Edinburgh EH10 4YE.

EUROSEEDS

MOJMIR PAVELKA

Rare wild collected seeds from Monte Negro, Greece, Alps, Nepal, Caucasus, Kashmir etc. Some Selected garden seeds also available.

Please send 2 U.S.dollars or two International coupons for Nov.mail Catalogue, E-mail euroseeds@tiscali.cz
MOJMIR PAVELKA, P.O. BOX 95,
741 01 NOVY JICIN, CZECH REP.

MOUNTAIN SEEDS

Wild collected and garden seeds of rare plants from mountains around the world.
Please send 3 Euros, 3 U.S. dollars or 3 International coupons for our catalogue.

Jean-Louis LATIL, LE MAUPAS,
05300 LAZER, FRANCE
E-mail : g.r.e.g.b@wanadoo.fr

You are cordially invited to join the

American Rhododendron Society

Benefits: quarterly journal, seed exchange, chapter affiliation, conventions

Annual subscription of \$35 (USA)
Dues may be sent to:
Laura Grant, Executive Director
P.O. Box 525
Niagara Falls, NY 14304-0525 USA

ARS Website: <http://www.rhododendron.org>

Hardy, colorful Hens-&-Chicks

Assorted offsets 25/\$18, 50/\$32. Older plants, unnamed 12/\$32, named 12/\$45.
Shipping \$5, plant list \$2.
Grown outdoors in Wisconsin, shipped bareroot April or August.

Alpine Gardens
W6615 Smock Valley Rd.
Monroe, WI 53566
(608) 325-1836



NORTH AMERICAN ROCK GARDEN SOCIETY

Join Today!

Benefits of Membership Include:
Beautiful, Colorful Quarterly Bulletin; Seed Exchange offering Thousands of Species of Seed at Low Prices; Spectacular National Meetings; Meet Fellow Gardeners

Send \$25, \$30 overseas to: Jacques Mommens, Exec. Secretary,
PO Box 67, Millwood, NY 10546



N · A · R · G · S BOOK SERVICE



SPECIAL INVENTORY REDUCTION SALE

Bulbs of North America. 308 pp., 101 color photos\$16
Covers North America's native bulbs popular with rock gardeners.
American Horticultural Society Book Award.

Additional discounts for quantities to chapters and groups.



RECENT RELEASES OF INTEREST FROM TIMBER PRESS

Consult the Timber Press website www.timberpress.com for additional details.

American Azaleas, L. Clarence Towe. 188 pp., 79 color photos\$24

Crocsmia and Chasmanthe, Peter Goldblatt, John C. Manning, and
Gary Dunlop. 236 pp., 14 color plates, 14 line drawings\$24

The Curious Gardener, Jürgen Dahl. 264 pp., 56 b/w photos\$20

American Household Botany, Judith Sumner. 396 pp., 40 color photos,
113 line drawings\$22.50

Garden Plants of Japan, Ran Levy-Yamamori and Gerard Taaffe.
440 pp., 788 color photos\$48

The Plant Hunter's Garden: The New Explorers and Their Discoveries,
Bobby J. Ward. See display ad in this issue.\$32

FAVORITES

**Alpine Plants of North America: An Encyclopedia of Mountain Flowers
from the Rockies to Alaska,** Nicholls. 344 pp.\$40

Columbines, Nold. 158 pp.\$20

Creating and Planting Garden Troughs, Fingerut and Murfitt. 108 pp.\$17

Cuttings from a Rock Garden, H. Lincoln Foster. 446 pp.\$9

Cyclamen, Grey-Wilson. 224 pp.\$32



N · A · R · G · S BOOK SERVICE

<i>The Genus Epimedium</i> , Stearn. 256 pp.	\$40
<i>Lewisiads</i> , Davidson. 224 pp.	\$28
<i>The Color Encyclopedia of Cape Bulbs</i> , Manning, Goldblatt, and Snijman. 486 pp, 611 color photos	\$48
<i>Rock Garden Plants: A Color Encyclopedia</i> , Mineo. 320 pp.	\$48
<i>Rock Garden Design and Construction</i> , McGary, ed. 316 pp.	\$23
<i>Penstemons</i> , Nold. 308 pp.	\$24

NARGS Book Service

4411 New Holland Road Mohnton PA 19540 USA

610 775 9084 voice or fax nargs@voicenet.com

Mrs. Janet E. Slater

ORDERING: Please print name and address clearly with postal code and country of origin. Orders must be prepaid via VISA, MasterCard, AMEX (please include signature, full account number, date of expiration) or check or money order in **US DOLLARS by check on a US bank or international money orders drawn on a US bank or US Postal Service.** Please make checks payable to NARGS Book Service.

Add postage and handling as follows:

US Orders	first book \$4.00	each additional book \$2.00
Outside US	first book \$8.00	each additional book \$4.00

Index

Volume 62 (2004), *Rock Garden Quarterly*

boldface = photo

pp. 1-80, Winter • pp. 81-160, Spring • pp. 161-240, Summer • pp. 241-320, Fall

Plants

Note: Plants merely mentioned in articles, without discussion, are not included.

- Acantholimon androsaceum, 105
Alchemilla alpina, 103; erythropoda, 103
Allium aaseae, **117**, 137; gypsaceum, 96;
protensum, 98; sarawschanicum, 97;
stipitatum, 97; tenuicaule, 99;
verticillatum, 96
Alyssum cuneifolium, 103; handelii, 181,
202; montanum, 103
Ambrosinia bassii, 262
Androsace lanuginosa, 103
Anemone multifida, 90, **113**
Anthemis cupaniana, 184; delphinensis,
184
Anthyllis pulchella, 185
Aquilegia coerulea, **29**
Arabis bryoides, 182; procurrens, 103;
× sturii, 103
Arisaema consanguineum, **277**, 298;
dracontium, **276**, 297; fargesii, **278**;
triphylum, 254, **274-276**
Arisarum proboscideum, 263;
simorrhinum, 262; vulgare, 262
Aristida stricta, 5
Asperula boissieri, 184, **204**
Astragalus angustifolius, 184, **205**;
monspessulanus, 105
Aubrieta gracilis, 103, 182
Bergenia atropurpurea, 209
Biarum aleppicum, 248; angustatum,
247; auraniticum, 251; bovei, 248;
carduchorum, 247; carratracense, 249,
273; crispulum, 248; davisii, 252, **273**;
dispar, 248, **273**; ditschianum, 251;
eximium, 248; fraasianum, 250;
kotschyi, 250; mendax, 251; olivieri,
249; pyrami, 250, **273**; rhopalospadix,
247; straussii, 249; syriacum, 249;
tenuifolium, 246
Calandrinia acaulis, 93; acutisepala, 93,
116; affinis, 93, **116**; caespitosa, 91;
hirtella, 92; ranunculina, 92
Calochortus eurycarpus, 89, **114**
Calopogon tuberosus, 5
Calydorea amabilis, 36; coelestina, **25**, 35;
pallens, 36
Calypso bulbosa, 172
Campanula andrewsii, 184; garganica,
103; oreadum, 181; radicata, 184;
saxatilis, **204**
Cardamine californica v. sinuata, **207**,
220; carnosa, 182
Cassiope 'Badenoch', 103
Castilleja rhexifolia, **113**
Celmisia verbascifolia, 288
Cerastium candidissimum, 103, 185
Chamaecyparis thyoides, 4
Claytonia megarrhiza, **288**; virginica, **31**,
44
Cleistes divaricata, 5, **17**
Clematis columbiana, 89; ranunculoides,
190; rehderiana, 190

- Collomia debilis*, **115**
Corydalis caseana, **115**; *glauca*, **203**;
 parnassica, 183; *solida*, 185
Crocus sieberi, 185
Cyclamen coum, 38
Cypella herbortii, **26**
Cypripedium acaule, 165, 172;
 bardolphii, 166; *calceolus*, 165;
 californicum, 165, 216; *candidum*,
 172; *cordigerum*, 165, 175;
 corrugatum, 165, **194**, **195**; *daliense*,
 166; *elegans*, 175; *fargesii*, 166, **195**;
 farreri, **195**; *fasciculatum*, **196**;
 fasciolatum, **195**; *flavum*, 165, **196**;
 formosanum, 166, 178, **193**;
 franchetii, 165, 178; *froschii*, **194**;
 guttatum, **199**, 215; *henryi*, 178;
 himalaicum, 166, 175, 178;
 irapeanum, 165; *japonicum*, 166, 178;
 kentuckiense, **200**, 217; *macranthos*,
 165, 175; *margaritaceum*, 178;
 montanum, **197**, 218; *parviflorum*,
 165, **196**; *passerinum*, 172; *pubescens*,
 165; *reginae*, 165, **198**, 214; *segawai*,
 165; *sichuanense*, **197**; *tibeticum*, 165,
 194; *ventricosum*, 165; *wardii*, 172
Dactylorhiza sambucina, 181
Daphne arbuscula, 107; *jasminea*, 183;
 laureola, 180; *oleoides*, 180
Delphinium biternatum, 96;
 semibarbatum, 96
Dianthus carthusianorum, 184;
 erinaceus, 103; *haematocalyx*, 181;
 minutiflorus, 181; *simulans*, 104
Dicromena latifolia, **18**
Dionaea muscipula, 5
Dodecatheon 'Red Wings', 104
Douglasia nivalis, **287**
Drosera, 5
Dudleya nesiotica, **284**, 302
Echinacea laevigata, 12
Edraianthus parnassicus, 184
Ennealophus euryandrus, 36
Epigaea repens, 104
Epilobium obcordatum, **115**
Eremurus stenophyllus, 96
Erodium chrysanthum, 185
Escobaria echinus, **208**, 223; *sneedii*, 221
Fritillaria olgae, 98
Galanthus reginae-olgae, 104
Galium scabrifolium, 185
Gentiana arethusa, **201**; *atunsiensis*,
 192; *georgei*, **201**; *lutea*, **285**; *olivieri*,
 96; *pontica*, 183; *verna*, 183
Globularia meridionalis, 105, 183;
 repens, 105
Gypsophila aretioides, 51
Habenaria, 5
Haberlea rhodopensis, 109
Helianthus schweinitzii, 12, **25**
Herbertia lahue, 36
Hieracium pannosum, 181
Hypericum lloydii, **24**, 34; *olympicum*,
 181; *reductum*, 34
Impatiens subcalcarata, 189
Ipomopsis aggregata, **113**
Iris danfordiae, 266; *histrioides*, 266;
 linifolia, **118**; *parvula*, 98, **118**;
 reticulata, 266; *sopenhensis*, 266;
 stolonifera, **120**; *svetlanae*, 97, **119**;
 tadshikorum, 98, **119**; *vicaria*, 99, **119**;
 vvedenskyi, 95, 98, **118**; *warleyensis*,
 97, **120**; *winogradowii*, 266
Jankaea heldreichii, 180
Jasminum parkeri, 104
Jeffersonia dubia, **28**
Lamium garganicum, 185, **204**
Leontopodium palibinianum, 211
Lewisia columbiana, 89; *disepala*, **124**,
 125, 132; *tweedyi*, 105, **288**
 Lilium pyrophilum, 13, **25**
Linaria peloponnesiaca, 185
Lindera subcoriacea, 13
Linum elegans, 180; *hirsutum*, 181
Lupinus arcticus, **122**, 134
Lysimachia asperulifolia, 14
Magnolia virginiana, 46
Maihuenia poeppigii, 104
Meconopsis horridula, 190
Montiopsis andicola, 94, **117**; *cistiflora*,
 94; *gilliesii*, 94; *sericea*, 93, **117**
Myosotis baumgarteniana, **202**;
 suaveolens, 183; *sylvatica* ssp. *cyanea*,
 185
Narcissus cantabricus, **123**, 133;
 romieuxii, **123**, 133
Nemastylis floridana, 37; *geminiflora*,
 37
Omphalodes luciliae, 182
Opuntia humifusa 'Claude Barr', 104;
 polyacantha ssp. *juniperina*, **208**, 223
Origanum 'Kent Beauty', 104;
 libanoticum, 104
Ornithogalum nanum, 185
Oxytropis campestris, 181; *multiceps*,
 105
Paeonia delavayi, 209
Paphiopedilum, 174

Paronychia rechingeri, 182; *serpyllifolia*, 104
Penstemon davidsonii, 105; *fruticosus*, 105; *hallii*, 105, **128**; *venustus*, 89
Petrophytum cinerascens, 104
Phragmipedium, 174
Pieris nana, 104
Pinelia cordata, 260, 264, **283**;
pedatisecta, 259, **283**; *ternata*, 259;
tripartita, 259, **283**
Pinguicula caerulea, 5, **18**; *hirtiflora*, 180
Podophyllum delavayi, **284**, 301;
hexandrum, 188, 190
Polemonium confertum, **287**
Polygala amara, 184; *calcarea*, 104;
minuta, 184
Potentilla alba, 104; *deorum*, 181;
speciosa, 181
Primula abchasica, **126**, 135; *auricula*,
126; *geraniifolia*, 211; *poissonii*, 189;
secundiflora, 189; *sikkimensis*, 211;
vulgaris, 136
Prunus prostrata, 185, **203**
Pterocephalus parnassii, 184
Puya raimondii, **206**, 218
Ramonda myconi, 109; *serbica*, 186
Ranunculus brevifolius, 183; *kochii*;
spruneranus, 183
Rheum alexandrae, 192; *nobile*, 191
Rhus michauxii, 14, **25**
Sarracenia flava, 5, **17**; *minor*, 5;
purpurea, 5, **17**; *rubra*, 5, **17**;
× catesbaei, 5
Satureja montana, 104; *spinosa*, 104
Sauromatum venosum, 264
Saussurea stella, 188, **201**
Saxifraga arguta, **114**; *grisebachii*, 180;
moschata, 182; *scardica*, 181;
sempervivum, 181; *spruneri*, 182, **205**
Scilla bifolia, 185
Sedum glaucophyllum, **27**, 45; *nevii*, **27**,
45
Soldanella pusilla, **286**
Spiranthes, 5
Teucrium aroanium, 49; *canadense*, 49;
chamaedrys, 49; *compactum*, 49, 104;
laciniatum, 49; *marum*, 50, 104;
polium, 48; *subspinosum*, 48;
webbianum, 49
Thalictrum cooleyi, 14
Thymus herba-barona, 105
Townsendia montana, **114**
Trifolium nanum, **288**
Trillium pusillum, 15, **24**

Triosteum himalaicum, 188, **200**
Trollius laxus, **30**
Typhonium diversifolium, 264
Valeriana pontica, 185
Veratrum californicum, 90; *viride*, 90
Verbascum thapsus, 184
Veronica thessalica, 182, **203**
Viola affinis, 8, **19**; *bicolor*, 10; *blanda*, 9,
21; *canadensis*, 9, **23**; *conspersa*, 9, **23**;
cucullata, 7, **19**; *delphinantha*, 181,
202; *graeca*, 181; *hastata*, 9, **23**;
hirsutula, 8, **20**; *lanceolata*, 9, **22**;
maeloskeyi, 9, **21**; *palmata*, 8, **20**;
pedata, 8, **20**, **21**; *pubescens*, 9, **23**;
rostrata, 9, **22**; *rotundifolia*, 9, **22**;
sagittata, 8, **20**; *sororia*, 7, **19**; *striata*,
9, **23**, 33; *striis-notata*, 183, **202**;
tricolor ssp. macedonica, 181; *villosa*,
8; *walteri*, 9, **23**, 33
Vitaliana primuliflora, 109, **287**
Zenobia pulverulenta, **18**
Zigadenus densus, **18**

General Subjects

Alaska Rock Garden Society, 187
Aldrich Mountains, 83
Andean plant books, 228
Artushenko, Z. T., 135
Avent, Tony, 39
Awards, 243
Barneby, Rupert, 224
Beal, Norman, **27**, 41
Berms, 212
China, 187
Conservation, 169, 174
du Pont, H. F., 136
Elkhorn Mountains, 84
Errata in *Rock Garden Design and
Construction*, 16
Foster, H. Lincoln, 135
Gibberellic acid, 10
Greece, 179
Green Swamp, 3
Greenhorn Mountains, 84
Griffith, Charles, 295
Halda, Josef and Jarmila, 179
Hinkley, Dan, 187, 293
History of rock gardening, 110
Kipping, Ted, **31**
Lawrence, Elizabeth, 56
Longevity of plants, 103
Miller, Jean L., **31**
North Carolina, 3–46

Olympus, 179
Ontario Rock Garden Society, 291
Ontario, 291
Orchid propagation, 166
Oregon, northeastern, 82
Parnassus, 179
Photo contest results, 64
Plant Delights Nursery, 26, 39
Pocosin, 3
Ripley, Dwight, 224
Roberts, Tim, 112
Roderick, Wayne, 32, 61
Seed germination, 10, 167
Strawberry Mountains, 83
Teague, Walter, 31
Tufa, 112
Uzbekistan, 95
Vancouver Island, 171
Wallowa Mountains, 85, 88
Ward, Bobby J., 294
Winterthur, 136

Contributors

Agback, Hubert, 108
Arakawa, Yoko, 218, 287
Armstrong, Ann, 52
Avery, Don, 198
Baggett, Pam, 44
Balistrieri, Carlo, 141
Bender, Pat, 293
Bixley, Brian, 110
Blaxland, Kim, 7
Blom, Walter, 133
Borkovec, Alexej, 164
Boyce, Peter, 244
Brimley, Jeff, 221
Bush, Gene, 297
Chelednik, Michael E., 35, 46
Crane, Diane, covers; bio, 6
DuFresne, Richard, 50, 108
Galletti, Maria, 202-205
Glover, Ed, 295
Goll, Daniela, 49, 227
Goroff, Iza, 107, 296
Grimshaw, John, 262
Gunnlaugson, Darcy, 171
Gyer, Janet, 135
Gyer, John, 135
Hadacek, Franz, 108
Hook, Fred, 104
Hornig, Ellen, 298
Howey, Frances, 228
Huling, Dianne, 29, 127, 286, 288

Ittner, Mary Sue, 220
Jensen, Norm, 207
Jones, Paul D., 3
Kelaidis, Panayoti, 48, 105
Klise, Nicholas, 128
Koopowitz, Harold, 174
LeCluyse, Jean, 278
Leggatt, Anna, 134, 291
Lunn, Jay, 117, 137, 147
Lupp, Rick, 91
Mackintosh, Robert, 33
Maffitt, Ginny, 145
Magowan, Robin, 179
Mazer, Mark, 104
McClements, Jim, 31, 200
McDonough, Mark, 105, 137
McFarlane, Robert C., 143
McMurtrie, Alan, 266
Murfitt, Rex, 112
Muzatko, Jack, 31, 132, 302
Nicholls, Graham, 285
Niederle, Josef, 228
Nold, Robert, 212
O'Byrne, Ernie, 149
Oikawa, Kiyoshi, 195
Peden, Michael, 287
Pratt, Frank, 199
Raff, Marilyn, 223
Redfield, Dick, 28, 126, 285, 288
Rehacek, Zdenek, 109
Rodriguez, Jaime, 187
Ruksans, Janis, 95
Russell, Loren, 82, 200, 218
Schmidt, Petra, 39
Sellars, David, 30, 88
Sembol, Milan, 164
Sierer, Dave, 51
Simpson, Roger, 288
Slater, Michael, 254
Smit, Leo, 226
Smithson, Janet, 32
Spiegel, Anne, 105
Taggart, Doris, 287
Taggart, Raymond, 30
Taylor, Margaret, 28, 286
Tryck, Doug, 215
Van Achterberg, Barbara, 104
Ward, Bobby J., 11, 45, 54, 55, 224
Wilson, Lindie, 56
Wrightman, Harvey, 214
Zabar, Abbie, 126
Zschummel, Dieter, 227

Book Reviews

Avent, *So You Want To Start a Nursery*, 149
Beyond English literature (booklist), 227
Crane, *Both*, 224
Golodoff, *Wildflowers of Unalaska Island*,
59
Gray, *Penstemons: Interactive Guide*, 143
Hellum, *A Painter's Year*, 226
Herring-Wilson (ed.), *Two Gardeners*, 55

Nold, *Columbines*, 141
North Carolina Native Plants (booklist),
52
Penstemons (booklist), 145
Raff, *Intuitive Gardener*, 58
Richards, *Primula* 2nd ed., 147
Riedemann & Aldunate, *Flora nativa de
valor ornamental*, 228
Wells, *Natural Gardens of North Carolina*,
54

CHAPTER CHAIRPERSONS

Adirondack	Michelle J. Ham, 1828 Pennsylvania Ave., Pine City NY 14871
Alaska	Carmel Tysver, 2030 Patriot Cir., Anchorage, AK 99515
Allegheny	Jerry Pottmeyer, 281 Wagon Wheel Rd., Wexford, PA 15090
Berkshire	Thomas Clark, 253 Batchelor St., Granby MA 01033
Calgary	Karen Maslanka, 19 Hendon Dr. NW, Calgary, AB T2K 1Y6
Columbia-Willamette	Thomas Bland, 3360 Fir Ridge Rd., Lake Oswego, OR 97035
Connecticut	William Jordan, 25 Harvest Hill Rd., W. Simsbury, CT 06092
Delaware Valley	Lydia Seibert, 1265 Clay Rd., Lititz, PA 17543
Emerald	Loren Russell, 3420 SW Willamette, Corvallis OR 97333
Gateway	Sandy Evertowski
Great Lakes	Don LaFond, 11836 McGregor Rd., Pinckney MI 48169
Hudson Valley	Don Dembowski, 130 6th Ave., Pelham NY 10803
Long Island	Joann Knapp, (615) 671-6590, jknapp@optonline.net
Manhattan	Lola Lloyd Horwitz, 446 Sixth St., Brooklyn NY 11215
Mason-Dixon	Jane Grushow, 213 Meadow Valley Rd., Ephrata PA 17522
Minnesota	Rich Rodich, 8880 Hilltop Dr., St. Bonifacius, MN 55370
Mt. Tahoma	Julia Galloway, 5615 E. M St., Tacoma, WA 98404
New England	Helen Herold, 168 Stony Gate, Carlisle MA 01741
Newfoundland	Todd Boland, 81 Stamp's Ln., St. John's NF A1B 3H7
Northwestern	Mindy Rowse, (425) 488-7256, mrowse@earthlink.net
Ohio Valley	Michael Evans, 119 Nansen, Cincinnati OH 45216
Ontario	Richard Birkett, (905) 849-7167, bbirkett@interlog.com
Ottawa Valley	Ernest Boyd, 2356 Upper Dwyer Hill Rd., Carp ON KOA 1L0
Piedmont	Marian Stephenson, 305 Clayton Rd., Chapel Hill NC 27514
Potomac Valley	Alma Kasulaitis, 3856 Cherry St., Falls Church, VA 22042
Quebec	René Giguère, 5810 rue du Parc, Pierrefonds QC H8Z 2V5
Rocky Mountain	Randy Tatroe, 17156 E. Berry Pl., Aurora CO 80015
Shasta	Patricia Swanson, 721 Sugar Creek Rd., Callahan CA 96014
Sierra	Rebecca Lance, (209) 532-3029, rlance@sonnet.com
Siskiyou	Meridel Hedges, 448 RT Jones Blvd., Eagle Point, OR 97524
Southern Appalachian	Dick Senneff, 44 Red Fox Ln., Pisgah Forest NC 28768
Watnong	Carole Stober, 28 Anthony Rd., Glen Gardner, NJ 08826
Wasatch	David Joyner, 3356 S. Plaza Way, Salt Lake City UT 84109
Western	Janet Smithson, 55 Harmony Ln., Walnut Creek, CA 94597
Wisconsin-Illinois	Tom Horner, 25706 Malchine Rd., Waterford, WI 53185

QUARTERLY STAFF

Editor	Jane McGary, 33993 SE Doyle Rd., Estacada OR 97023 (503) 630-3339 / janemgary@earthlink.net
Advertising	Please write to the Editor
Editorial Advisors	L. Thomas, M. Moshier, A. Spiegel, T. Cole, D. Joyner
Guest Artists	Diane Crane
Proofreaders	Hans Sauter, Loren Russell

NARGS WEBSITE

www.nargs.org

OFFICERS

President	William King 1564 Wasatch Dr., Salt Lake City, UT 84108	(801) 582-0432
Vice President	Dick Bartlett 1569 S. Holland Cr., Lakewood, CO 80232	(303) 986-8096
Recording Secretary	Loren Russell 3420 SW Willamette, Corvallis, OR 97333	(541) 752-7558
Treasurer	Michael Kaericher 8171 Brookville Rd., Plymouth, MI 48170	(734) 459-5386
Immediate Past President	Bobby J. Ward, Raleigh, NC	

DIRECTORS OF THE BOARD

2002-2005	Michael Chelednik, Greenville, NC Iza Goroff, Whitewater, WI Verna Pratt, Anchorage, AK
2003-2006	Marguerite Bennett, Seattle, WA Grazyna Grauer, Columbus, OH Michael Slater, Mohnton, PA
2004-2007	Maria Galletti, Sutton, QC, Canada Martha Oliver, Scottsdale, PA Andrew Pierce, Evergreen, CO

MANAGERS

Executive Secretary	Jacques Mommens PO Box 67, Millwood, NY 10546 / nargs@advinc.com	(914) 762-2948
Book Service	Janet Slater 4411 New Holland Rd., Mohnton, PA 19540	(610) 775-9084
Archivist	Marnie Flook 208 Heron Point, Chestertown, MD 21620	(410) 810-1429
Slide Collection	Leland Gage PO Box 133, Akron PA 17501	(717) 859-1300
Library	Janet Evans, c/o Pennsylvania Horticultural Society 100 N. 20th St., 5th Floor, Philadelphia, PA 19103-1495	

ROCK GARDEN QUARTERLY (ISSN 1081-0765; USPS no. 0072-960) is published in January, April, July, and October by the North American Rock Garden Society, a tax-exempt, non-profit organization incorporated under the laws of the State of New Jersey. Submission deadlines are the first of Feb., May, Aug., or Nov. Periodical postage is paid in Millwood, New York, and additional offices. Address editorial and advertising inquiries to the Editor, Jane McGary, 33993 S.E. Doyle Rd., Estacada OR 97023. Address circulation inquiries to the Executive Secretary, nargs@advinc.com. Postmaster: Send address changes, report lost or damaged issues to: Rock Garden Quarterly, PO Box 67, Millwood NY 10546.

You are invited to join the North American Rock Garden Society. Membership includes a subscription to *Rock Garden Quarterly* and participation in the seed exchange, as well as other benefits. Annual dues: US \$25; UK £21; Canadian equivalent. Payment by check on a US bank, International Money Order, Visa or MasterCard, or check in appropriate currency from country listed above. General Membership, \$30 (single or household), \$35 overseas; Patron, \$75; Life Member, 40-59 years old, \$500; over 60 years old, \$450. Membership inquiries, dues, and inquiries regarding missing or damaged issues should be sent to Executive Secretary, NARGS, PO Box 67, Millwood NY 10546.

