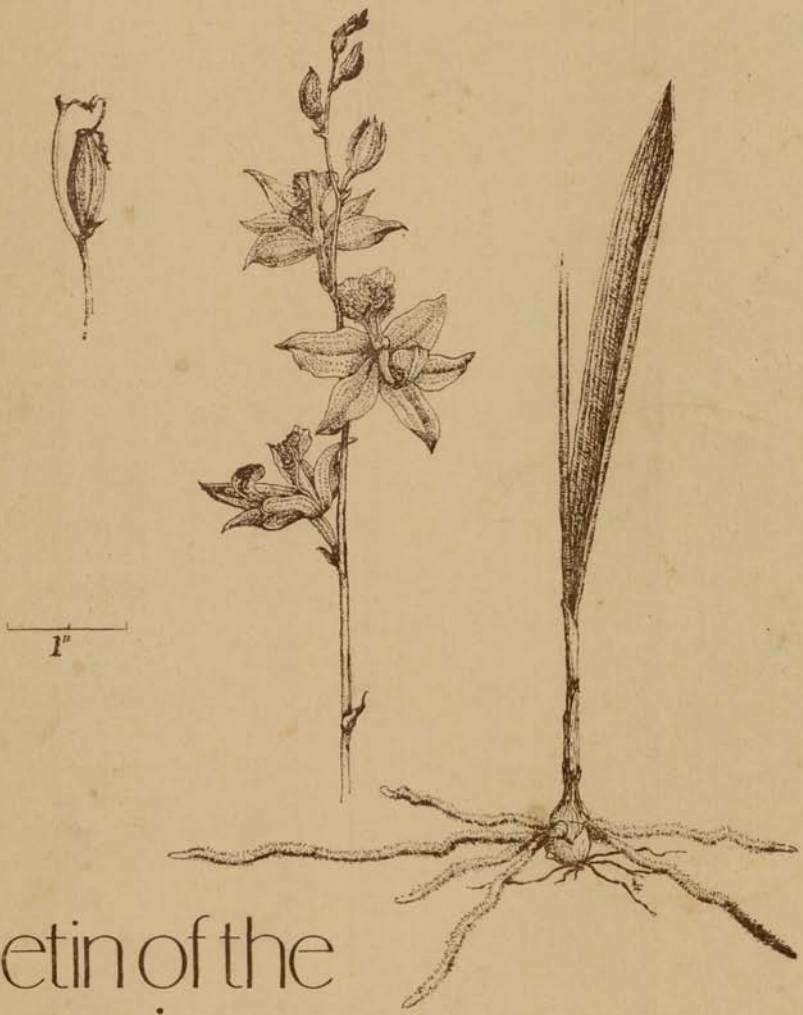

Bulletin of the American Rock Garden Society

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The Bulletin

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TERRESTRIAL ORCHIDS

It is not the intention in publishing the following articles on terrestrial orchids to encourage collecting them yourself for use in the garden or buying them from wild-flower nurseries, which also invariably obtain their plants from the wild. Quite the contrary. As some gardeners will insist on so doing, however, it is hoped that these articles will point out the difficulties and endless care needed for their culture and thus discourage all but the most dedicated.

Where terrestrial orchids grow naturally they may be fairly prolific and a cursory examination of such sites may lead some gardeners into thinking they can duplicate such areas on their own land. This is not usually so. Some terrestrial orchids can, indeed, be transplanted and with sufficient knowledge and care grow successfully out of their native habitats, as is demonstrated in the following articles. Their requirements, however, vary from species to species, and they demand very special and subtle combinations of growing conditions if they are to survive for more than a year or two. In most cases these conditions cannot be met easily in the garden and a gardener is usually only subjecting wild orchids to a more or less lingering death by trying to grow them away from their native sites. We therefore urge you to consult your conscience and consider your dedication before digging up or buying these plants.

GROWING NATIVE ORCHIDS

Frederick W. Case, Jr.
Saginaw, Michigan
Photographs by the author

Growing the native terrestrial orchids of the northeastern United States and adjacent Canada presents an unusual challenge to the gardener. For the most part few serious attempts have been made and the successes are fewer yet. There is a reason for this.

Most native orchids are plants of specialized soils and specialized habitats. Nearly all species live throughout their lives in association with soil fungi. The balance between the orchid plant and the fungus is a delicate one, easily destroyed, with the resultant destruction of the orchid partner. In wild orchids, fungi, usually of the genus *Rhizoctonia*, penetrate the root or rhizome structure of the orchid; branches of the fungus mycelium enter the living orchid cells. The special tissue formed of both plants is termed the *mycorrhiza*. The association of the two organisms is called *symbiotic*, the orchid contributing photosynthetically manufactured foods, the fungus contributing absorbed materials from the soil or its contents. Only in highly specialized environments such as very acid or very sterile soils (or those rendered absorptively sterile by unusual chemical concentrations) can the specialized orchid-fungus or mycorrhizal relationship be maintained. Hence, the limited occurrence of orchids within their natural range.

To make matters even more difficult for the gardener, this special relationship between fungus and orchid starts at seed germination. As might be suspected, the germination process is critical. Orchid seeds at maturity lack the preformed embryo and food supply (endosperm) found in most seed plants. Instead, the nearly dust-like seed consists of a net-like cover surrounding a tiny mass of cells. Germination depends upon a supply of nutrient minerals and sugars. This is obtained when soil fungi attack the seed, digesting its outer cells. If the fungi growth is not too vigorous, those orchid seed cells not yet affected by the fungal digestion absorb some of the fungus's digestive products and utilize these for their growth. The first development of the orchid plant is a small mass of tissue, almost shapeless, called the *protocorm*. In our native terrestrial orchids the protocorm may become dependent upon the fungus which caused its germination, or with other soil fungi, and may remain in a dependent, saprophytic, underground state for months or even several years in the case of the lady's-slipper (*Cypripedium* species). Obviously, such a specialized life history presents complications too great for most gardeners to overcome under their garden conditions. Suffice it to say, almost no one has had success in growing our native terrestrial orchids from seed except under laboratory conditions.

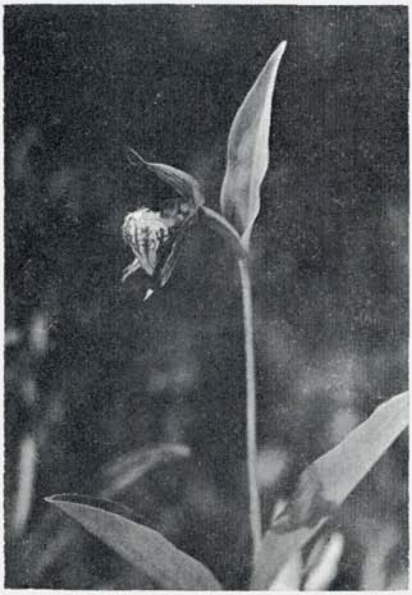
If one is to grow the native terrestrial orchids, then, he must have a source of mature or nearly mature plants. Such a source is usually through purchase or collection. Although the number of kinds available is limited, orchid plants are obtainable from several American nurseries. Fortunately, most of them offer the more showy of our species.

Conservation Considerations

Collection of our native orchids from the wild is a controversial subject and

should be approached thoughtfully. Most states have laws which restrict collection of native plants, especially orchids. Many avid conservationists become livid at the mere suggestion of taking orchids from the wild. However well-meaning these reactions are, and however well-intended the laws, both the thinking of the conservationist and the law need to be updated. Plants of such specialized growth as orchids need proper habitat in which to grow. No anti-picking laws can restore drained bogs, marshes or meadows. No orchids can grow on a lakeshore filled in to provide lawn for a cottage. Pasturing, urban development, or parking lots do not provide needed conditions for these rare plants. A responsible, concerned collector, occasionally taking a few plants for his garden, would not in years of collecting do the damage to an orchid population of one bulldozer filling a marsh on one afternoon. Conservationists should be reasonable in light of our times. Of course I do not advocate wanton collecting, ever, nor irresponsible commercial collecting. No station for a rare species should be stripped of all its plants, for these plants produce seeds to start new colonies elsewhere. But since many orchid colonies become established only during certain stages of vegetational development and later begin to die out naturally as conditions change, a few plants can usually be removed without permanent damage to the species. Many of our showiest kinds, especially the cypripediums, form clumps. It is possible to remove shoots and offsets from such clumps without in any way injuring the main clump. One clump of yellow lady's-slippers (*Cypripedium calceolus*) in my garden has furnished gift plants for years, yet still has twenty-seven flowering stems.

When considering orchid conservation problems, we should note that for years we have allowed hunting and fishing of



Cypripedium arietinum

certain animal species, some of which are quite rare. Wise use of this resource, especially when coupled with management of the species, has not destroyed them, and has, in many instances, increased their numbers. What is needed badly in wild orchid conversation is not futile non-picking laws or an overly sentimental approach to their preservation, but rather establishment of natural areas of varied habitat within heavily developed regions to provide a natural environment for wild things. Since natural areas also undergo changes through plant succession and geological processes, mere establishment of preserves is *not* enough. The areas must be dedicated to production of given forms of plant and animal life, and then must be *managed* to maintain the desired environmental conditions. The benefit of this is that not only the orchids, but all the wildlife requiring the same basic conditions, will prosper. Unfortunately, it does not appear that the general public or even some plant conservationists are ready to accept this

concept yet, although habitat management for game has been successful for years.

What about the native orchid colonies presently marked for destruction? I do not advocate ignoring the law, but it seems that some provision should be made to allow legal collection of plants doomed to perish. It is a fact that some states provide in their plant protection laws for possession of a few plants of each protected species. Perhaps in some areas, plant collectors could be licensed to reduce the danger of excessive collecting of rare species.

It is obvious that the gardener, before collecting in the wild, should apprise himself of the local laws and conditions. Assuming that one has a legal and proper source for live plants of our native orchids, how may such specialized plants be grown? Two basic methods present themselves: outdoor culture and greenhouse culture. Let us consider the two methods separately.

Garden Culture and Naturalization

If your land area is large, with semi-natural soils or natural, undeveloped areas, you may already have suitable conditions for some orchid species. Mixed deciduous woods or groves containing native ferns and shrubs may be fully suitable for certain lady's slippers, Showy Orchis (*Orchis spectabilis*), Purple-fringed Orchid (*Habenaria psycodes* varieties), Downy Rattlesnake-plantain (*Goodyera pubescens*) and others. Streambank habitat is also acceptable to many species provided the soil is not clayey. To make sure that you select the correct species, studying your own special conditions is important. You should consult a number of wildflower books and culture articles before proceeding. Soil analysis and tests for acidity prove helpful. Unfortunately, most persons will not have such natural conditions to work with, and will need to provide a special soil bed in the garden for native orchids.

In preparing the bed, keep in mind that many of our orchids grow in rather acid, sterile soils, also in bogs, sand dunes, or pine needle humus. For these excavate a bed at least ten inches to one foot deep and as long and wide as desired. Before adding a prepared soil, some provision must be made to prevent earthworms from bringing up unsuitable soil from below. Do not use cement or other highly alkaline materials for this barrier. A sheet of plastic with drainage holes at intervals will work, as will a layer of perlite or granite gravel. Above this, fill a mixture of quartz sand to which peat and spent tanbark or fir bark has been added. The proportions of the mixture depend somewhat upon the regional rainfall. The drier the area and the soil in summer, the more peat and bark can be added. I suggest, however, that such prepared soils be at least sixty-five per cent sand. If too organic, the soil may become excessively sour, causing bacterial or fungal destruction of the plants growing in it.

To provide drainage, the prepared soil bed should be built up above ground level about five or six inches. While many of our showiest native orchids grow in bogs, they grow in other situations as well. Water is rarely the essential reason for their presence in the bog. Under garden conditions, water must be watched carefully. The soil around plants should be continuously moist, but never soggy; otherwise rot may ensue.

Many species prefer cool soils, or those with little temperature fluctuation during the growing season. Light shade from trees or shrubs may be utilized to provide some soil-temperature control. A mulch of fir bark, tanbark or pine needles is especially useful, for it helps not only to insulate the orchid's roots from temperature change, but also helps to keep down

weed competition, a condition frequently fatal to orchids. Furthermore, such a mulch can help to maintain the acidity and moisture content of the soil.

Greenhouse Culture

If you have the facilities of a small greenhouse, and have the interest and patience, most of the terrestrials suited to garden culture can also be grown in the greenhouse. Most lady's-slippers and many other kinds can be grown as pot plants in either their native soil or a prepared one. Be sure, however, to note the comments below on containers for indoor planting.

Bog orchids and those species requiring rather intensely acid soil can be grown well in live sphagnum. This method has proved surprisingly easy provided you avoid certain problems. Regular unglazed clay flowerpots are unsatisfactory for most terrestrial orchids or other bog plants. They seem to be chemically unsuited, and bog plants grown in them quickly sicken and die. Wooden tubs are satisfactory for a period until decay of the pot develops, then they too become unsuitable, the sphagnum moss dies and soon the orchid follows.

Glazed ceramic and plastic pots are good. Plastic paint pails, just as good, and generally available at less cost in larger sizes, may be obtained at paint or variety stores. I have seen several persons use cut-off plastic bleach jugs with excellent results. These plastics are chemically inert; at least they do not inhibit the growth of sphagnum moss. Small drainage holes should be punched in the plastic containers.

The potting medium should be clean, weed-free, living sphagnum moss. I have used several species, but the most satisfactory types are those larger-headed species found in damp acid sand or near bog borders, not those from far out in open bogs. Masses of the sphagnum should be arranged with the growing ends uppermost; an attempt should also be made to place the moss to form an even surface. No special drainage material such as potsherds need be placed in the container below the live moss. After arrangement of the moss in the pot, the roots or tubers of the orchid should be inserted just under the upper surface.

Living sphagnum must be kept moist at all times. This may be accomplished by frequent watering, or by standing the pots in a tray of shallow water, allowing capillarity to distribute the moisture.

Goodyera pubescens

Chlorinated water used repeatedly, Malathion-type sprays of strong dosages, and water containing metallic salts all damage or destroy sphagnums and, subsequently, the orchids growing in them. To avoid problems, use rain water or distilled or de-ionized water. If a plastic tray is not available in which to stand pots, metal or wooden trays may be lined with polyethylene plastic sheeting to in-

sulate the moss, orchids and water from sources of metallic salts. Never fertilize living sphagnum. Death usually results. If you do utilize the tray method of growing the moss and orchids, the moss should be watered heavily from above at least once a week to dissolve away mineral salts deposited on the moss surfaces by evaporation. When treating insect pests, avoid contact of the insecticide with the moss.

Calypso bulbosa

Proper soil temperature during the dormant season is just as important as during the growing season. Most of our native orchids require a definite rest at low temperatures before they will commence new growth. Provision must be made to keep greenhouse-grown plants close to freezing temperatures during at least part of the winter dormant period in order to initiate new growth. I hold my plants at 38° Fahrenheit during the winter season. The plants should not actually freeze.

Depending upon the climate of the region, the methods suggested for greenhouse culture may also be adapted to a coldframe, heated or unheated.

Pests and Problems

The usual garden and greenhouse pests prove serious hazards to terrestrial orchids, for their foliage is often soft and succulent. Many species exude a vanilla-like odor which seems to attract slugs and snails. One large slug can wreak havoc overnight. Control of slugs and snails may be had by use of any of the commercial slug-snail baits or sprays. It is not known what effect continued use of these sprays will have on the soil in pots if used as a drench; therefore I recommend the pellet form of the bait used only as necessary.

Aphids, perhaps the worst enemy of many of our terrestrial orchids in the greenhouse, must be watched carefully. Even the dormant growth bud nestled in the moss or at the soil surface may be attacked. The result of aphid attack is deformity or complete destruction of the plant. Any regular aphid spray seems to be satisfactory, but one should always use caution and experiment with a few plants before undertaking blanket application.

Thin-leaved species are subject to red-spider attack. Most of the damage occurs before the presence of the pest has been detected. Malathion is suitable for control, but contact with sphagnum *must* be avoided. The same control may be used for the various scale insects.

Small animals — especially squirrels, chipmunks, meadow-voles and white-footed mice — should be controlled, for they can be very destructive, eating tubers, dormant growth buds, and also flower buds. Leaf-chafer beetles often eat flower buds of the fringed orchids, and may, in fact, eat out the heart of the stem's growing tip while it is enfurled in

the leaves. Dusting with DDT* or rotenone, especially during early development of the stem, provides good control.

Fungus-caused leaf spot or rot proves difficult to control once it occurs on terrestrials. General garden fungicides or those used to control leaf-spot on roses will aid. If a leaf is badly infected, it should be removed by cutting well back into healthy tissue with a sharp, clean razor blade.

Challenge and Service

Many native terrestrial orchids can be grown, at least by skillful gardeners. It will take determination, careful attention to the needs of the plants, and some experience. The successful grower not only enjoys the beauty and challenge of these rare plants, he may contribute to the conservation of the species, either by maintaining plants that would otherwise have perished, or by providing divisions of the original plants to other interested persons. When the day comes that ecologists and other specialists can grow our natives readily from seed, cultivated plants can be used to provide the parent stock.

This article was written prior to the ban on DDT. — Ed.

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EXPERIENCES WITH HARDY TERRESTRIAL ORCHIDS

N. C. Deno
State College, Pennsylvania
Photograph by Frederick W. Case, Jr.

Why grow hardy orchids at all? This question is particularly poignant in view of the enormous numbers of orchids that have been collected from the wild only to soon perish in gardens. Clearly the gardens of England and America have served as graveyards to a greater degree with orchids than with any other plant family. So why attempt to grow them. Of course some orchids, such as *Cypripedium reginae*, are beautiful. However, many have insignificant flowers, often green or of indeterminate hue, so that one must resort to the word "challenge" to justify their culture.

However, beyond beauty and challenge there is a sound reason for attempting to understand the culture of hardy orchids. In nature's scheme of things, orchids are colonizers of disturbed and evolving areas. Their ultimate fate is to be displaced and killed by the climax vegetation. As part of this role, they produce enormous numbers of seed that fly on the winds, perhaps to find new sites for colonization. But as the percentage of cultivated and inhabited land increases, it becomes increasingly difficult for orchids to leap the greater distances. Here is where man can help. Orchids seem particularly suited to planned stocking programs. This is a program by which the ARGS and other horticultural societies could make orchids a more prominent feature of our parks and landscapes.

As a point of departure, read *Wild Orchids of Britain* by V. S. Summerhayes. This could well be the greatest

horticultural book ever written. It is readable, fascinating, and authoritative, a combination to which every author aspires. A worthy companion is *Orchids of the Western Great Lakes Region* by Fred Case. Armed with these two books, there should be few mistakes in the choice of soil and location. Carlyle Luer's *The Native Orchids of the United States and Canada* is an incredible collection of superb color photographs and should provide incentive for interest, if any were needed. Finally, a visit to Paul Keisling's small planting in Boylston, Mass. is an education in itself.

It is also a great help to observe orchids growing in the wild. Centre County, Pennsylvania and Alger County, Michigan on Lake Superior each contain over half of the species native to northern United States. Living in one and vacationing in the other has afforded an excellent opportunity to observe a wide variety in their native haunts.

The life cycle of orchid seed is a story in itself. The seed is very small and may consist of as few as twenty cells. There is no supply of stored food so that cotyledons do not develop. The seed is invaded by filaments of fungi. A desperate battle ensues between the invading fungi and digestion of the fungi by the orchid's minute bit of protoplasm. If all goes well for the orchid, a pseudocorm builds up. Little is known about the conditions favoring the orchid in this battle for survival. Can one species of fungi serve several species of orchids? Can one species of orchid use several species of fungi? What is clear is that orchid seed need growing fungi to develop. Two experiences will illustrate this fact.

Habenaria leucophaea

A tiny artificial wet sand bog was created by digging a hole one foot deep, three feet long, and two feet wide. It was lined with black polyethylene and filled with sand. An *Iris versicolor* grew in it for two years, but died one summer due to iris borer. In October, *Spiranthes cernua* seed was lightly sprinkled over the whole surface. Two years later in September, fifty evergreen rosettes of *Spiranthes cernua* appeared and their appearance exactly traced the outlines of the dead rhizones of the iris. Clearly the fungi growing on the dead iris had been required by the orchid.

The second observation involves *Epipactis helleborine*. Seed was scattered one fall over our whole acre. Eighteen months later in spring a number of plants appeared. Their appearance was confined to areas where there was rotting wood. This experiment also showed how fast seedlings can develop under favorable circumstances. It is of interest that every plant was a flowering spike. In fact the life cycle is such that only mature plants appear above soil, and immature plants are never observed. Many species of orchids continue to obtain nourishment from fungi even after they have devel-

oped green leaves. This may be a factor with *Epipactis helleborine* because it can bloom in very dense shade. The need for fungal action is also evidenced by the frequent appearance of the *Epipactis* in old compost piles. Of course the coral roots never develop green leaves and depend entirely on fungi for nourishment.

One problem with orchids is that they have evolved to a state where they depend on few or perhaps one species of insect for pollination. *Cypripedium acaule* and *Orchis spectabilis* set seed poorly in Centre County and this must be a limiting factor in their ability to spread. My old friend Leon Gleicenstein was adept at hand pollination and a native stand of *Cyp. acaule* would set abundant seed after his administration.* Some species fertilize themselves and by this mechanism a full pod of seed is set by virtually every flower on *Epipactis helleborine*, *Habenaria clavellata*, and *Habenaria hypoborea*.

Most hardy orchids are not adapted to rapid vegetative propagation. Thus *Habenaria psycodes* and *H. leucophaea* will send up single stems for years. Some slowly multiply and can be divided. This behavior is shown by species with diverse root systems such as the round spherical corms of *Orchis militaris*, the sparsely rooted *Orchis fuchsii*, the octupus like system of many cypripediums, and the three inch stolons of *Cyp. formosanum*. A few such as *Pogonia ophioglossoides* spread rampantly by thin white stolons. These quickly fill little artificial bogs and the hundreds of blooms as at Paul Keisling's make a handsome sight.

The main problem in growing orchids is that propagation by seed has such stringent and unknown requirements and vegetative propagation is so slow. Thus when leaf blight (LB) or root rot (RB) kills the plants, the game is over. Orchids may be no more susceptible to such ills than *Gentiana acaulis* or Kabschia saxifrage, but the latter are so readily propagated that a loss here and there does not obliterate the planting.

The special frustrations of growing orchids can be illustrated with three anecdotes. *Cypripedium reginae* was planted in black neutral soil in half shade in a position that stayed slightly moist. They grew so vigorously that after ten years the original three had increased to about fifty blooming stems. Abundant seed was set and seed flew all over the garden and down to a neighboring marsh. A note on their culture was published in an ARGS Bulletin (Vol. 34, p. 166), always a dangerous practice; the ink was hardly dry before stem rot appeared and within two years only one isolated clump remained.

A single *Habenaria leucophaea* bloomed beautifully for six straight years in a similar site. Last year leaf blight led to early death of the leaves and this year the disease attacked the stem causing it to topple. Can it recover, I wonder.

The strangest experience of all involved *Habenaria blephariglottis*. Three tubers were purchased. When they failed to appear for two years, they were written off as long gone. The third year they appeared with great vigor and the three were the most beautiful spikes of this species that I have ever seen. The biggest had over fifty flowers and many photos were taken to record the triumph. Abundant seed was set. They never appeared again.

In half shade in limestone soil, *Cypripedium calceolus* prospers and sets seed naturally. A neighborhood boy reported seeing calceolus in flower in a nearby park, and I like to think that it spread from our planting, although it is native

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*(*A description of how to pollinate* Cyp. acaule *can be found in the article on this species in Vol. 35, p. 163.* — Ed.)

to Centre County. *Cyp. andrewsii* does nearly as well, and it is hoped that supplies of this rare and beautiful plant can be built up. *Cyp. speciosum* developed two beautiful flowers and high hopes were held, but it disappeared. *Orchis militaris* and *Orchis fuchsii* have grown for five years and *O. militaris* sets seed. This suggests that more of these European limestone orchids might do well. In fact, *Gymnadenia* bloomed well, set much seed, and died. Oddly, a seedling of *Habenaria hypoborea* appeared from sowings and has done very well for three successive years.

In moist black limestone soil, the experiences with *Cyp. reginae*, *Hab. leucophaea*, and *Hab. blephariglottis* were recorded above. *Cyp. candidum* grew for a while and slowly increased before LB got it. *Orchis spectabilis* and *Habenaria ciliaris* are both native to Centre County and will bloom vigorously for a few years, but they die out.

In artificial wet sand bogs, pogonia, calopogon, *Liparis lilifolia*, *Hab. clavellata*, *Liparis loeselii*, *Spiranthes cernua*, and *Spiranthes lucida* grow and bloom for a while but in the absence of self seeding, they die out.

A single *Cyp. guttatum* has persisted in a sand bed for five years and has finally increased to two stems. *Cyp. californicum* is fully hardy and flowers, but is impermanent. *Cyp. formosanum* and *C. cordigerum* have been grown in sand and rotting wood for several years. They have been kept over winter at 32°F. so that their hardiness has not been tested. They bloom nicely and *Cyp. formosanum* can be especially recommended as a beautiful little plant.

In summary, the problem with orchids is that they die of fungal and bacterial infections before adequate propagation can be effected. Where conditions are favorable for the development of seed, explosive colonization can occur. In Centre County, plantings of pine have *Cyp. acaule* appear in large numbers when the pines reach about forty feet in height. In both Centre and Alger Counties, *Hab. clavellata* invades quarries where springs keep the sand moist. Large numbers of plants quickly develop. Even *Calypso bulbosa* appeared and bloomed spontaneously in our vacation spot in Alger County and just as promptly disappeared. In the last analysis, perhaps orchid culture should be limited to those places where seed can develop, and it is a worthy enterprise to search out such spots and to stock them by sowing the orchid seed.

MICROCLIMATES FOR HARDY ORCHIDS

Paul Keisling
Boylston, Massachusetts
Photographs by Viki Ferreniea, Woodbury, Conn.

In growing hardy terrestrial orchids from all over the world, I have found almost as much pleasure in constructing microclimate areas for different species as I have in seeing the plants succeed in their new homes. These microclimates are simply areas of specialized soil conditions, exposure, moisture and temperature that match as closely as possible those of the plants' original homes. If you live within the geographical range of a plant, it may simply be a matter of duplicating its habitat as best you can. However, if the plant's range does not include your

area, certain adjustments may have to be made to compensate for the change in climate.

Cypripedium guttatum var. *yatabeanum* is a good example. The plant is indigenous to the open grassy terrain of the Aleutian Islands. There it grows in loamy soil and almost full exposure to the sun. Growing it under the same conditions here in New England would almost certainly result in failure. The sunlight at this latitude is stronger and more direct and we do not have the almost daily fog of the Aleutians to block the sun's rays. As a result, the plants would quickly burn up with a full sun exposure. Soil micro-organisms are not very active in the Aleutian soil because of low soil temperature. Soil of the same organic content at our latitude would encourage the activity of these micro-organisms because of higher temperature and the active bacteria would in turn kill the plant.

The microclimate that I have found successful for this species is in deciduous shade surrounded by rock to keep soil temperatures down. A soil mixture of clay and gravel is used with little or no organic matter. The soil is sterile because bacteria have nothing to feed on. The small amount of nutrients needed by the plants is supplied artificially by adding dilute orchid fertilizer each spring and moisture is retained by an underlying layer of polyethylene.

Other aspects of microclimates are in the areas of hardiness, wintering conditions and pest control. I have had tremendous success with pleiones, Japanese calanthes, and even *Cymbidium georingii* planted in open ground and simply covered with an overturned bucket of leaves in winter. This seems to compensate for our changeable winter and early spring weather, which may alternate between freezing and thawing. It also shields plants from damaging winds.

Generally, hardy terrestrial orchids are not affected very much by insect pests; but occasionally an exotic that is exposed to unknown enemies may need some help. I have treated nearly all my orchids with systemic insecticide and the fungicide, Benomyl, with great success and no adverse effects on the plants.

I do not suggest that the specific micro-habitats that I use will be successful for everyone. The conditions that exist where the grower lives can make a whole world of difference as to the type of area that must be constructed. I have a checklist that I fill out for both the plant's native home and my own. This includes: high and low yearly temperatures, moisture, companion plants, soil pH, and amount of winter snow cover. After listing these things for both places, I circle the ones with the greatest discrepancies. Then I concentrate on how I might adjust my conditions to minimize the differences and how easy it will be to maintain those conditions.

If all this sounds like a lot of trouble rather than an exciting challenge, then maybe hardy orchids are not for you. Every plant presents a new set of conditions to strive for and new problems to solve. However, if you do your homework before you get your plants, you can sit back and reap some great horticultural rewards.

Making Microclimates*

As previously mentioned I make microclimates for all my orchids. Some prefer a boggy situation while others do best in a calcareous meadow. I make soil pockets of special soil mixture for all the *Cypripedium* species and some others.

**Mr. Keisling wishes to stress that the following specific cultural recommendations are appropriate for the climate of his area (about 40 miles west of Boston, Massachusetts) and might not be suitable for other sections of the country. — Ed.*

These micro-habitats are kept suitably moist either by rain or by watering artificially with water that is naturally soft and contains no lime or water softening salts.

The Artificial Bog

A man-made bog, which is an ideal home for a number of orchid species, is not difficult to construct. The best site for such a bog is an open area with rocky or gravelly topsoil. The lack of humus or turfy topsoil seems to discourage burrowing rodents from invading the bog.

Cypripedium macranthum

A hole should be dug to a depth of 15 to 20 inches and at least ten square feet in area. The rocky soil that is removed can be mounded up around the edge of the hole to further discourage rodents. The hole is then lined with heavy polyethylene plastic (4 to 6 mil) in which a few holes have been punched. This permits drainage so that mineral salts from artificial watering do not build up in the soil. The hole is then filled with a mixture of half sand and half sphagnum peat. It should then be filled with water so that the dry peat becomes thoroughly soaked. Then, and this is possibly the most important step, this wet mixture should be topped with living bog vegetation such as living sphagnum moss and cranberry. Grasses and sedges should be avoided, however, lest they take over. This vegetative covering will establish itself quickly and spread over the bog. It is also a good idea to include in this cover some of the carnivorous plants that grow in bogs such as sundews and pitcher plants. These will help control the insects.

All this, I realize assumes that all these things are available to you. Such a cover has worked extremely well for me and I honestly do not know, if something were left out or substituted, that the bog would not work just as well. Your own experimentation would have to be your guide.

The Calcareous Meadow

This area is constructed in the same way as the bog except that the hole is filled with a mixture of half fine sand and half good garden loam. Hardened chunks of lime are added to sweeten the soil to about pH 8 and enough soil is put in the hole so that it can be mounded up at least one foot above the surrounding soil level. This discourages the accumulation of water. The soil mound can be smoothed off and seeded with grass just like a new lawn. The orchids are planted in this turf after the grass has been cut at least two or three times. Care must be taken during the growing season to shear the gass periodically so that it does not get so high as to choke out the orchids.

Soil Pockets

These are particulaily useful for growing the ladyslipper species. It is simply a

matter of using the same procedure as mentioned above but on a smaller scale and mounding up a proper soil mix and placing the pockets in suitable exposures to sunlight.

Soil Mixtures

The five following soil mixtures for various types of orchids are keyed by number to the species listed below.

#1. Pure acid humus from decaying oak and pine foliage.

#2. ½ peat humus (Sterling Peat), ¼ vermiculite or Perlite, ¼ fine sand made neutral by adding lime if necessary.

#3. ½ gravel, ¼ loam, ¼ vermiculite.

#4. ½ decayed needles from stiff needled pines such as Red Pine or Pitch Pine, ¼ coarse sand and ¼ vermiculite.

#5. ½ rich woodland loam and ½ fine sand made neutral with lime.

(Note that the sand and gravel used in these mixtures is of acid pH.)

The Species Grown

Those marked with an asterisk have been successfully grown for four or more years. All cypripediums have been grown in soil pockets as previously described.

*Cyp. acaule** — #1: Partial or full shade. Keeping soil acid is more important for this species than moisture.

*Cyp. acaule albiflorum** — Same as above.

*Cyp. arietinum** — #4: (Decayed White Cedar peat may be substituted for pine.) Evergreen shade is preferable. Must be kept moist but not wet. Mulch with fresh needles each fall.

✓ *Cyp. candidum** — #5: Should have full morning sun and afternoon shade if possible, otherwise light shade. Should not be kept too wet as this will cause crown rot.

*Cyp. cordigerum** — #3: Should have light shade and be moist but not wet. A thin mulch of granite grit is beneficial for keeping soil cool and loose.

*Cyp. guttatum** — #3: Light shade. Granite grit mulch and surrounding the soil pocket with large rocks will help keep soil cool. Be careful it does not dry out in summer.

Cyp. yatabeanum — Same as above.

Cyp. formosanum — #4: In light shade. Should have a large soil pocket and should be mulched in winter.

Cyp. fasciculatum — #4: Light shade. Very susceptible to rot and must be kept on the dry side.

*Cyp. himalaicum** — #3: Light shade. A little lime added to the soil.

Cyp. japonicum — #4: Light or full shade. Make the pocket large enough so the roots can spread.

Cyp. macranthum — #5: Light shade. A topping of thin grassy turf serves as a good mulch and seems to benefit the plants.

✓ *Cyp. montanum** — #4: Light shade. Plants should be kept on the dry side and sheltered from heavy rains if possible.

*Cyp. parviflorum** — #2: Light shade. Plants should be kept moist, but not wet.

*Cyp. pubescens** — Same as above.

✓ *Cyp. reginae** — #2: Can take direct morning sun. Keep a little damper than *C. parviflorum*, but not *wet*.

*Cyp. passerinum** — #3: Can be slightly sandier and mulched with granite grit. Also watering with ice water in summer seems to help keep subsoil cool.

*Cyp. speciosum** — #4 with a little lime added. Direct morning sun is beneficial.

*Arethusa bulbosa** — Plant in artificial bog. This orchid possibly follows a blooming pattern similar to tulips, where for one or two years only a leaf is produced with no blossom so that nutrients can build up in the bulb.

Arethusa japonica — Same as above.

*Bletilia hyacynthina** — Soil of ½ garden loam, ¼ peat, ¼ vermiculite, with possibly wood chips added. Sunny position for at least half a day. Good mulching in winter.

*Calanthe japonica** Soil of ½ peat, ¼ coarse sand, ¼ wood chips. Mulch in winter.

Calanthe takane — Same as above.

*Calanthe seiboldii** — Same as above.

Calanthe tricarinata — Same as above.

Calanthe discolor — Same as above.

*Calopogon pulchellus** — Artificial bog.

*Epipactis gigantea** — Grows well in the artificial calcareous meadow.

*Epipactis helleborine** — Soil mix of 1/3 coarse sand, 1/3 peat humus, 1/3 loam in light shade. Should be kept moist.

Epipactis thunbergii — Same as above.

Epipactis palustris — Artificial bog. Does best among bog grasses.

*Goodyera oblongifolia** — Peat from White Cedar. Evergreen shade. I have it growing under rhododendrons.

*Goodyera repens** — Same as above.

*Goodyera pubescens** — Decayed pine needles and woodland loam in light or deep shade.

*Goodyera tesselata** — Same as above.

*Liparis lilifolia** — Leafmold of pine and maple trees. Light shade. Don't keep too wet.

Liparis loeselii — Artificial bog. If possible shaded by grasses.
Liparis sasakii — Same as with *L. lilifolia*, but in shade of rhododendrons. Mulch in winter.
*Listera ovata** — Grows well in calcareous meadow.
Ophrys fusca — Calcareous meadow.
Ophrys aranifera — Same as above.
Orchis aristata — Artificial bog.
Orchis incarnata — Same as above.
Orchis latifolia — Same as above.
Orchis maculata — Same as above.
Orchis morio — Calcareous meadow.
Orchis sambucina — Same as above.
Orchis militaris — Same as above.
Orchis mascula — Same as above.
Orchis simia — Same as above.
*Orchis spectabilis** — Leafmold from maple and beech trees. Light shade. Moist, but not wet.

Cypripedium candidum

Galeorchis cyclochila — Same as above.
Gymnadenia conopea — Calcareous meadow.
*Isotria verticillata** — #1: In the same situation as for *C. acaule*. I have the two growing side by side.
*Pleione formosana** — #4: Light shade. Mulch in winter.
*Pleione priceii** — Same as above.
*Aplectrum hyemale** — Good woodland loam and leafmold from maple trees in full shade. Very irregular bloomer.
Amitostigma alpestre — #3: Top soil pocket with grass turf in full sun. Keep soil moist.
Amitostigma keiskei — Same as above.
*Pogonia ophioglossoides** — Artificial bog.
Pogonia japonica — Same as above.
*Triphora trianthophora** — Full shade in pure leafmold soil pocket. Surround with ¼ inch mesh screen to discourage rodent invasion. Do not plan on blossoms every year.
*Tipularia discolor** — Light shade. Mixed leafmold from pine and maple. Blooms irregularly.
*Spiranthes cernua** — Artificial bog.
*Spiranthes gracilis** — Soil pocket of soil from an abandoned field. In full sun or light shade in company of grasses. Should be kept fairly dry.
*Spiranthes grayi** — Same as above.
Spiranthes lucida — Calcareous meadow.
*Habenaria ciliaris** — Artificial bog.
*H. psycodes** — Same as above.
*H. psycodes albiflora** — Same as above.
*H. blephariglottis** — Same as above.
*H. lacera** — Same as above.
*H. fimbriata** Bog situation, but in light shade.
*H. blephariglottis integrilabia** — Same as above.
*H. clavellata** — Same as above.
*H. hyperborea** — Rich woodland loam as for *Orchis spectabilis* from beneath maple and beech trees. Take care it does not dry out in summer. Plant in a soil pocket.
*H. orbiculata** — Same as above.
H. radiata — Artificial bog. Mulch in winter.

Pests and Diseases

Hardy orchids are not generally affected by too many diseases or pests. However, there are a few that should be watched for.

In damp shady areas, slugs can be a problem, but I have found that a yearly application of Metaldehyde bait is very effective. It is better to apply this whether you have visual evidence of slugs or not rather than wait for a rare treasure to be cut down in flower.

Many orchids are lost the first year because of rot. This is due to overwatering or the use of a poorly draining soil mix. Some people mistakenly think that orchids must be constantly soggy to be happy. This is not so.

Occasionally fungal diseases and parasitic insects will attack orchid plants. I have successfully used the systemic fungicide Benomyl and the systemic insecticide Isotox on some of my most

fragile orchids with good results and no ill effects on the future growth of the plants. These sprays should be applied at the first sign of insect infestation or disease or as a preventative during humid rainy weather. Avoid excessive wetting of foliage in summer.

Fertilizer

These orchids do not generally require fertilizing, but some of the ladyslippers, particularly those grown in #3 soil mix do not have the natural nutrients from decaying organic matter. I have found Peter's Orchid Fertilizer (20-30-20) to be very beneficial at one application each spring or more often if there are frequent rains to leach away nutrients.

Blooming Cycles

Many native species of orchids follow regular or irregular cycles. One season is for flowering and seed production, the next year for vegetative increase when no blossoms appear. Some even go underground to carry on their vegetative increase and seemingly disappear like *Triphora*, but they are busy developing their bulbs or rhizomes so that they can send up flower stalks the next year or the year after. *Triphora* seems to follow fairly regular two year cycles of subsurface growth.

Many habenaria species bloom about every other year with just foliage growth on the off year. I've found that removing the blossom spikes just before seed development helps keep the plants flowering every year by channeling strength into development of next year's bud instead of seed production.

One of the many pleasures of growing these plants is in observing their diversities of development.

Rejuvenating "Thoughts on Growing Old"

"There can be little doubt that the useful life of a rock garden is limited to 7-10 years . . . if I were starting over again there would be no 'garden soil' — there would be screes of varying degrees of richness, and there would be peat beds, and rather than any less plants being well grown, I do think there would be more and in better health; most of them would live to a ripe old age.

"Steadfast plants that remain in good stead a very long time will aid in alleviating a tired, out-grown look." Roy Elliott wrote this in the AGS bulletin, June 1959. His "steadfast list" included *Cytisus decumbens, C. ardoinii, C.* X *'Kewensis', Genista dalmatica, G. villarsii, Dryas octopetala, Hebe astonii, H. hectorii, H. armstrongii, acantholimons in variety, Berberis* 'Atropurpurea Nana', B. Corallina Compacta', the male *Salix apoda, S. reticulata, Spiraea bullata,* some daphnes and some dwarf conifers. These were most satisfactory for his conditions in the Midlands of Britain. This garden has matured rather than grown old; add to the screes and peat beds the covered tufa cliff in which such a wealth of good plants find precisely what they need, and you have certainly met a variety of precise sets of ecological circumstances which favor longevity and beauty. —R.D.

Bernard E. Harkness

Following the formal sessions of the 1972 annual meeting at Canandaigua, New York, many members of the American Rock Garden Society visited the Bernard Harkness home in nearby Geneva. They were amply rewarded. An exciting auction of choice alpines was followed by a tour of the garden and greenhouse of one of America's most talented and knowledgeable horticulturists, for Bernie had rare ability as a gardener and an unparalleled knowledge of plants from the far reaches of the earth.

During his college years, the young botanist worked in Wisconsin wild flower nurseries, becoming familiar with the prairie flora. He was employed under the tutelage of Herbert Durand on Long Island estates and thus became acquainted with rock garden construction and many of the rarer alpine plants. Following his graduation from Cornell University in 1929, where he majored in Ornamental Horticulture, he spent a year in the Graduate School of Landscape Architecture at Harvard. In the summer of 1931, Bernie visited native plant nurserymen across the country. This summer trip is well documented in the October 1966 Bulletin. It is an enchanting story, and tells of his growing love for alpine plants and our native flora as it recounts the story of those indefatigable collectors and purveyors of rare native plants a half century past.

Following World War II, in which Bernie served in the Air Force as a weather observer and cryptographer in far off Szechuan Province, he became taxonomist with the Monroe County Department of Parks and Recreation at Rochester, New York. He served the park well for twenty years, and managed a number of expeditions in search of new plants and seeds. Following his retirement in 1967, he and his wife Mabel moved to Geneva, in the Finger Lakes Region of New York, where he started a new rock garden and devoted himself to a rigorous research program. Busy with his new plantings, and involved in many demanding chores, he found time to contribute to the American Association of Arboreta and Botanical Gardens, of which he was a past president, the Alpine Society of England, the American Horticultural Society, the Rochester Museum and Science Center, of which he was a fellow, the Rochester Academy of Science, and the Royal Horticultural Society.

Bernie Harkness was associated with the American Rock Garden Society for forty years. Never was there a more devoted member. When he took over the Seed Exchange in 1953, it was to be for a two year stint. He served for *twelve years!* He was the director and the committee. During this tenure, he devoted countless hours to library research and was a frequent visitor to the Bailey Hortorium at Cornell, for it was during this period of involvement with seeds that he set about a great task. He had collated the offerings from the seed lists of three major rock garden societies and in a one line abbreviated description gave the maximum information on these offerings. His purpose was to provide a guide that could be used in seed selection. The book, published in 1974 as *The Seedlist Handbook*, has proved indispensable to rock gardeners. An updated second edition appeared in 1976, while a third edition has recently gone to press.

During his four years as president of the ARGS he fulfilled the arduous duties of this office with his characteristic thoroughness. Bernie was recipient of the ARGS

Award of Merit in 1974, an honor long overdue. In recent years he was engaged in writing a history of the first forty years of the society to which he had contributed so greatly.

Bernie Harkness left us on September 18, 1980 after a short illness. How we shall miss this shy, lovable man. To his wife Mabel, who was his constant companion, and to his sister, Audrey O'Connor, we offer our deep sympathy.

— W. J. Hamilton Jr.

Cyclamen in Australia

Isolde Kershaw
Epping, North South Wales, Australia

Epping is an "older" suburb of Sydney having been settled in the 1880's by orchardists who grew citrus and soft fruits in orchards of about ten acres or less. Our block of land is reputed to be part of an old vineyard. The land, before clearing, was eucalypt forest. Some three hundred feet above sea level, we have a sloping plot sixty feet wide and one hundred and fifty long. When we bought the house there was very little garden as the soil is heavy clay. The house and land run roughly east and west with a five foot paling fence the length of one side and our garden is at the foot of the southfacing wall of the house. Summers can be hot, rather like those of Minnesota; in winter our temperatures run between 9 and 19°C. (48 to 66°F.) with occasional heavy frosts — heavy by our standards. Most months we have rain showers; June, July, August and September usually bring the wettest weather.

After over twenty years of heavy applications of animal manures: horse, sow, sheep and even chook (Australian for fowl or chicken) and *all* our vegetable refuse from the garden and kitchen (composted well), the soil in the garden beds is a fine tilth that needs little digging.

Cyclamen coum and *hederifolium* were originally planted at the outer edge of an azalea bed below the south fence about ten years ago. Here they have bloomed beautifully and seeded well. We rarely harvest the seeds and find they come up very well in the bed. Other plants from seed are flourishing in the bed on the southern side of the house where they get lots of light without direct sun. Here the older corms like to sit on top of the ground. In this patch we have discovered that old horse manure placed at the outer edge of the leaves of the plants greatly increases flower production.

A few small corms of *coum* were sneaked into a western facing bed, planted between low growing azalea bushes shaded by a tall flowering cherry. They flourish here. One corm of *hederifolium*, placed by the side of a rock path, shaded spring to autumn by a flowering peach tree, just romped ahead — so much so that baby corms of *C.C. africanum, cilicium, libanoticum* and *caucasicum* have also been planted here.

As a flower arranger, I love the flowers, which last very well in water and when they drop off, the small seed pods keep going, looking like small birds' heads.

IN THE MAKING:
Denver Botanic Garden's Alpine and Rock Garden

H. R. SCHAAL, ASLA*
Photograph by Merle M. Moore, Director Denver Botanic Gardens
Plan by EDAW, Inc.

Denver, as a site for an alpine rock garden, has distinct elevational and climatic advantages over other major botanic gardens and arboreta in the United States, therefore, the garden in time should be an outstanding one, exhibiting a large collection of plants in a wide variety of natural conditions. An Alpine House (cold house) is a key element. Walks and paths are designed to permit access for handicapped persons to all points. The Denver Alpine Rock Garden has been created to reproduce as many different high elevation growing conditions as possible on the .86 acre site in the southwest corner of the Gardens.

A total of about five hundred tons of five types of rock was used in separate portions of the garden. The limestone, granite and high silica sandstone are from the Fort Collins area, about 75 miles north of Denver. The largest pieces weigh over fifteen tons each. The tufa is from Steamboat Springs, Colorado, and the pumice is from Arizona.

In order to achieve the many diverse horticultural and visual conditions desired and still have a unified garden, the various elements are carefully composed and separated from one another. A NE-SW direction is repeated in the path system and in the major fractures and rock beds to establish a degree of order. Also important to the organization of the garden is a central open space made up of the alpine meadow and stream area and the strong topographic enclosure on three sides. The Alpine House provides the major focal point and is a specially designed, climate-controlled solar structure for research and the propagation and growing of high mountain plants which require conditions not met in the outdoor garden.

The planting of the garden will be an ongoing project extending indefinitely. Plants have been selected from alpine and high mountain regions in the Rocky Mountains and from around the world. They are placed in representative associations on the variety of specially prepared sites within the garden.

The moraine is the centerpiece of the garden. It occupies 1500 square feet and is six feet high. It is specially constructed to simulate high mountain conditions where there is a constant underground flow of water from melting snow or glacial ice. (In nature, the flow of water is prevented from seeping downward by plates of solid rock. The water ultimately escapes through fissures in the rock or by surfacing in tiny streams.) Some of the choicest alpine plants will not grow in any other conditions. Therefore the moraine has as its water source several buried pipes near the top of the mound. A plastic liner at subgrade substitutes for the impervious bedrock and surrounding the bottom of the mound is a drain line to carry the water away. To ensure perfect drainage, there is a twelve inch deep

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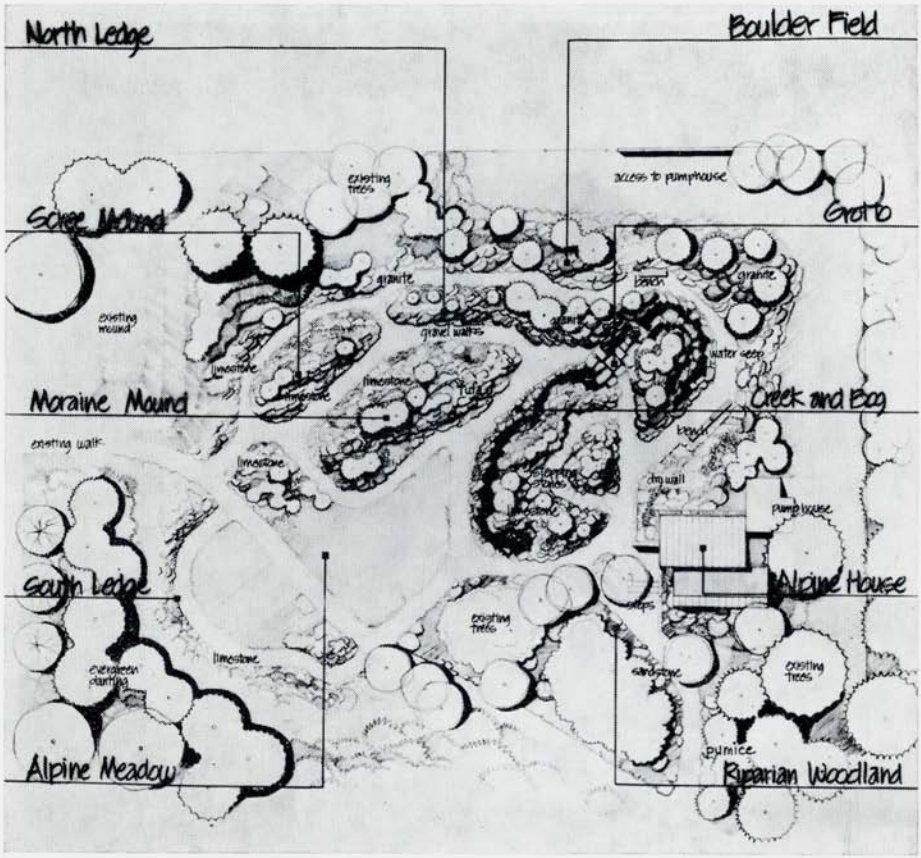
**Principal of the landscape architecture firm, EDAW Inc., Environmental Planning, Urban Design, Landscape Architecture, the firm responsible for designing the garden.*



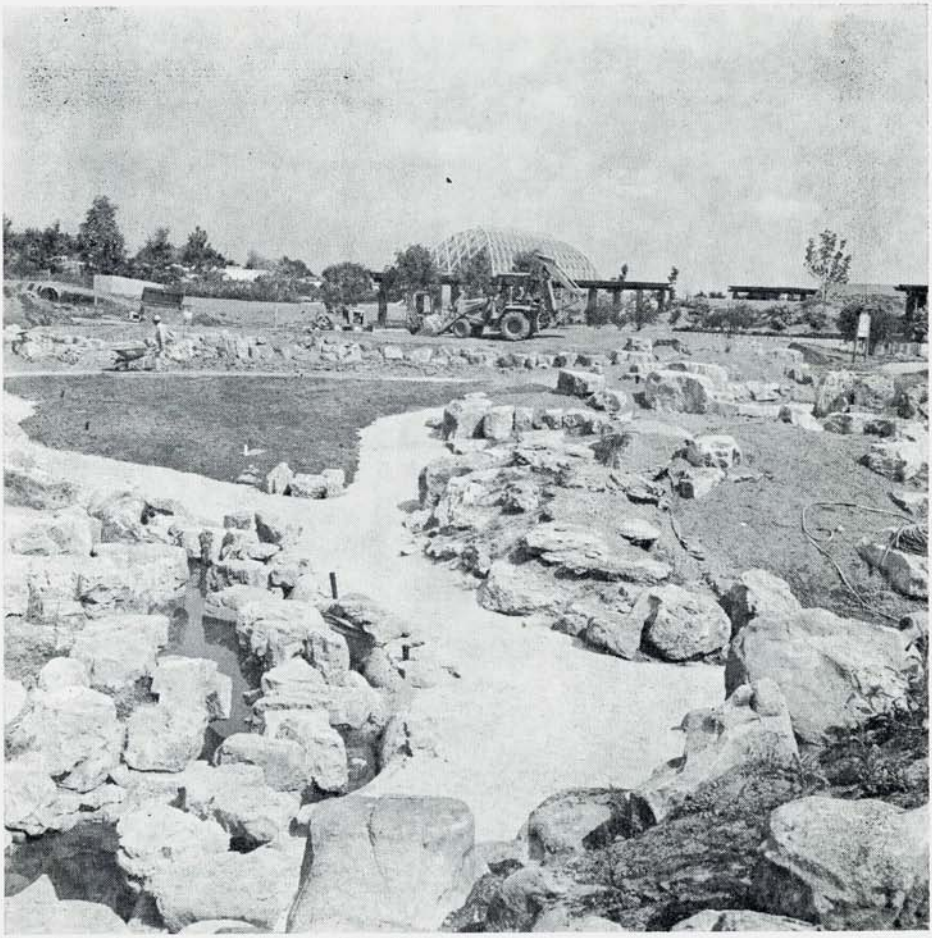
General Plan of Alpine and Rock Garden at Denver Botanic Garden

bed of coarse gravel directly over the liner. Above the gravel there are three inches of sand to prevent the soil above from migrating into the gravel. Two special soil mixes are distributed on the moraine to allow a range of pH conditions. The soils are separated from each other by a plastic liner placed vertically to prevent the calcium of the higher pH soil from leaching into the adjacent soil of lower pH.

The scree is adjacent to the moraine. It is half the size of the moraine and outwardly appears the same. The major difference is that there is no underground water source. The drainage, soil structure, and soil types are similar. (In nature, screes develop from accumulated materials at the base of steep slopes or cliffs and may become droughty in the summer.)

The trough is at the base of the moraine. It faces to the northwest in order to be shielded from direct south sun. The trough gets its water underground from the moraine and retains it in a well-drained depression.

The bog is adjacent to the stream. It is very narrow, being forty feet long and one and a half feet deep. Water enters the bog from the overflow between the rocks separating the bog from the stream.



Nearing end of construction — October, 1979

The included "soil" is largely composed of living sphagnum moss.

The stream originates through seeps at the highest portions of the garden and winds through the center of the garden after trickling down sheer rock faces in a deep, shady grotto. The rock in the grotto is comprised of large granite pieces weighing over ten tons each. Along the stream planting pockets were created, and the stream bottom has shelves to allow various container-grown aquatic plants to be placed.

Among the rocks and upon the mounds there will be planted a variety of dwarf conifers of the following genera: *Abies*, *Juniperus*, *Picea*, *Pinus*, *Pseudotsuga*, *Taxus* and *Thuja*. These conifers are placed in such a way as to accentuate enclosure, provide transition from the adjacent areas and provide continuity and permanence in the planting design. This is in marked contrast to the ephemeral effect of the small flowering plants.

Other features include an alpine meadow, ledges, cliffs, fellfield, riparian woodlands and walls.

Plants For Denver's New Rock Garden

ANDREW PIERCE*
Photograph by Patrick McNamara

As a follow-up to the previous article by Herb Schaal on the Denver Botanic Garden's new rock garden some thoughts are given here as to the plant material that is being used, even on a trial basis, for the area. A few salient points on Denver's general growing conditions will surely not be amiss. The garden is situated at an elevation of 5,400 feet (1,646 meters) in a very light intensive area, and its wind protection is only from the west. Denver's rainfall and snowmelt content varies considerably, from just over 10 inches (25.4 cm.) in 1978 to double that the following year, with an average of 14 inches (34.5 cm.). Snowfall can be heavy and short lived or, as of the time of writing, on the ground for several weeks. Temperature contrasts are always present with absolute minimums of around −30 deg. F (−34 deg. C) and highs of over 100 (38 deg. C). It is not unusual to experience rises or falls of as much as 30 degrees (17 deg. C) in an hour and this is of course not very conducive to plant growth and hardiness. Additional water can be applied through the extensive system of sprinklers but if your feelings are the same as the writer's it never quite duplicates nature's own resources and with the wide range of plants envisioned it cannot be as selective as always desired. Most of the area is exposed to the sun for considerable periods of the day but thanks to the design and construction there the some areas of shade both full and partial. Other extensions of plant material can be accommodated in the bog area and extensively in the moraine mound with its contrasting areas of pH.

Seed Supply

We are very fortunate in that we are able to obtain a varied selection of seed from the Index Seminum international distribution. This important method of seed disbursement between botanic gardens and other concerned institutions was established in 1682 between Chelsea Physic Garden in London and Leiden in Holland. In the past we have obtained seed for alpine and rock garden plants from sundry European countries, New Zealand, Japan, Russia, Kenya, Iceland and many areas of the North American continent. Credit must also go to specialized societies like the Primrose and Penstemon groups. Various Rock Garden societies, along with our own, are playing an increasingly important role as our attention turns to the plants more difficult to obtain.

It is obvious from the start that a fair share of experimentation will need to be done and the end product will no doubt be somewhat modified from the outset. It is equally important to know what dies as survives. Plants, like people, are diverse and this gives a clue to the diversity the site will allow. Another area of experimentation will be plant density. Do you plant several in a group or just single specimens? The effect of micro climates and seed source will also play their part. Altitude here may be 5,400 feet but the same plant could be perfectly happy several thousand feet lower in a

Conservatory Superintendent at the Denver Botanic Gardens, Mr. Andrews grew all the seeds of plants destined for the rock garden.

more northerly latitude. We, locally, realise that Rocky Mountain horticulture is different and it cannot be designated accurately on any line limiting zone map. The potential is here to develop an extremely fine range of plants from sundry areas of the globe and at the same time, perhaps more importantly, further the knowledge and the education of our many visitors.

Existing Stock

Amongst our plants on hand we have many varieties of aquilegia, gentiana, dianthus and primula. The dianthus in their many subtle shades, *Allium* spp. with their unusual shaped flower heads, along with a quantity of *Draba* spp. and *Campanula* spp. create contrast. As Herb Schaal in his article indicated, spot height is to be achieved principally with conifers, but there is no reason to exclude an occasional taller group of plants such as *Platycodon grandiflora* cv. *mariesii*, *Scabiosa lucida* or *Verbascum phoeniceum*. Length of the flowering period or time of season plays a very important part. From the earliest flowering crocus through the persistent fruits of the Kinnikinnik (*Arctostaphylos uva-ursi*) the flowering/fruiting interest will be extended to its furthest limits. Many of the alpine flora tend to flower early so that they can complete their life cycle in a short period. Consequently we will look for protracted period bloomers such as *Silene compacta*, *Adenophora nikoensis* and *Armeria maritima*. Very early flowers can be found amongst the doronicums, the pretty little townsendia or Easter Daisy, Leucocrinum or Sand Lily and if you wish to put up with it, Johnny-Jump-Ups. Late in the season the Composites come into their glory including sundry *Aster* spp. and the attractive Blazing Star or *Liatris puncata*. Many *Gentiana* spp. tend to be late flowering and often the odd dwarf veronica will throw a late flush of blooms.

Foliage contrasts are an integral part of the rock garden display. The upright habits of the dwarf iris and miniature daffodils contrast with plants such as acaena, sibbaldia and veronica which may be found trailing over rocks. Gray in the alpine regions is often very prominent due to protective hairs covering the foliage. Good examples are the various leontopodium, senecios, helichrysum and lychnis. Other grays include aethionema, dianthus, artemisia and cerastium but much care must be taken in their placement to avoid drabness. Thought has also been given to finely divided foliage. Ferns in crevices have been used and interesting plants such as *Aletes anisatus*, *Harbouria trachypleura* and even linum have been incorporated to add this subtle effect.

Trials and Fancies

Given the extremely wide range of plants available to us we are inclined to experiment with a greater diversity of plants than most, and as a consequence, often experience failures. There is no doubt we all wish to grow the rarest gentian or the almost unheard of primula. With a project as new and ambitious as ours considerable trial and error is going to be needed. For example certain groups of plants such as erodium, edrianthus, lewisia, mentzelia, codonopsis and the whole area of hardy cactus will be attempted to a greater extent than seems to be the case at present. Following a trip to New Zealand I cannot help but wonder why we aren't using raoulia and haastia in our screes or those unusual Umbellifers, aciphylla, miniature muehlenbeckias and the grand group of New Zealand Daises or celmisia. Perhaps because of the distance we tend to be unfamiliar with the Australasian flora with its wide range of possibilities. I could not get over the incredible diversity of

plants they have introduced from many northern areas of the world. Finally in our period of trial and error, we will give *Ramonda* spp. and *Soldanella* spp. the opportunity even though they are considered rather difficult in this area. Right off the beaten track is Puya, a South American Bromeliad — why not? It grows at high elevations, is covered by snows and tarnished by frost. Given the microclimatic range of the garden, experimentation should perhaps be taken this far.

In time the Denver Botanic Gardens rock/alpine garden along with its alpine coldhouse will come to be recognised as the finest facility of its kind in the entire Rocky Mountain Region. By 1982 those of you who will be attending the ARGS Annual Meeting will have the chance to admire the progress we have made. But you don't have to wait until 1982 to visit. We welcome and encourage you to come, see what we are doing and share your ideas and experiences with us. We can grow in rock gardening together.

Waiting for Spring

ARGS member Panayoti Peter Callas, whose articles in the pages of the Bulletin have been enjoyed by us all, has been appointed Curator of the new Alpine-Rock Garden. Mr. Callas reports that all the plants put in the rock garden to date have done extremely well. — Ed.

A Visit To The Flowery Kingdom –

Part I

Ronald A. Beckwith
Southampton, Massachusetts
Pictures by the author

"Never the time and the place and the loved one all together."
Robert Browning

How well this quotation sums up my visit to Sikkim during May and June 1979. The trip was organized out of London by Fairways and Swinford and was led by Oleg Polunin. The party, numbering twenty-one in all, left London on May 14th. My expenses were defrayed in part by the Penrose Fund Grant from the American Philosophical Society.

The trip started very well. It was a brilliant day over Europe, and as we flew over the Alps, the pilot took the plane down a bit so that we could get a better look. — Bless him, he must have been a rock gardener at heart. — I was ready to get out there and then, but decided that as I had spent all that money to go to India, I had better continue. After that, the flight was like most other long distance flights, and it was with some relief that we arrived in Calcutta. We had an eight hour lay-over at Calcutta, then flew to Bagdogra. From there, we travelled by bus to Darjeeling, a most fascinating ride full of the sights and sounds of the East. It was good to be back east of Suez, where the best is like the worst.

In Darjeeling we stayed at the Planters Club. It was as though the Raj had just left and was expected to return shortly. I found Darjeeling to be a most interesting town, a place in which one could easily spend a week or more. Spectacular views of the Himalaya in the early morning hinted at what lay ahead.

We spent but two days at Darjeeling and then set off for Sikkim. Travelling by 4-wheel drive vehicles, we went down to the Teesta River then turned north to Rangpo, and it was here that we entered Sikkim. We followed the River to Singtam (approx. 1000 ft.), then crossed over and headed for Pemayangtse (6880 ft.). For some official reason, we were not allowed to go by the short route, but had to travel the longer route over some very narrow roads. That was quite a ride — hot, dusty, and cramped as we had to sit on the baggage. Already there was much to see, with ferns everywhere, sub-tropical trees and shrubs, birds, butterflies, but always the up and down and never a straight stretch of road.

Pemayangtse, when we arrived in the early evening, turned out to be a very comfortable and welcome stop. A newly constructed hostel that was very clean, with good food and fantastic views of the mountains to the north.

The day after our arrival, we were taken to the Monastery which was a short walk from the hostel. It is believed to have been built some 400 years ago, and is the head monastery of the Nyingma Buddhist sect. Removing our shoes to enter, a world new to our Western eyes opened up. Saints and demons were everywhere, paintings covered the walls, and three great Buddhas watched over all. On the second floor there was the

library, of great repute. The books, unlike ours, measure about sixteen inches by six inches and about six inches thick, the single pages being unbound. They were wood block printed, and were held together with purple ribbon and wrapped in saffron cloth. Instead of shelves, each book had a "pigeon" hole. On the third and highest floor, there is a model of the universe as envisioned by the former Abbot. Apparently it took him eleven years to construct. It is about eight feet long by five feet wide and eight feet high. Rest assured that none of us would have guessed what it represented had we not been told. I rather thought that it was some kind of warning, "This will happen to your rock garden if you are not careful." We also met the present Abbot and his aide, two charming individuals.

Ah, but outside the Monastery the woods were filled with a fascinating array of plants. There were ferns everywhere; on the ground, on the trees, over the rocks. Two species of *Arisaema* of note were in flower; *A. speciosum*, having a purple and cream spathe and a fantastic elongated spadix that drooped over the other herbage and invited the pollinators to come on upstairs to the boudoir, and *A. tortuosum*, a much more upright plant with a quieter, restrained spathe of green. Both these plants were curious rather than attractive.

From the hostel we could see Yoksum across the gulf of the Rathong Valley. Only six miles away, the guides said. The next day we were to learn not to count miles, but hours.

All assembled at an early hour the following morning. It was a grand day, clear and warm. Packs were adjusted, spirits soared, and we were off, down and down and down, the track becoming steadily worse. *Castanopsis tribuloides*, *Schima wallichii* and a *Melastoma* species were the main flowering plants. As we got lower in the valley, the vegetation changed, becoming sub-tropical. Where we crossed the river, a huge *Lycopodium* species was seen growing epiphytically and close by was *Pandanus furcatus*. Many of us were suffering from the heat and the strenuous descent, but after a rest and bathing, it was "shoulder packs" and off we went again, up the other side of the valley, following a steep zig-zagging trail. This south facing side of the valley was much cultivated with corn and rice. At last we reached a road and it was easy walking for a bit, but we soon left the road and it was down, down, down again to a bridge and then up, up the other side. As yet the dry rice paddies were uncultivated, but every so often one would see a brilliant green paddy where the seedling rice was being cultivated by irrigation. It was interesting to note that *Zephyranthes grandiflora* (a New World plant) was frequently seen flowering on the banks of the paddies.

Perhaps at this point I should point out that Sikkim has a monsoon type climate, receiving about 110 inches of rain per year, 89 inches of which falls between June and September. As a result, in May the flora looked a trifle tired and was obviously waiting for the rain. It was to get worse rather than better; indeed, when we left the country they were in a drought situation.

Eight hours after our early start, a a very tired group arrived at Yoksum (5874 ft.), where Sikkim's first ruler was crowned in 1641 A.D. The camp site and the tea that were waiting, were, indeed, most welcome. It was interesting to see that *Datura suaveolens* (Angel's Trumpet), another New World plant, had naturalized itself in this area with great proficiency. Its toxic properties were well recognized by the local population, I was told.

At Yoksum, the group took on the look of a well organized expedition. The previous day's march was merely a toughen-

ing process to see if we could do it. Some trial! It nearly sent some of us to that Big Greenhouse in the Sky. But now we were joined by the main body of porters and those infernal creatures, the dzo (joe). These beasts should be avoided at all costs: fearful horns, and tempers to match. They are a hybrid between the yak and domestic cattle, and are more tolerant of heat than the yak but not as hardy. Supposedly they have a better temperament than the yak; just don't get in their way as they have the eyesight of a runaway bulldozer. At lower altitudes leeches were a problem. They attached themselves to one and all at the least excuse, causing no pain, just making a bloody mess; the midges were much more virulent. When all was loaded, man, woman, child and beast, we started off on a very reasonable track, headed for Bakhim at 9000 ft.

Leaving civilization behind at Yoksum, the countryside changed abruptly. Gone were the paddies and terracing. We now entered a magnificent mixed forest of deciduous and evergreen trees. Everywhere under the trees epiphytes and ferns luxuriated. Here and there a notable gem, the orchid *Microstylis wallichii* was in flower, a nice find in a quiet way, whilst a *Begonia* species reminded one that we were still in the warm temperature zones. Although we saw many fine plants in flower, it was the overwhelming abundance of the fantastic herbage that struck us most. But there was no time; it was ever onward, up and down, up and down, but always more up than down. As we rounded a curve in the track, *Rhododendron arboreum* could be seen flowering below us. It was a giant of a tree, the red trusses held so high above the forest floor that I am sure that we should not have noticed them had we passed beneath its branches.

As we got higher, we saw *Rhododendron dalhousiae* flowering very well, and just below Bakhim there was a very fine stand of *Cardiocrinum giganteum*, heavily budded but not in flower; this was, indeed, a great disappointment. I was surprised how deeply shaded and very sheltered the area was in which it was growing. On a bank overlooking the path, *Aletris pauciflora*, with its white Lily-of-the-Valley-like flowers, looked down at us as we passed.

Bakhim was a welcome rest; Spartan, but who cared? A rest house, a fire, water and wooden beds. What more could we ask?

The next day we were off with the lark, ever upwards. The landscape changed quite markedly at Bakhim, as if a line had been drawn. Gone was the mixed deciduous forest. Now we were in a thin *Tsuga dumosa* forest, interspersed with the lovely *Rhododendron falconeri*. Its blossoms were so high it was difficult to appreciate them fully, but the large leaves were very impressive. At a more appreciable level, *Rosa sericea* presented a delightful picture. It was here that we saw our first *Arisaema griffithii*, the large ominous hooded spathe anything but attractive. Much more attractive, and the cause of much "lusting after" in the milder climes back home, was *Pleione hookeriana*. Soft lilac and white, it was growing and flowering on a rotted stump; a real charmer. We later saw it growing epiphytically.

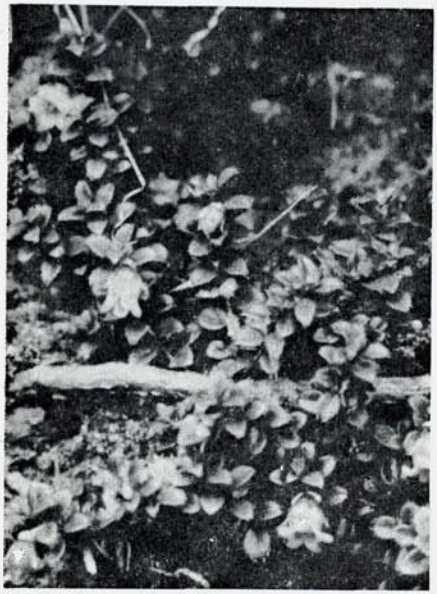
Ever upward we went, until we came to Tsokha (10,500 ft.). A Tibetan refugee village since 1974, it is the highest place of year-round habitation in these parts. The vegetable gardens here were very good. This is also the lowest place at which snow falls. Again we came to an abrupt change in the forest. We now started running into *Magnolia campbellii;* unfortunately I saw none in flower. We now moved into the lower *Rhododendron* and *Abies spectabilis* forest, which is also a cloud forest, with epi-

phytes everywhere, lichen and mosses in great profusion. *Rhododendron hodgsoni* was truly magnificent; the size of the trunks was quite incredible, easily exceeding twelve inches in diameter. One could but wonder at their great age. Beside the track, *Clintonia udensis* var. *alpina* reminded me of home, though its flowers are a very charming blue rather than the yellow of our Northeastern *Clintonia*. *Viburnum cordifolium* here appeared to be a somewhat straggling shrub, though with clean white flowers. Perhaps its habit would improve if it were grown in full sun. A small *Primula* species, possibly of the Petiolaris Section, was seen growing in the track and on the banks; unfortunately there were no flowers, and everyone, including the dzo, walked over them. I felt my soul flinch.

Ever upward, misty, dark, and damp, the track was getting wetter and stickier under foot. Logs had been laid across to "improve" the track, and they really made the going tricky. But everywhere the rhododendrons flowered, and the great firs shot way up into the mist, their tops quite invisible. Then suddenly we came to a meadow, about one acre in extent, completely surrounded by rhododendrons in all their beauty. What a pity the mist prevented a good photograph; it would have made an almost unbelievable picture. Walking round the meadow after lunch, we noted *Rhododendron lanatum, thomsonii, campylocarpum, wallichii* and *cinnabarinum*. Underfoot, *Primula calderiana*, with its attractive magneta flowers and darker maroon eye, creating a perfect complement to the rhododendrons — a lovely sight. Just below the meadow *Rhododendron hodgsonii* and *R. barbatum* had "given out," and we were now in the upper rhododendron/coniferous forest. But still no rest, ever

Anemone obtusiloba

on upward we pressed. The rhododendrons were now losing their giant size, and on reaching the crest of the hill, we came to a more open and rolling heath-like country. We had broken the back of the climb.



Vaccinium nummularia

But where were the *Abies?* I suddenly realized that there was no Krummholz. Preconceived visions of dwarf conifers vanished. Someone had drawn that line again. The rhododendrons were somewhat smaller here and the dwarf *R. anthopogon, lepidotum* and *setosum* put in an appearance. We were up over 12,000 feet now and, in the short grass, *Primula glabra*, a charming diminutive species of a very lovely bright blue, was everywhere. Here too, *Cassiope fastigiata* was present, first only in bud, but later in flower. I was greatly encouraged by seeing the cassiopes in the wild; they had the same brown, beaten look about them that they frequently have in the garden. It must be in the nature of the beast. However, the flowers were a lovely white, and despite everything we all adore cassiopes. *Anemone obtusiloba* too was seen, the flowers mostly white, but with a hint of blue, and all carried very near to the ground. In the wetter, peatier areas, great thrusting rosettes of primulas mocked us with the last season's seed capsules whilst flaunting a tantalizing promise of what was to come.

We were starting to puff now, and suddenly I acquired a headache, something I had to learn to live with for the next few days. As we pushed on towards our destination for that day (the campsite at Dzongri at 13,299 feet), it was still up and up, but there were some rolling, heath-like stretches in between the rises. On the last stretch, *Vaccinium nummularia* was found flowering on a very sandy, gravelly bank. It was a small plant, no more than eight inches high, with rather larger flowers than we in the northeast U.S. normally associate with members of that genus. A strong pink overlaid the white. It was a rather pretty plant, and, I am glad to say, one that travelled well. Coming into the campsite, we saw one plant of *Primula calderiana alba*, and shortly after that a dwarf red stemmed willow, the latter about twelve inches high.

It was in the late afternoon that we arrived at the Dzongri camp site; actually it was a little short of Dzongri as there was no water at Dzongri at this time. Problem: how do you feed a party of more than forty persons and keep them in fresh meat without refrigeration? It's simple, you drive goats ahead of you and when you get to the appropriate time and place, you lop off a head with a kukri, skin the creature, and there you are — fresh meat. It made a good curry, a trifle tough, but we were hungry and wolfed it all down.

Part I of two part article

MY FAVOURITE ALPINES

Harold Esslemont
Aberdeen, Scotland

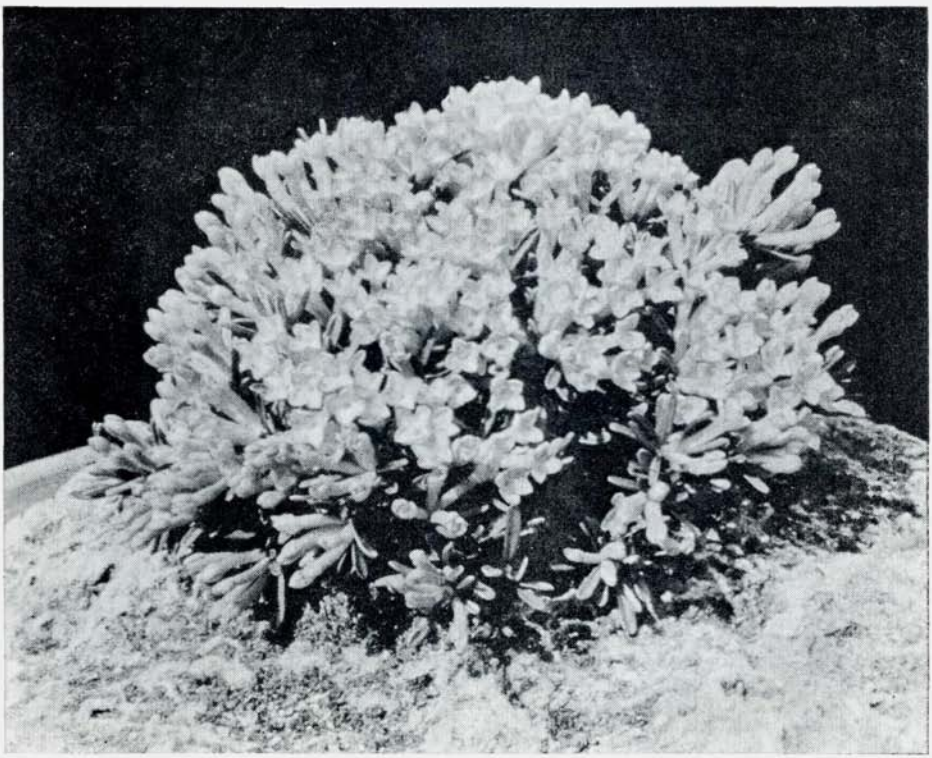
I suspect that we all have our favourite alpines and that we prefer them for different reasons. Their appeal may lie either in their form, their association or the real challenge of their cultivation. In this article I shall attempt to select twelve of my favourites and to add a few notes on how I try to grow them.

All my plants are grown in clay pots or pans and the pots are plunged in sand in an unheated alpine house or frames. Plunging reduces watering considerably and helps to provide the cool root run that alpines enjoy. Frame lights are removed in summer and slatted blinds give shade as required.

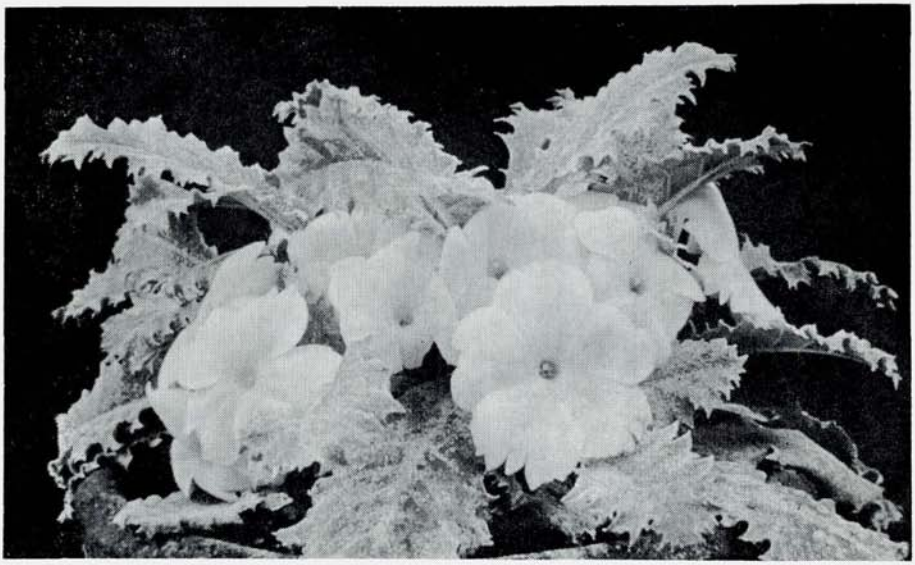
The Royal Botanic Garden, Edinburgh has installed a thermostatically controlled electric heating system in their recently constructed alpine house. This is set, in winter, to maintain a temperature just above freezing.

It has proved very successful and in colder climates enables one to grow a much wider range of plants.

My first plant *Daphne petraea grandi-*



Daphne petraea grandiflora Harold Esslemont



Primula aureata Harold Esslemont

flora will rank high on the lists of all plantsmen. It provides a real test of patience as it just won't be hurried. After eight or ten years it is quite a modest sized plant, after twenty it can be sensational.

A gritty ericaceous mixture over good drainage suits it. Be very careful not to disturb the grafted roots when potting on. Many a good plant has been lost after this operation. I still prefer the smaller wild form grown on its own roots. Try planting this in a hole bored *through* a lump of tufa. If you succeed, you will be reminded of Lake Garda and Monte Baldo.

I shall allow myself one more shrub, *Kalmiopsis leachiana*, 'M. le Piniec' form. My plant, with its large clear pink flowers, came from an American source in 1960 and received an F.C.C. five years later. It spent its summers in a shaded north frame and the winters in the alpine house. After repotting, care must be taken not to allow the old root ball to dry out. This is easily done. Propagation is by cuttings.

Primulas are universal favourites and from their ranks I have chosen two very different species.

My first, *Primula aureata*, is a member of the petiolares group and is a plant for the peat garden. It enjoys our cool, moist, Scottish climate and all it asks is a pane of glass or a cloche to protect it from the worst of the winter weather. Propagation is by division after flowering.

This primula shows a marked reluctance to set seed and with the co-operation of two fellow Scottish Rock Garden Club members, I am trying to build up a strain that will set seed more freely. We are cross pollinating pin eyed and thrum eyed flowers that have themselves been raised from seed.

My second primula, *P. allionii* is described by Farrer as "a gem of gems among the European saxatile primulas". It hails from the Maritime Alps and requires very different treatment. It is a plant for the alpine house and enjoys a well drained mixture containing lime chips. It flowers at an early age and if

you can keep it happy may well outlive its owner.

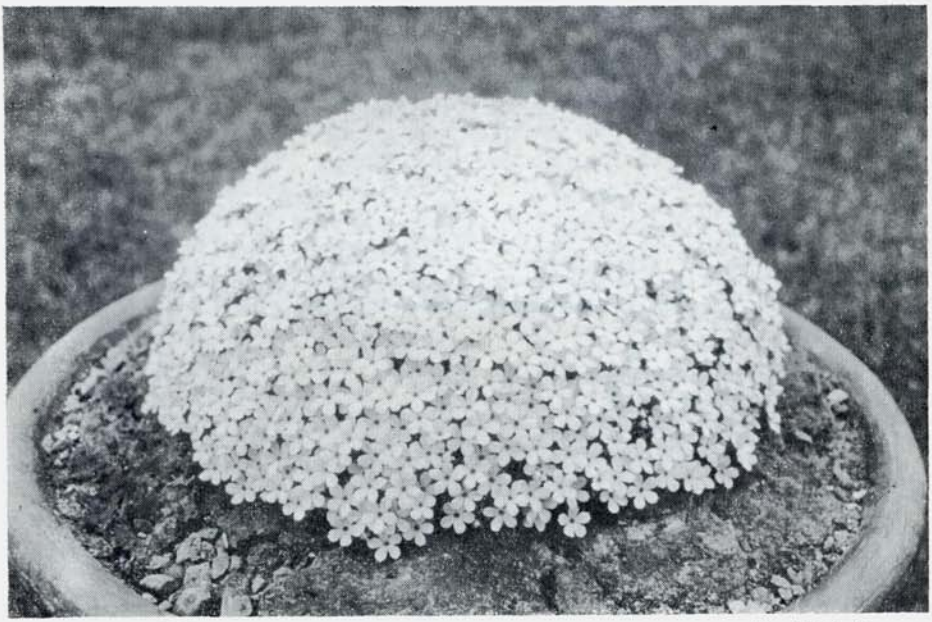
There are many attractive hybrids of this primula. Propagation is by cuttings or seed. It is advisable to remove unwanted seed heads after flowering.

I fell in love with *Androsace vandelii* at first sight when I saw it flowering in a rock crevice in the heights above Saas Fee and I have grown it ever since. Do not attempt to collect. You will do much better from seed. This can be had from the exchanges or from Correvon of Geneva. Sow in December or January if possible, expose to frost and prick the seedlings into thumb pots at an early stage. After the first flowering, select a few of the best forms to grow on. Opinions vary as to the ideal mixture. Some advocate two thirds grit, others one third. I use one third and keep my plants fairly tight potted, with a collar of hard tufa or gravel around the vulnerable neck. In a well flowered plant not a leaf should be visible.

A. helvetica is another good androsace for pot culture. It is a lime lover.

Paraquilegia grandiflora is an outstanding alpine by any standards and I was delighted to learn that seed of selected forms had been collected in the wild by some of your members. My F.C.C. form came as a seedling from the famous Branklyn garden and gave me great pleasure for the next twenty years. Once established paraquilegia should not prove too difficult provided a close watch is kept for aphis. Give it a gritty mixture, a dusting of bone meal in spring and, as it is a crevice plant, do not overpot it. At a recent Alpine Garden Society Show, a plant was exhibited with 140 flowers! My best was 35. One must keep on trying.

I met my next plant on a memorable tour to the Dolomites, led by the late Gerard Parker, an accomplished artist. I was searching for *Campanula morettiana*, which I had never seen and which was not in flower at the time. I set off up the mountain with a sketch of the leaves in



Androsace vandellii Harold Esslemont

my pocket and eventually matched them up with some corresponding leaves in the rock face. I managed to secure and later root a few cuttings. They were next transferred to small holes bored through a soft lump of tufa. They established and the tufa made a natural picture covered with the pale blue flowers and finely dissected foliage. There is a good white form of this campanula.

Campanula morettiana H. L. Foster

My next two plants will challenge the skills of the most experienced plantsman.

Eritrichium nanum, "The King of the Alps", does not take kindly to lowland culture. Propagation is by seed and cultivation is similar to the androsace. I find that most of my plants are lost in summer in hot humid spells. Try plunging the pots in an open frame with some protection from excess rain and bring in to the alpine house in winter. A few flowers on your eritrichium will amply repay you for your trouble.

One clever grower in Scotland, I knew, used to harvest his own seed.

Dionysia is another challenging genus and my choice is *D. curviflora*, an inhabitant of the bare cliffs of Schir Kuh in Iran. Dionysias are not generally obtainable in commerce and seed or brushings from an expedition, or cuttings from a friend, are the usual sources of supply. Dionysias require a gritty compost and perfect drainage and, although they need sun, they burn easily and some shading is required. Another approach is to plant it in a hole bored through hard tufa. My twelve year old plants flower, but I have never attained the standard of the St. Andrew's Botanic Garden who exhibited a plant on which not a leaf was visible.

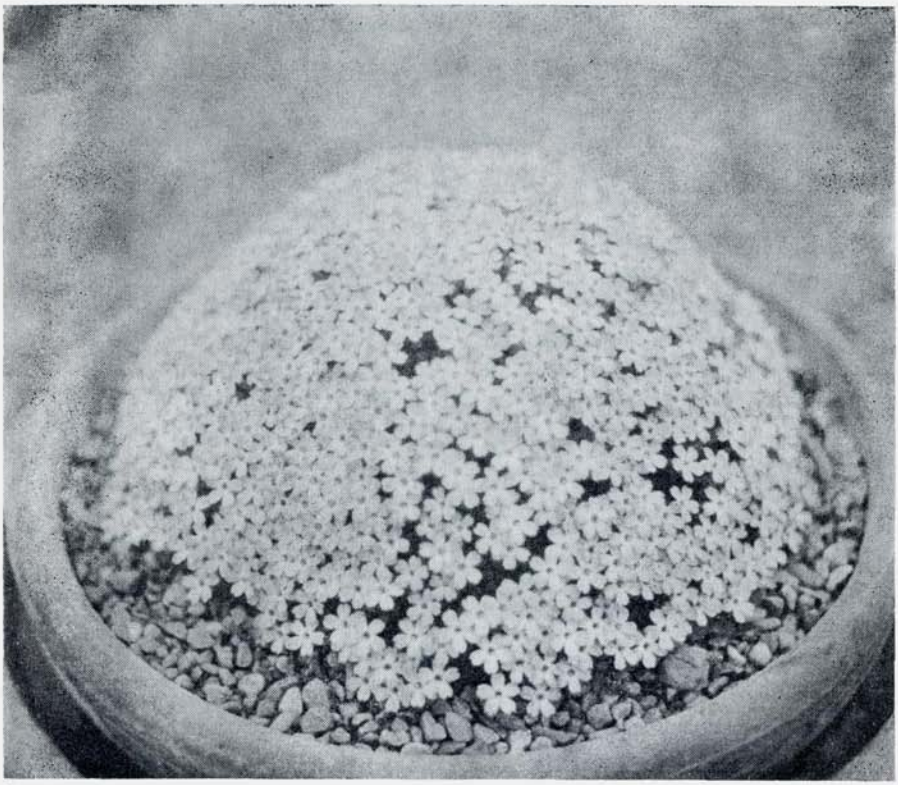
My second dionysia, *D. areteoides* is perhaps surprisingly a much easier proposition. It is an inhabitant of the Chalus Gorge and the moister climate of the Caspian Sea.

It enjoys a richer mixture which should not be allowed to dry out and with annual repotting will soon fill an eight or ten inch pot. In a good form a cushion covered with its bright yellow flowers is quite striking. Propagation is by cuttings and it may set seed.

The hardy cypripediums fascinate me although after thirty years I have had only modest success with them. *C. reginae*, with its pink and white slippers is my favourite.

At an early stage in my alpine gardening career, I visited the garden of the late William Buchanan, that renowned Scottish plantsman. After admiring a magnificent clump of *C. calceolus* with thirty or forty crowns, I enquired, "How many crowns did you start with?" "One", he replied. "And when was that?" "Forty years ago." "That is a long time." "Yes, but if you begin with two, it will only take half as long!" Patience evidently is the recipe for success in growing cypripediums.

I grow several species in pots in a shady north frame with moderate success, although I might do better to risk some of them in the peat border. I once



Dionysia curviflora R. Mitchell

had eight flowers on *C. cordigerum* and *C. acaule* flowers but is impermanent.

A visit to Mt. Olympus, the Home of the Gods, provides my twelfth plant. *Jankaea heldreichii*, "that pride of Thessaly and its shady mountain walls". I feel that I cannot do better than to continue with Farrer's suggestion for its cultivation. "Let it then be planted in rough, coarse, sandy peat with plenty of grit in a hole of stone as can never be visited by rain and there its silver rosettes will take no hurt until one day in June or July you see the stems springing up and unfold their little gloxinia flowers of palest, clearest lavender."

I feel that Farrer was unduly concerned about moisture on the leaves as experience has shown that jankaea enjoys a light spray on warm summer evenings. I lost my first plant through allowing it to dry out and had to wait many years for a replacement. I now double pot it.

I once germinated seed on tufa but did not succeed in establishing them.

This brings my short list of alpines to a close and I feel that I owe an apology to the many good plants that I have had to leave out.

I hope some of you will attempt to grow them. All you require is a love of plants, a degree of dedication, and plenty of patience.

SOILS FOR THE ROCK GARDEN

Karl H. Grieshaber
New York Botanical Garden
Bronx, New York

The selection of a suitable soil is very important in growing alpines successfully in our gardens. Of special importance are: the ratio of humus to inorganic matter, the chemical nature of the soil, and the physical condition of the soil.

Plants of alpine regions can be divided into three groups according to the amount of humus in the soil in which they grow. In the first group are those plants which undertake the colonizing of ground with no appreciable humus in it or existing vegetation on it. These plants settle for the most part in rubble and boulder fields, on scree slopes, in rock crevices and on moraines. Most of the plants that appear isolated in nature belong to this group. In cultivation these should be grown in soil with almost no humus. Among such plants are: epilobium, papaver, salix, valerians, almost all composites, alsines, silenes and drabas.

The next group of plants are those that follow the colonizers, utilizing the very small fraction of humus left by their predecessors. For the most part these are lawn-like and runner making species such as grasses, sedges and plants that can thrive only in solid turf. Such plants in the garden require a half and half mixture of humus and inorganic matter. The potentillas, most Primulaceae, gentianas, Orchidaceae, Leguminosae, Ranunculaceae, and Umbeliferae are among those that do best in such soils.

Each generation of plants will contribute to the enrichment of the humus by leaving decaying residues. In time it becomes a brown peaty mix with almost no inorganic residue. Plants that prefer pure humus are lycopodium, luzula, juncus, eriophorum, vaccinium, empetrum and most Ericaceae.

There are some exceptions to this order of succession such as when the underlying rock formations disintegrate into a limeless loamy soil, or when organic matter is windblown into depressions among the rocks.

The chemical composition of the inorganic part of the soil varies considerably. In flat, low land the soils are usually a mixture, which comes from several different types of rock formation; the chemical components are somewhat equalized and the underlying rock formation does not greatly influence the distribution of plants. In high mountainous territory, however, geological substrates are frequently sharply delineated, with resulting strong chemical differences.

Both the physical condition and the chemical nature of the soil influences the world of plants and will, to a large extent, determine which plants grow where. Independent of the climate, the alpine vegetation is more or less divided into alkaline or silicate plants. In other words, the pH. content separates the plants according to their preference for basic or acid soils.

Soil is important as the supplier of various foods. However, the presence of certain specific inorganic substances in the soil is a vital necessity to only a few plants: for instance, the Halophytae (plants that grow naturally in soil impregnated with salts such as those on the sea coast or alkaline desert.) Most plants

which are sensitive to certain chemical components in the soil either avoid localities where such inorganic materials are found or evolve genetic differences even while retaining many similarities of appearance. *Gentiana clusii*, which prefers calcareous soil and *G. kochiana*, which loves a moist soil with little or no lime are examples of such selective adaptation.

Below are examples of parallel species derived from the same genus, but separated by soil preference:

Lime-loving	**Disliking Lime**
Achillea atrata	*Achillea moschata*
Androsace lactea	*Androsace carnea*
Androsace helvetica	*Androsace glacialis*
Dianthus alpinus	*Dianthus glacialis*
Primula auricula	*Primula hirsuta*
Pulsatilla alpina	*Pulsatilla sulphurea*
Rhododendron hirsutum	*Rhododendron ferrugineum*

Lime is a necessity for all plants, as can be proven by analyzing their ashes, and only becomes disadvantageous for some plants if it appears in the soil in unusually large quantities. In nature, certain plants, which for thousands of years have adjusted themselves to a soil very low in lime, will naturally avoid a location with a high concentration of calcium. Should some of their seeds drop by chance on such a location, the seedlings become stunted soon after germination. In nature, a content of .02 to .03 percent calcium carbonate in the soil will hinder the growth of many moor and heath plants, also drosera, linnaea, arnica, calluna and many more. Other plants, however, though they also dislike lime, can tolerate a lime content in the soil of up to .05 to .06 percent. On the other hand, it has been demonstrated in our rock gardens that almost all plants, even genuine lime lovers, are able to thrive in silicate soils if the other physical conditions of the soil are suitable, though the same is not always true in reverse. Research tells us that it is not only the actual lime content of the soil, but also the generally larger content of other nutritive material available to lime loving plants that makes it possible for them to do well in silicaceous soils.

Usually plants that prefer calcareous soils are more hirsute than their parallel forms growing in silicate soils. They will often have whitish or grayish foliage that is frequently of a feltlike texture. The leaves of plants growing in alkaline soils are of a bluish green and often are more deeply cut than those of plants growing in soil containing no lime. These latter tend to be of a lighter, more yellow-green color. The flower crowns are likely to be of larger dimensions on plants that prefer calcareous soils when compared to those of their parallel species on acidic soils. However, the blossom color of the lime-loving species may be of a paler hue than those of their calcifuge counterparts. If, for example, the flower color is white on the calcicole species the parallel species that prefers acid soil will frequently have red, blue or yellow blossoms.

Important for our purposes are those plants requiring magnesium, which is present in dolomitic limestone as a

brittle calcium magnesium carbonate. Examples are *Aethionema saxatile*, *Anemone trifolia*, *Campanula caespitosa*, *Linum alpinum*, *Petrocallis pyranaica*, *Potentilla clusiana*, *Rhodothamnus camaecistus*, *Salix glabra*, and *Saxifraga caesia*.

Another calcium carbonate, but one lacking magnesium, is tufa (a porous limestone formed by deposition in lime-rich springs and streams), which is well liked by almost all alpine plants.

Compared to the steep, wild, jagged Dolomite Mountains with their rubble, boulder-fields and stony meadows, slate mountains usually have more gentle forms, crumble away faster through atmospheric action, and provide a greater opportunity for the accumulation of humus deposits. Slate rock is able to retain water much longer than limestone and, as we know, uniform moisture expedites the making of humus. Because slate holds more water than limestone it remains cooler and the soil in meadows on slate mountains is usually cold, heavy, clayey and wet. Naturally the flora on such soils is completely different from that on the dryer, warmer lime soils.

Plants which grow normally on igneous rocks or slate will quickly become stunted and usually die when planted in calcareous soil, or when watered with water containing lime. These plants do not need the alkaline minerals and are indeed repelled by their presence. Some lime hating plants are *Ajuga pyramidalis*, *Anemone vernalis*, *Cardamine alpina*, *Chrysanthemum alpinum*, *Linnaea borealis*, *Primula glutinosa*, *Salix helvetica*, and *Saxifraga aspera*.

Of special interest to us as gardeners is the physical condition of soils: the degree of fragmentation through weathering of the underlying rock formation. The size and shape of the particles will determine the firmness and consistency of the soil and its hygroscopicity: its ability to absorb water and retain it.

The physical quality of inorganic soil particles can be categorized into three groups according to their degree of mechanical decomposition. (Soils modified by humus are not included.) These are as follows: soils derived from relatively large crushed stones, boulders and rough rubbly rocks; soils usually known as sandy soils, that have fine, dispersed, loosely connected particles; and soils composed of both the aforementioned plus an admixture of extremely fine particles. These are usually referred to as loamy or clay soils. When growing alpines, we usually employ one or another of these soil groups. Hardly any two gardeners will use the same soil mix yet they may still achieve the same results.

As a rule, heavy loam is used in small proportions mixed with twice its bulk of sharp, coarse sand along with either peat or leaf mold. Adding these latter components to the loam will guarantee drainage and prevent the soil from baking. The loam in the mixture will absorb and hold water. This is of vital importance. We know that even a temporary but disproportionate drying of the soil mass around the roots can have a deadly effect on most alpines.

A loam containing no lime results from the disintegration of slate or schist. Argillaceous (clayey) and silicate soils can also be derived from granite, gneiss and trap rock. Loess, a diluvial clay, is the best loam to use if one with a lime content is needed. Of course, any decomposed limestone or marley soil is good for this purpose as long as rain water has not leached out the lime.

If lime has to be introduced into the soil mix, a granulated limestone, sold under the trade name Nylco can be used. It is a dolomitic limestone, finely granulated and high in magnesium. It comes in fifty pound bags. Another good lime additive is Lime Crest #3, which contains

calcite crystals, is coarsely ground, and comes in eighty pound bags. Other ground limestones of various grades of coarseness, either with or without magnesium, known by other trade names will be found in various sections of the country. The coarser the grains, the less lime is immediately available for the plants; on the other hand, powdered limestone can be absorbed by the plants immediately.

Pure humus is able to hold onto moisture for quite a while, yet some alpine plants, though they may grow in nature in deep decayed matter, will not be happy when planted in pure humus in our gardens. It seems that in the higher temperatures of the lowlands, humus goes through a process of decomposition different from that in the mountains.

The best humus for the culture of alpines comes from the floor of coniferous forests. The use of decayed pine needles is important in the pot culture of difficult plants. Fresh pine needles, when shredded, can be used after one year's aging.

One of the simplest and cheapest soil improvers is peat-moss. It is able to hold water like a sponge; it will withstand rot; and because it is pure cellulose, it cannot harm any plant by reason of an inorganic content.

To recapitulate, an excellent standard growing medium would be loam, peat-moss, coarse sand, and pea gravel mixed in equal parts.

DWARF SHRUBS
by H. E. Bawden, The Alpine Garden Society, England, 1980. $12.00

Another very commendable effort in the Alpine Garden Society's series of educational guidebooks for beginners, this fills the bill in putting before the amateur aspirant at reasonable cost the subject of dwarf shrubs. Certainly the author's half-century experience in no less than eight separate gardens, all of them featuring alpine material, lends a unique intimacy to his subject.

We anticipated another A-Z listing and that is what we have; yet nowhere are either of the two rather flexible words of the short title defined or delimited for us and we are in for a few surprises — some by their inclusion, others by their absence. The introduction states that two large and important groups of suitable material, dwarf conifers and heathers — having been already adequately dealt with — would have made far too large a book if properly considered again, yet Erica gets a page so why not Calluna? And dwarf conifers have been allotted a three-quarter page mention, regardless. We are a bit distressed that there are no Phlox included for surely this genus is rich in species of dwarf shrubby plants of prime quality. Dozens of other genera, perhaps ten percent of the total of almost 150 generic entries, cite inconspic-

uous, little known or collector's species, so why no phloxes? It is stated that weed smothering groundcovers are much to be appreciated and so if Linnaea is includable, then why not Vinca? And if small forms of Phormium are allowable amongst "shrubs" then why not also small species of Yucca? There are some incomparably lovely ones with the added virtue of scented blossoms on powerfully attractive inflorescences.

It is good to note, however, the inclusion of some subshrubs frequently overlooked in treatments of low woody plant material, Shortia being one such. But it is a surprise to find that though the Japanese *Shortia uniflora* and the eastern North American *S. galacifolia* are mentioned, the latter, a strictly American plant of very limited range, is credited to both America and Japan. But this is a minor point we do not intend to belabor, as with certain other taxonomic matters. The author is, we presume, following British horticultural custom of the day as will undoubtedly the majority of his readers.

There is much here for the beginner or the anticipant gardener no matter where he is, but is it really important to the beginner that he be advised that in no case can Chimaphilia end with a "phylla?"

Each generic entry is matched with the family affiliation and the beginner should take note that this can be helpful in undertaking and appreciating the species entries that follow and also in providing their needs in cultivation. Each is, true to the author's avowal, described simply as it looks to him. Some of their special virtues and uses are told, as well as their expected growth rate; all things the novice needs to know, but things about which he may not otherwise become informed in this day of brevity in catalogs. American readers need to pay careful attention, however, to the fact that "hardy" in Britain can be quite different for our various local conditions and should make further inquiries before investing in a plant whose tolerance to cold and wet or heat and drought is in question.

There are 28 excellent photographs, four of them in color, 113 pages, plus index and reference list.

Shrubby materials are the structural plants of the rock garden; some are show pieces in their own right and all the first rate sort must lend themselves to utilitarian usage as bank retainers, shade casters, ground covers or as background and framing plants to set the scene for more ephemeral, seasonal, colorful, and less permanent things, many of which are grown for flower alone. The wealth of material in this one small book should impress on any would-be gardener the fact that he can have an enduring and interesting low-maintenance garden on any piece of ground (or even without ground) and in any situation — wet or dry, warm or cool, in city or country.

— R. D.

THE SEEDLIST HANDBOOK
by Bernard Harkness (3rd Ed.), 1980, Kashong Publications, Bellona, N.Y., $7.50

Yes, the 3rd edition of *The Seedlist Handbook* is off the press. Completed just before his death by Bernard Harkness, this edition has been revised to include the latest listings from the seed lists of the ARGS, the Alpine Garden Society of England, and the Scottish Rock Garden Club. The entire listing has been corrected to include the most recent nomenclature cross-referenced to former names.

Former editions are presently in use by gardeners all over the world and by many botanical gardens and arboreta, containing, as they do, concise informa-

tion nowhere else available; to rock gardeners *The Seedlist Handbook* is invaluable. If you don't have a copy, get it. If you have a prior edition, get this updated version. Also available from Your ARGS Store.

BUILDING A COLDFRAME

Sandra Ladendorf
East Lansing, Michigan
Drawing by Ray Ladendorf

The cold frame is finished. It would probably rate about a C+ from a high school shop teacher. If I look at it critically, I can see that the lids are just the teeniest bit off square and one bit of plastic support was cut half an inch short. And, oh yes, there's that nail that went askew and I said "Wotthehell" and hammered it flat into the wood instead of withdrawing it and redriving it properly.

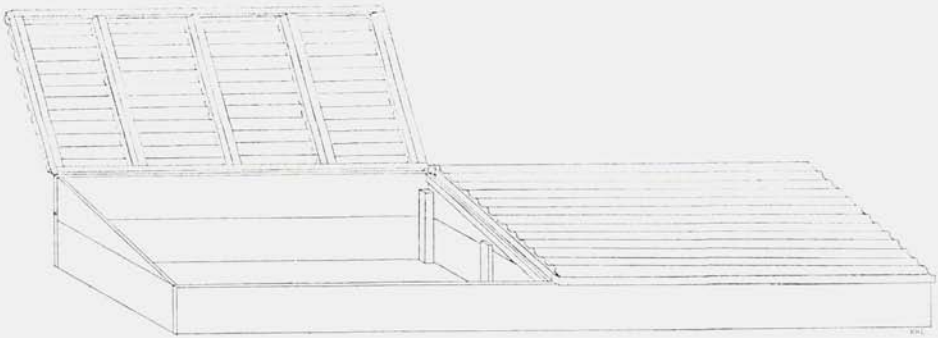
But I did it! All by my klutzy self. I planned it, shopped for the component parts and built it. I really felt a great flush of accomplishment as we put the frame in place behind the garage.

I wanted a cold frame to shelter those fussy alpines like saxifrages, androsaces and lewisias, which in our climate do best with a little protection. Our present home is not the place for an alpine house, so a cold frame was the next best bet. My engineer husband is always the family do-it-yourselfer, but his present job requires lots of travel and crazy hours, so if I wanted a cold frame this fall, I had to do it myself.

Putting old storm windows on a wooden frame is a common way of creating a cold frame. I poked around, but couldn't locate any old windows when I wanted them. So I utilized an idea I'd seen in Milwaukee at the ARGS Annual Meeting and used the translucent corrugated fibreglass which comes in 24 inch widths and a variety of lengths. Because I hadn't been smart enough to sketch those cold frames I admired, I had to work up the simple design myself. I asked the patient men at the lumberyard a lot of dumb questions, particularly about the stress of snow weight on the lids. The end result is a sixteen foot long frame divided into two sections, each with eight foot lids. If I were doing it again, I would build it in two independent sections of eight feet each, which would be very little additional work, but a bit easier to handle.

Choosing the material was an education. Rough wood or finished wood, nails with heads, nails without heads, flat head screws or round head screws, redwood or pine?? For someone who barely knows one end of a screwdriver from the other, there was a lot to learn. The consensus of expert opinion was that whatever wood I used would have to be thoroughly painted, and since redwood is about three times more expensive than pine, I went with pine.

It's easier, I learned, to go with standard sizes and lengths of wood, so I planned the frame accordingly. (Though I never will understand why a 2x4 is actually $1\frac{1}{2}$x$3\frac{1}{2}$, a 2x2 is $1\frac{1}{2}$x$1\frac{5}{8}$, or a 1x12 is $\frac{3}{4}$x$11\frac{1}{4}$.) The frame itself is built of four 1-12 boards in sixteen foot lengths. I used one for the front, two for the back and one cut into five thirty-six



inch lengths for the ends and central divider. Two of these thirty-six inch lengths were sawed in half diagonally to provide me with three sloping pieces for the top of the ends and the center. I even had a bit of firewood left over. To maintain the sixteen foot length, the end boards were fitted inside the front and back rather than outside. This sort of mickey-mouse figuring would be second nature to anyone who has ever built something before, but I had to stop and think.

So that the tip ends of the diagonal boards would not move, I fastened them securely to the boards underneath by nailing short pieces of small board vertically over the seam inside each end and on one side of the center support about one-quarter and three-quarters in from the front of the frame. In addition there was, inside each corner, an upright 2x2 to nail my front and back boards to. On the central divider the upper end of these uprights and reinforcing pieces came about three inches below the top of the frame. There was a reason for this. When I fitted the lids to the bottom frame it was immediately apparent that the one inch thick center board was not wide enough to support both lids. I had to jerry-build support by adding a 1x2 on each side of the central divider at the top edge above the reinforcing uprights. If I were doing it again, I would cut the center board lower and add one 2x4 on the top of the edge to provide a four inch wide surface to support the lids.

The lids are built of 2x2s, two eight foot pieces for the front and back and five 25 inch lengths evenly, vertically, spaced between them. This number was necessary, according to husband Ray, to support the snow load in this part of the world.

Three feet is about the right width for a cold frame as it allows me to reach the back without stepping into the frame. The other reason for selecting a three foot width rather than four as I had originally planned is that my engineer husband said I would need to use 2x4s rather than 2x2s throughout the lid construction of a wider frame because of snow stress. Two by fours would have made the lids too cumbersome and heavy for me to handle easily. As it is, each lid weighs about ten pounds and that's heavy enough.

Having finished nailing the lid frames together, I stopped the construction and painted for a few days. Every part got two coats of paint and I gave an extra splash to the bottom three inches that would touch the ground. I also painted the corrugated support strips that would go under the plastic.

When the paint was dry, it was time to assemble the covers. First I hinged them to the back of the cold frame. Then on top of each vertical of the cover I

placed a strip of the corrugated wood. As the only fibre glass I had been able to get came in two foot widths, I gently laid two of the pieces lengthwise across each lid, the upper one overlapping the lower one. With all corners squared and the wood strips in place, it was time to screw the whole thing together. I used screws rather than nails and put washers under the screw heads so as not to splinter the rather brittle plastic, also predrilled holes for each screw.

At this point, Ray saved me lots of time and anguish by showing me a special drill bit called a drill and countersink. This makes a perfect hole for assembling something like this frame — a hole wider at the top for the screw to enter and thinner at the bottom to screw into and grip. Marvelous! The only trick to using corrugated fibreglass and wood strips is to screw or nail through the thick lumps in the strips of corrugated wood rather than through the valleys between.

Project finished, I enlisted the aid of the whole family to carry the frame to its site behind the garage. Now it is not only storing alpines, but also wintering over 'mums, sheltering some Swiss chard that I rescued from the vegetable garden, and I hope to force a pot of bulbs for indoor pleasure in February. I even planted some lettuce seed. We'll see if that idea produces anything in our chilly Michigan winter.

The additions left for springtime construction are two anti-pest inner lids. Since our frame is near the woods where pheasant, squirrels and rabbits gambol — and munch — I will follow the example of Ted Berginc in Wisconsin and build simple inner screens to keep hungry critters out.

I will look for lightweight aluminum pipe that I can bend easily, bend it roughly into the inner shape of the frame and cover with relatively fine meshed chicken wire. Hinges can be created out of bent nails and the front edge can rest on another set of nails. Primitive, but I hope effective. I can also use such frames to hold up shading material if I need it over the frames in summer.

* * *

CACTUS FROM SEED

Kathie Lippitt
Scotia, New York

In 1975 I planted a packet of deluxe-mix cactus seed I had received from Horst Kuenzler of the New Mexico Cactus Research. Penned on his card were the words: "Good luck, Mrs. Lippitt." And I certainly did have good luck. Two days after planting, the seeds started to germinate boisterously and I'm fairly certain that every one of the one thousand seeds germinated, most by the end of three weeks.

I started replanting the seedlings before all the seeds germinated. To my uneducated eye they appeared to include bereskias, opuntias, cereus, mammilarias, parodias, echinocactus, notocactus, and ferocactus. Their globe to egg shaped plant bodies were deep red, green, light green, pink, orange-pink, various shades of flesh pink, and maroon, and each had two seed leaves. Some of these were non-succulent, some were very succulent, obvious leaves, while others were mere nubbins or points on each side of the

ball. There were spines on the top of most of them — even at that tender age — and the oreocereus and cephalocereus were born old men with white hair.

By fall the seedlings were presenting me with a real problem. What could I do with them all? I transplanted them to small pots until I ran out of these. Then I started to fill clay saucers with holes drilled in the bottom. (This can be done with an electric drill and patience.) I filled these containers with soil and put seedlings all over the surface. I soon discovered that most of the ball shaped cacti have small root systems immediately underneath the ball while the taller tree cereus have wide ranging roots.

Fortunately my husband is very tolerant about my keeping such a large collection of plants in the house. He was even very helpful and made shelves for them in the living room the first winter, made more shelves for them in our bedroom the second winter and has since put up an alpine house so that the cacti and other rock plants can spend the winter in dry cold. We kept about two hundred and fifty of the cactus seedlings, giving the rest to friends.

Identification of all these babies has been the rough part. They are crying for names. The next year I got named seed from Mr. Kuenzler but he has since discontinued his retail business and I have had to get any further cactus seed from elsewhere.

On the whole I have had excellent results: of twenty-nine different cactus seed planted on June 24, 1976, twenty-five species germinated, though in all honesty I must admit that I lost all four seedlings of *Espostoa churinensis* and two other species. I now have twenty-one named cactus species from seed plus one *Ferocactus gracilis* with no name tag.

By the second summer the young plants were still awfully small, but I set them outside anyway as they were suffering from lack of care in the house and I thought the spring and summer rains would be of benefit to them. They were all placed with my other cacti. Some were lined out under a tree, the others (the very hairy or spiney ones, which I thought could take full sun) out in the open. Here they underwent a number of vicissitudes. Our cat hunted among the pots, knocking them over, mixing them up, and tipping out quite a few of the plants. I would try to get them all righted in the morning or at least by evening so they would have a few hours of peace and quiet before being tipped over again. At the end of the summer I discovered a hidey-hole in one of the clay saucers where mice had lived all summer out of reach of the cat's claws. One of the saddest experiences with these young cacti, were that some became badly sunburned during the early days of summer.

No cold pre-sowing treatment is needed for cactus seed. This year I am using a commercial peat-vermiculite-perlite planting medium plus an equal part of perlite or stone chips in plastic pots for all my seeds including the cacti. I also use stone chipping to cover the seed and to hold newly transplanted seedlings upright in their pots. I think cacti germinate best at 75 to 80°F. For their first winter I keep my plants two to three inches from the fluorescent lights where it is warm. They are watered regularly with a very dilute liquid fertilizer. As we live in upper New York State, a few miles north of Albany, the walls and windows inside the house are a trifle colder in winter than the thermostat setting and the humidity is apt to go lower than that of a desert. Therefore I feel it is a good idea to keep the cactus seedlings in active growth by giving them plenty of light and warmth and keeping them well watered and fertilized, rather than setting

them on our cold window sills where they would become chilled and dehydrated. They can be moved to the window sills by their second or third winter, however. Unfortunately mosses and liverworts also enjoy this regimen of fertilizing, watering and the twelve hour day under fluorescent lighting and after several months I must clean these weeds off the surface of the pots. I do this by carefully lifting them off with a cocktail fork (my favorite inside garden tool), after which I put on fresh chippings. I have also tried top-dressing the pots with charcoal but I don't know that it worked much better. If there is a problem with mealy bugs, I touch these with a cotton swab dipped in alcohol. If the infestation is very bad, I spray the plants with alcohol or dip them in it.

Because most cactus seedlings produce their roots immediately underneath the body of tthe plant, they are easy to transplant with a minimum of set-back, though a day of rest without watering after transplanting is perhaps helpful.

To those who wish to try growing cacti from seed, I repeat Horst Kuenzler's wishes, "Good luck, all."

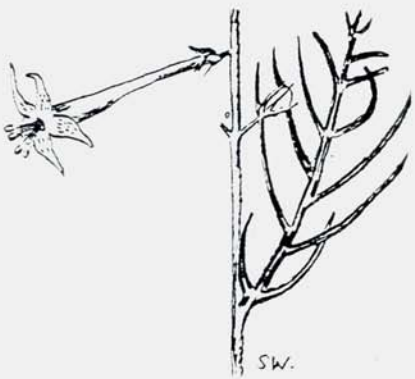
* * *

THREE SKYROCKETS

Sally Walker
Portal, Arizona
Drawings by the author

These attractive plants are perhaps better known by the name *Gilia* in which genus they were formerly included in the subsection Ipomopsis prior to their reclassification in a genus of their own.

Ipomopsis aggregata is one of the better known western mountain wildflowers that bloom in late summer. This is, no doubt, in part due to its wide distribution from British Columbia to Montana and California to New Mexico, where it is often abundant in coniferous forests at elevations, in the southern limit of its range, from 5,000 to 8,500 feet. Its stem is about two feet tall with many branches and the leaves are alternate and very variable in shape, ranging from entire to pinnatifid. The orange-red flowers are scattered along the branches, sometimes in groups, and are attractive to hummingbirds. The corolla tubes are one inch long and the five lobes are half an inch long and rather narrow and pointed. The five stamens are inserted in the corolla throat.

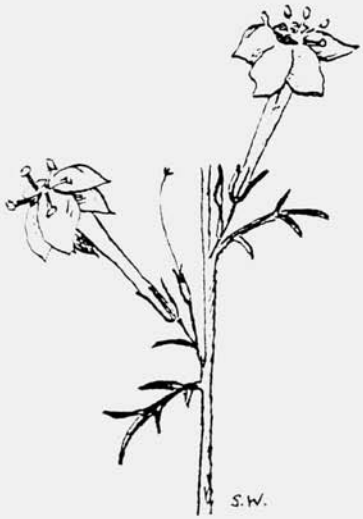


Ipomopsis aggregata var. *macrosiphon*

A variety of this plant is extremely local in distribution, being found only in the Pinaleno and Santa Catalina mountains of southern Arizona. *Ipomopsis aggregata* var. *macrosiphon*, as its name

indicates, has a very long tube, one and three-quarters inches long and the petals are pink with purple spots. The plants I have found are about eighteen inches in height and tidier in their growth habit than the species. Although grown to flowering size in a pot in the alpine house at Kew Gardens the plant has been found to be short lived.*

Ipomopsis thurberi competes with *I. aggregata* for the title of prettiest skyrocket in Arizona. It is about twelve inches tall and bears its flowers at the tip of the stem. The corolla tube is one inch long and the lobes, which are rounded instead of being narrow and pointed, are one-third of an inch long. There is great variation in the length of the anthers. The color of the flowers is bright purplish blue or claret. This plant is also extremely local in distribution, being found from 4,000 to 6,500 feet in the mountains of Cochise, Pima and Santa Cruz counties. All three of these skyrockets have a late season of bloom, from August to October.



Ipomopsis thurberi

*(I. aggregata *has done well in gardens in the Northeast in sun or part shade, in well drained soil with the addition of a little peat. As it appears to be monocarpic, it is best raised from seed. It will self-sow in suitable sites. — Ed.)*

• • • *of Cabbages and Kings* • • •

It was only after considerable soul searching that I decided to publish, in this issue of the Bulletin, the series of articles on growing terrestrial orchids.

As gardeners, most of us are tempted time and time again to move into our personal landscapes the lovely wildlings of forest, swamp, and mountain, no matter how rare, and most of us succumb at least occasionally to the temptation. The more choice, rare and difficult the plant, the greater the challenge to try to grow it and all too frequently we dig up or buy from so-called "wildflower nurseries" plants which should better be left in situ.

Most rare and difficult plants are rare in the wild and difficult to tame because they have over eons of time developed genetic characteristics that make it possible for them to grow in particular sites. In so doing, they have frequently cut off their options so they can grow only under these very specific conditions; conditions which may be limited both in number and extent in the wild and almost impossible to replicate in the average garden. Temperature of both soil and air, light factors, day length at various seasons, moisture, both in the atmosphere and in the soil during certain periods of growth and dormancy, soil composition and chemistry, fungal and bacterial compo-

nents and other subtle influences may, singly or in combination, all play a part in the well being, even the existence, of such plants.

It is, of course, true that certain plants are endangered not so much by their collection as by the increasing destruction of their specialized habitats. Lumbering and agriculture, draining, filling and the construction of highways, factories, airports, marinas, shopping plazas and homes all play a part. But one has only to read some of the articles in conservation journals to realize that collecting also plays a role in the disappearance of some of our flora. The wanton, wholesale digging for the trade of rare cacti in our American deserts and the present vogue for growing plants, among them some of the smaller and uncommon insectivorous species, in closed glass containers have resulted in the drastic depletion of some species in the wild. And these are but two examples of the detrimental effect of commercial collecting for the gardening trade. What is particularly sad is that most of these plants are badly dug, and carelessly stored and shipped, and that they will, to a great extent, be bought by people who have no knowledge of their value or how to grow them, people who will treat them as a passing fancy soon to be discarded on the rubbish heap.

But even some of our more dedicated gardeners are no better: the plant is beautiful and rare in gardens and they covet it for their own. How well I remember one such gardener, not, let me say, one of our members. She had asked us if we would take her into one of our local sphagnum bogs — we have very few in our area and they are not easily accessible. We agreed and one summer day, after a tortuous drive over twisting dirt roads, we plunged down the thickly forested slope that enclosed the bog. As we reached the bottom of the embankment, we saw growing in the deep, cool leaf-mold under a thicket of laurel, a single plant of *Habenaria orbiculata*, the tall slender spike of long-spurred, long-lipped flowers rising from between the two basal leaves, round and large as butter plates, pressed flat to the ground. We pointed it out to our gardening acquaintance, telling her it was an excessively rare orchid in Connecticut, that it grew, as far as we knew, only in this one small area and nowhere else in the state. As we looked at the orchid, the breeze ruffled the tree branches above our heads and a vagrant sunbeam shone for an instant on the plant, lighting the delicate greenish-white flowers so they gleamed like phosphorus against their dark background.

"Oh, how beautiful," she exclaimed, "how I would love to have it." She fell on her knees beside the habenaria and, noting the greedy shine in her eyes, we hastened to explain that it should not be dug, not only because of its rarity, but because it would not survive transplanting. "I'm sure I could make it grow," stated this gardener, but she reluctantly got up and followed us down into the bog.

After several hours of squelching and bouncing through the floating mat of sphagnum, admiring the Calopogon, Bog Rosemary, Bog and Sheep Laurel, Wild Calla, Buckbean, Round and Spatulate-leaved Sundews and Pitcher plants, we returned to the shore and changed into dry shoes before starting up the slope. Our companion was already heavily laden with trophies, but as we came to the habenaria she couldn't resist.

"I just know I can make it grow," she exclaimed and before we could stop her, she had plunged her hands into the leaf-mold on either side of the plant and ripped it up. Our return to the car was pregnant with gloomy silence on our part and bubbling enthusiasm on hers. Needless to say, we never took her on another field trip and the orchid and all her other

collections died as we knew they must. We knew her garden: on an exposed rocky hillside with a small evanescent trickle of a brook, dry except in spring, under a few thin poplars at the foot of the rocky outcrops.

The miracle is that so many plants from varied climes *will* do in our gardens; that plants from the deserts of southwestern North America, the sun baked hills of the Mediterranean basin, the cool forests of the Appalachians, the peaks of the Alps, the Himalayas and the Sierras will grow, practically cheek by jowl in our gardens, with others from the islands of Japan, the Aleutian Peninsula, and the sandy coastal plains of mid-Atlantic United States. But not all plants will do in all gardens and it behooves us as responsible gardeners, to discriminate among those available and decide which are likely to live in our particular situation. To persist in trying to grow plants that will not survive in our climate and terrain is foolish and if the plants are rare it is almost akin to murder — a type of herbicide, if you will.

Certainly there are occasions when rare plants should be rescued from the advancing blades of bulldozers or logging equipment, but one must be very careful not to rationalize such rescues. One must beware the little devil of temptation who whispers, "It is growing very near the road and will surely be destroyed if I do not dig it up and take it home"; or "If I don't take it, someone else, less capable of growing it than I, certainly will"; or, like the avid gardener who dug the habenaria, "If I leave it here, no one will ever see it to enjoy it. I'm sure I can make it grow in my garden, where I and my friends can see it." Perhaps, if the plant is truly growing in a site doomed to imminent destruction, it might be better to move it, but not necessarily into our garden. Transfer it rather to another suitable and safer place in the wild, perhaps on protected land, and there nurture it until it becomes established.

In any case, unless a specimen is one of a particularly good form in a wide spread population, it is better to collect the seeds of a wild plant, or to take layers or cutting material for propagation or dig one or two young plants rather than take a mature plant at a time when it is in full growth (probably in flower); a time usually unsuitable for transplanting. And by all means propagate it and pass it around rather than succumb to the temptation of being able to boast that you have the only specimen.

Many plants now fairly common in cultivation have, for one reason or another, become rare or even extinct in the wild: *Shortia galacifolia*, *Franklinia alatamaha*, and *Ginkgo biloba* come to mind. And many superb forms, such as the double-flowered *Sanginaria canadensis multiplex* and 'Cole's Prostrate' hemlock, would have lived and died without producing progeny except that they were rescued *and disseminated* by knowledgeable, dedicated gardeners willing to take the pains to grow and propagate their finds.

So think carefully and responsibly before digging up or purchasing wild plants for your garden. The role of a good gardener is to nurture plants. Let us not be counted among their destroyers.

Weeding's prevailing virtue is that it gives you a chance to garden when, maybe, you ought to be doing something else.

— Joseph Kastner in the *Smithsonian*

HOLIDAYS FOR FLOWER LOVERS
A 1981 PREVIEW

Some of the holidays outlined below combine an interest in sites and flowers while others are primarily for gardeners and botanists. All are suitably accompanied. Full details, with final dates, prices and names of tour leaders, will be available in October. Please do write or telephone and you will receive the information directly it is available.

JORDAN & SYRIA—17 March to 1 April

Although the itinerary of this tour is planned round archaeological sites and crusader castles, it should be emphasised that the wild flowers in spring can present an outstanding spectacle, and that plenty of time is allowed to enjoy and photograph them. Places visited include Amman, Jerash, Petra (where three nights are spent) Madaba, Kerak, Oamascus, Palmyra, Aleppo, Qala't Sema'n, the Krak des Chevaliers and Bosra.

GREECE—The Peloponnese—25 March to 9 April

An equal stress is laid on sites and flowers on this holiday, which covers the countryside of the Morea from Athens as far as Pylos in the south-west corner, and the mountains in between. **A tour of NORTHERN GREECE is also planned, highlighting Olympus and Parnassus, from 29 April to 13 May.**

RURAL TURKEY—15 to 31 May

This original holiday is of equal interest to those who enjoy visiting new places and sites and to flower and country-lovers. The first two days are spent in Istanbul at a hotel on the Bosphorus, then on to Lake Abant, Ankara, Bogaskoy and Akseray from which we explore the Peristrema Valley. Here, in a long, narrow gorge, are to be seen painted rock-cut churches of about the same period of those at Goreme and where, in the opinion of many, the art is of an even higher quality. This wild, scenic country should provide a fine variety of botanical specimens and splendid photographs. The tour ends at Bursa, with its fine mosques and attractive market plus, as a bonus, rare plants on nearby Ulu Dag. **A tour of SOUTHEAST TURKEY is planned for later in the year.**

ZIMBABWE—July/August

A three-week holiday of special interest to mountain flower enthusiasts includes a week in the Eastern Highlands of Inyanga and Vumba, a stay in the Bumi Hills near Kariba and two days at the truly remarkable Zimbabwe ruins at Fort Victoria. We also visit the Victoria Falls, Bulawayo with its fine museum and Salisbury. A recent tour of exploration has shown that hotels are good (some excellent) and the countryside superb.

HOLIDAYS FOR ALPINE GARDENERS—May and June/July

These cover the Spanish Pyrenees, the Swiss Alps and the Dolomites in Italy and, further afield, South Africa in September and treks in Nepal and Kashmir.

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