

December 1987

American Horticulturist



Help Save America's Endangered Wildflowers



Kenneth Wurdack

Ashe's magnolia (*Magnolia ashei*) is the rarest of the native American magnolias. Many of America's most treasured wildflowers are threatened with extinction. In fact, experts estimate that 10 percent of the species and varieties native to the United States are in jeopardy. Over 50 taxa have already disappeared.

Learn more about Ashe's magnolia and other endangered plant species by purchasing a copy of the American Horticultural Society's *Endangered Wildflowers 1988 Calendar* and reading through the informative text. Funds raised from sales will be used to support conservation projects. To order your calendar, turn to page 40.

Contents



President's Page: Season's Greetings by Carolyn Marsh Lindsay	2
The Design Page: Garden Reflections by Margaret Hensel	4
The Indoor Gardener: Ladyslippers to Grow on Your Windowsills by Ella May T. Wulff	7
Strange Relatives: The Pepper Family by Jane Steffey	10
Botanica at Key Biscayne by Ruby Weinberg	14
Bougainvilleas: A Feast for the Eyes by Tovah Martin	22
The Mystery of Flowering Plants by Dr. Gilbert A. Leisman	27
Sources	36
Classifieds	38
Unusual Species: <i>Dracunculus vulgaris</i> —My Heirloom Plant by Alice B. Yeager	42
1987 Index	44

On the Cover: The glossy leaves and profuse scarlet fruit of *Ilex cornuta* 'Burfordii' fairly sparkle with holiday cheer. Though this vigorous ornamental evergreen has an affinity for the American South, it is hardy as far north as zones 7-9. A densely-growing holly, it can reach heights of up to 30 feet and provides an effective display both in the garden and in indoor arrangements. *Ilex cornuta* is a native of eastern China, where the dried leaves have been used as a medicine; its brilliant colors are still a most inviting tonic as winter days grow short. Photograph by Pamela Harper.

Botanica at Key Biscayne; see page 14. Photograph by Ron Oprzadek

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Season's Greetings

On behalf of the Board of Directors and the staff at River Farm, I want to wish each of you a joyous holiday season and a New Year filled with great gardening experiences! Our gift to you, and our New Year's resolution, is to make your American Horticultural Society a more exciting, enjoyable, and rewarding Society for all its members.

We are thrilled about the plans for our 1988 Annual Meeting, scheduled April 14-16 in Atlanta, Georgia at the height of the spring season. Each day will be packed with exciting events, from internationally recognized speakers whom you will meet at receptions and dinners to entrées to Atlanta's most exquisite private gardens.

The Southern hospitality extended to our Planning Committee has been overwhelming! The distinguished Atlanta Botanical Garden, its Board of Directors, and Ann Crammond, the Executive Director, have rolled out the red carpet for us all.

The meeting has been scheduled to follow the Williamsburg Garden Symposium April 10-13, enabling our gardening enthusiasts to attend both events. You may extend this "Great Garden Week" even further by taking our post-conference tour to Callaway Gardens.

In response to numerous requests we have shortened the meeting to three days, reduced the costs substantially, and arranged a variety of hotel accommodations for your selection.

If you have never been to an Annual Meeting previously, mark your calendar and give yourself a gift—a trip to Atlanta. Meet with the officers and directors, and join us in congratulating the recipients of our distinguished awards.

Most important of all, bring your suggestions for molding the future of the American Horticultural Society. Come, participate, and share this glorious gardening experience by bringing a friend!

Carolyn Marsh Lindsay



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Margaret Hensel

Garden Reflections

This month marks the fifth anniversary of "The Design Page." To celebrate the occasion, I leafed through a thick stack of past issues of *American Horticulturist* and finally found my first column, titled "What is the Purpose of a Garden?" After five years, I was curious to see if my ideas had changed and if the column had accomplished what it set out to do.

Surprisingly, a lot of things in that first column still hit home. I still think a garden represents different things to different people. As a place where our sense of wonder is stirred and illuminated, a garden is both a means of self-expression and a place of quietude and peace where we can regain a sense of our own connection with nature.

During these past five years I have written on many aspects of garden design—everything from garden architecture, seats, gates, walls and fences, to such very subjective topics as color and fragrance. The columns about plants have ranged from trees to ground covers, spring bulbs to vines. Perennials have been an important subject; their culture and maintenance, seasonal color, the value of foliage, and the succession of bloom are only a few of the topics I have explored.

While these topics are useful tools in creating a garden, probably the most important advice I could give any new or experienced gardener would be, "Don't be afraid to experiment." The best gardeners I know, those whose gardens are a rich and spontaneous expression of their unique personal styles, have acquired a good bit of knowledge about plant culture and the many varieties available, but more important, they delight in exploring their own ideas.

Any garden, large or small, is also a great teacher. If we are willing to be receptive, we'll learn any number of useful human

virtues: patience, flexibility, honesty, and the ability to gracefully relinquish preconceived ideas, to name only a few.

There have been many times when I have drawn a design and specified certain plants through visualizing the finished effect of seasonal combinations of foliage, flower color, texture, and form. And while I've tried like some mad computer to take absolutely everything about the site and soil conditions into consideration, a small percentage of plants will simply fail, while others will thrive, self-sow, and delight in their new home.

One woodland walk immediately comes to mind. Here, within a framework of native trees and shrubs, I planned drifts of yellow and white *Aquilegia*, *Polygonatum odoratum* 'Variegatum', *Tiarella cordifolia*, ferns, and *Lobelia Cardinalis* and *L. siphilitica* for late summer color. At the end of the first year, the *Tiarella cordifolia* had all but disappeared on the left side of the walk, but on the right side were happily thriving. Probably half the *Aquilegia* failed to come through the winter, but the remaining clumps grew quite large, and this year I noticed hundreds of seedlings. After three years, the *Polygonatum* seems to be barely holding its own, while the *Lobelia* species are wintering well and blooming prolifically.

At this stage of the garden's development there are a couple of different approaches I might take. I could stick slavishly to the plan and with a great deal of effort rework the soil, replant the *Polygonatum*, buy more *Aquilegia* of the right colors, and replant them. Instead, I have decided to work with the garden, listening to what it is obviously trying to tell me. A good percentage of those self-sown *Aquilegia* will become a major feature in late May and June, and because the *Lobelia* species are doing so well, they will be an

Achillea and *Sedum* create a harmonious color combination in this cottage garden, but the spontaneity of such an effect may take years of careful attention to achieve.

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THE DESIGN PAGE

important feature for the end of the summer.

Originally envisioned as low maintenance, this woodland garden has taken about three years to settle into its own rhythm, so I figured why fuss around with it? It is lovely and still in keeping with the character of the original plan, and the money and time saved can easily be put to better use in another area of the garden.

The creation of a good garden or landscape does not happen in a year or two; it can take decades, even a lifetime of developing and refining ideas. Along with patience and long-range vision, good gardening demands a gardener with an objective and critical eye, someone who is not afraid to make changes and can step back from what has been created and say, "Heavens, that is the worst-looking mess!" then get out there with pitchfork and trowel and give it another go.

It also takes courage, but of a different sort, to recognize the beginning of a great idea and take it slowly, often laboriously, through its many stages of development, ending with something that looks uncontrived, spontaneous, and honest.

At some point in the development of a garden, particularly in the conceptualization and development of an overall landscape plan, it certainly is not cheating to solicit some help from a design professional. While your knowledge of plants may be extensive and backed by years of experience, sometimes even the most experienced gardeners have difficulty visualizing a garden's possibilities, especially with all the terraces, steps, paths, and levels that are necessary to make smooth and logical transitions between house and landscape. In rethinking an existing landscape, sometimes all that is needed is the objective eye of someone who is looking at the trees and shrubs for the first time.

If you do call in a design consultant, tell this person what you want but also mention all those ideas that have been knocking around in the back of your mind. A skilled and sensitive professional will help you sort out the impractical and build on the rest. Even if your ideas are not fully formed or seem slightly ridiculous, share them anyway, for after all it is *your* garden, and the chances are that you will be surprised and delighted with what you create.

—Margaret Hensel

Margaret Hensel, a landscape designer and consultant, lives in the Berkshires in western Massachusetts.

Ladyslippers to Grow on Your Windowsills

As I watered my plants one morning, I was thrilled to discover a flower bud on a plant I had purchased in England eighteen months earlier. This plant had been sprayed with insecticide, removed from its pot, and mailed bare-rooted from England to John F. Kennedy Airport in New York. There it sat for more than two weeks, waiting to clear customs and agricultural inspection. It finally arrived in my hometown post office on the Fourth of July and might have had to languish yet one day more in its dark box had not the postal worker on holiday duty been a fellow gardener. He telephoned me at once to come get the plant.

Eighteen months did not seem to be an excessively long recovery period for a plant subjected to such rough treatment. I checked again to be sure that what I had seen was not a new leaf. No, a leaf tip would have been thin. This was fat, a fat little bud which, if all went well, would become an elegant ladyslipper blossom.

The lovely ladyslipper orchids of the North American woods are both a joy and a bane to gardeners. These showy plants of the genus *Cypripedium*, also called pouch or moccasin flowers, are notoriously difficult to transplant and maintain in cultivation. Their tropical southeast Asian cousins, once classified as cypripediums but now placed by taxonomists in the genus *Paphiopedilum*, are much easier to grow. The plant I purchased in England is a hybrid of paphiopedilum. If some attention is given to paphs' special needs, they make excellent houseplants and will bloom reliably every year. Individual flowers last from one to three months on the plant and nearly as long when cut for flower arrangements.

Many orchid plants look impressive only when in flower. This is not true of paphiopedilums, which have attractive leaves as well as exotic blossoms. A number of varieties have leaves which are beautifully mottled with several shades of green.

The tip of paphiopedilum flowers has



This striking example of *Paphiopedilum mitylene* boasts both a showy blossom and the attractive foliage characteristic of this genus. Paphs are much easier to grow than their cousins, the ladyslipper orchids of the North American woods.



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THE INDOOR GARDENER

been modified into the pouch or slipper-shaped structure which gives the plants their common name. In most species and hybrids the pouch is smooth and glossy, almost waxy in appearance. The sepals and petals of some varieties also appear waxy, so that the flowers look artificial. In other varieties, the petals may be covered with warts or hairs, or both. Some species have thin petals much longer than the other flower parts, fancifully twisted to resemble handlebar mustaches or corkscrews.

Asian ladyslippers, whose flowers are from two to nine inches wide, come in every color but blue. Although many species are a combination of green, white, and maroon, others are red, rust, rose, orange, tan, yellow or a wine color so deep it appears to be black. The colors may be subtly brushed on the flowers or boldly arranged in spots and stripes. Flowers are usually borne singly on stems ranging from a few inches to a foot and a half tall. A few species carry two to four flowers per stem; some have only one flower open at a time but keep making new buds at the end of the stem so that they are almost always in bloom. The only thing the flowers lack is fragrance.

Some paphiopedilums are much easier to grow and flower than others; it is these you should try if you don't have a greenhouse. The large, round-flowered waxy hybrids derived from *Paphiopedilum insignis* and a few other species are very easy to grow. The species *P. hirsutissimum*, whose hairy green and brown flowers have fat rose or lavender petal tips, will quickly grow into a clump with several mature plants, each of which produces a short-stemmed flower. Another very easy species to cultivate is *P. sukhaluii*, a mottled-leaf variety with green and white striped flowers whose pointed petals are spotted dark maroon and held nearly horizontally. It seems unbelievable that this showy species was discovered in Thailand as recently as 1964! It has been much used in hybridizing, and the hybrids made from it seem to share its ease of culture.

Paphiopedilum hennisianum, *P. argus*, and *P. urbanianum*, which were also discovered quite recently, are all easily grown and have green, maroon, and white flowers and mottled leaves. The plants grow fairly rapidly and bloom reliably for me every year. *P. tonsum*, also an easy grower, has very shiny, greenish-tan blossoms with warts on the petals.

A few easily grown paphs are curious

rather than beautiful. *Paphiopedilum appletonianum* is one of these. Its small green flowers are narrow and have pink petal tips. Flowerheads are carried on top of stems that seem oversized in comparison. Its leaves are mottled. *P. appletonianum* is an oddity, but it is a very reliable bloomer.

If attention is given to paphs' special needs, they make excellent houseplants and will bloom every year.

One of the loveliest orchid hybrids, with green and white striped flowers and mottled leaves, is *Paphiopedilum X Maudiae*, first made from a cross between the alba (colorless) forms of *P. callosum* 'Sanderae' and *P. lawrenceanum* 'Hyeantum'. (The cross was made later between the normally colored forms of those species. The resulting purple-striped hybrids are designated "coloratum" to distinguish them from the more popular green-striped ones.) Many orchid culture books call *P. X Maudiae* a beginner's orchid because it is supposedly easy to grow. From my experience, this is not an easy paph and should be tried only after you have been successful in growing some of the plants recommended above. I have tried to grow it several times. Not only have the plants failed to bloom, but they have gotten smaller from year to year until they disappeared altogether!

Another group of paphiopedilums that I do not recommend for beginners includes the species *P. bellatulum*, *P. concolor*, *P. godefroyae*, *P. niveum*, and especially *P. delenatii*. These are diminutive plants with mottled foliage and beautiful, round flowers in shades of yellow, pink or white that seem to have very special requirements. If you are charmed by them, as I have been, I suggest that you try hybrids between these and some of the easier to grow species or hybrids.

The best way to begin growing paphiopedilums is to visit a flower show or orchid nursery and purchase a mature plant in bloom. You not only will know what the flowers look like, but that the plant is free

Continued on page 32



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The Pepper Family

From ancient times, pepper had such value in the commerce of the Old World that it was one of the treasures sought by explorers who, in looking for the Spice Islands, found the New World. There they found plants with a peppery taste and called them peppers. But those plants were not true peppers: botanically, they were quite different. The New World peppers, capsicums or red peppers, are of the potato family, *Solanaceae*. True peppers belong to the pepper family, *Piperaceae*, the vine peppers of the Far East, and are the subject of this column.

The genus *Piper*, from which the family name is derived, consists of a thousand or more species of shrubby, treelike, or climbing plants with a pungent odor, widely distributed in tropical and subtropical regions of Asia and the South Pacific. Their often ornamental alternate leaves are simple, with flowers arising opposite the leaves. These flowers, without sepals or petals but subtended by leaflike bracts, are extremely small and densely clustered on a spike. One-seeded fruits (berries) are produced on the spike. The most prominent member of the pepper family, *Piper nigrum*, is a



One of the Western world's earliest spices was the fruit of *Piper nigrum*, which gives us both black and white pepper.

Anita Sabarese



ABOVE: *Peperomia Sandersii* is very popular as a houseplant; it is sometimes listed as *P. argyreia*. RIGHT: *P. ariseoargentea*, a species from Brazil, is an ornamental peperomia that closely resembles a small heartleaf philodendron.

vine from the tropical forests of monsoon regions of Asia, whose fruit—the peppercorn—was one of the earliest spices known. From the days of the ancient Greeks and Romans, peppercorns were a caravan import to Europe by overland trade routes between India and Europe. They have been used for barter, tribute, and ransom. In the Middle Ages, Venice and Genoa were the centers of distribution; their monopoly of the trade prompted the Western traders' search for a sea route to the Far East.

Black pepper is grown today throughout the East Indies and the islands of the South Pacific and India, and has been introduced into tropical areas of Africa and the Western Hemisphere. In suitably warm, wet climates of the tropics, the dark green leaves and hanging strings of berries are trained on concrete posts or in the shade trees of coffee plantations.

Piper nigrum gives us both black and white pepper. The berries are first green and then, when ripe, bright orange-red. Collected berries are immersed in boiling water for ten minutes, which turns them black, and are then spread on mats to dry for three or four days. The black pepper of commerce is the finely ground fruit of *P. nigrum*. When the skin and pulp are removed from the fruit and only the seeds are ground, white pepper is the result.

Pepper has become basic to cooking in most countries of the world. The many distinct varieties in the trade vary in aroma and pungency, size and color, and are often called after their place of origin. Pepper is best bought whole because the aroma of pepper is fugitive and also because ground pepper is easily adulterated. Peppercorns keep almost indefinitely.

Pepper berries contain the alkaloid piperine, which is a stimulant; when ingested it causes a flow of saliva and gastric juices and so is an aid to digestion. In this context pepper has had some limited uses in medicine.

Another species, *Piper methysticum*, has been under investigation for its possible drug content. This fascinating member of the pepper family from the Fiji Islands is used by natives to prepare Kawa Kawa, a drink identified in some references as “the national beverage of the Polynesians.” It is the most powerful soporific in existence. The plant was first scientifically described by a father and son team of botanists who accompanied Captain Cook on his second voyage to the South Seas in 1776. They were welcomed to the islands by the natives with libations which had a strange narcotic effect and witnessed the ceremonial preparation of Kawa Kawa from the macerated roots of *P. methysticum*.



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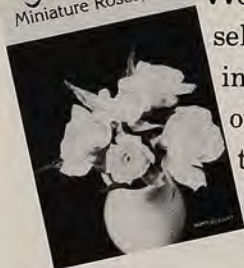
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STRANGE RELATIVES

Piper betle is a shrubby vine widely cultivated in southeast Asia for use as a masticatory. Its fresh green leaves, called "pan," are chewed with slaked lime and betel nut (the fruit of *Areca catechu*) as a stimulant of sorts.

Another climbing shrub grown in the tropics of the Orient and the West Indies for its fruit is *P. cubeba*. The dried fruits are aromatic, with a taste that is pungent, acrid, and slightly bitter. Dried unripe fruits are medicinally important in some parts of the world. Most of the commercial supply of berries is shipped from Jakarta and Singapore. Cubeb camphor, a drug separated from the berries, was used in Europe as a spice from the eleventh century and as a diuretic from the beginning of the

nineteenth century. The berries have also been crushed and smoked in cigarettes for relief of catarrh and asthma. However, beneficial effects of cubebs are too uncertain to offset undesirable side effects, hence it has been replaced by more reliable remedies.

While vine peppers have value as food and medicine, another important branch of the family has aesthetic appeal, the peperomias. Peperomias differ basically from the shrubby, vining members of the genus *Piper* in being herbaceous, and are native to the Western Hemisphere as well as the Orient. On the basis of certain anatomical differences, they are segregated by some authorities as a separate family—*Peperomiaceae*. However, pepper family char-

SOME WELL-KNOWN ORNAMENTAL PEPEROMIAS

- *P. argyreia* - Watermelon Begonia; Watermelon Peperomia. (*P. sandersii*).

An excellent and very popular houseplant, this species is an herb six to ten inches high. Reddish petioles are attached near the center of the underside of the ovate leaf. Nine to eleven veins radiate from the base of the leaf. Dark green and silver zones alternate on the surface and resemble the marking on watermelon rind. Flower spikes grow three to five in a cluster.

- *P. caperata* - Emerald Ripple; Green Ripple; Little Fantasy.

This wrinkled-leaf species is a compact, tufted plant, six inches or more in height, with short stems. The glossy, dark green leaves, on reddish petioles, are strongly rippled or corrugated. It produces many spikes of white flowers on reddish stems six inches long.

- *P. ariscoargentea* - Platinum Peperomia; Silverleaf Peperomia; Ivy Peperomia.

This species from Brazil resembles a small heartleaf philodendron. It is a compact, tufted plant with very short stems. Moderately puckered leaves are glossy and gray to silvery cream above, darker along the depressed veins. Flower stalks are four to five inches long on reddish stems.

- *P. obtusifolia* - Ovalleaf Peperomia; Blunt-leaved Peperomia; Baby Rubberplant.

This prostrate plant from tropical America and south Florida has wrinkled reddish stems which root at the joints. The fleshy leaves taper at the base and are rounded and notched at the tip. Spikes are solitary or in pairs. Numerous cultivars of this species are available; a variegated form is most often seen. It has a long history in cultivation.

- *P. fraseri* - Flowering Peperomia.

This plant from Ecuador is the only peperomia that makes a fair flower display. It has a tuberous base and erect branched stems which grow to two feet tall. Stems, petioles, and flower stalks are red. Basal leaves, in a rosette, are very succulent. Stem leaves are in whorls of three to five in the lower part and opposite or alternate above and less succulent. White flower spikes are long-stalked, pyramidal panicles.

- *P. rubella*

A six-inch plant with hairy stems, erect and much-branched. Stems and petioles are crimson. Oval leaves in whorls of four, about half an inch long, are dark green, sometimes with netted pattern above and crimson beneath. Its slender spikes, either terminal or axillary, are one inch long.

acteristics are shared by the genus *Peperomia*: simple, entire leaves; minute flowers densely clustered on a spike; and tiny one-seeded berrylike fruits. About a thousand species make up this genus of low-growing perennial plants (the few annuals among them are not in cultivation). They are tropical and subtropical herbs, distributed mainly in North and South America and the West Indies. Several species are natives of Florida. In their jungle homes, many grow as epiphytes and others crawl and sprawl over stumps and roots on the jungle floor. Still others live an almost xerophytic life akin to that of succulent plants. To thrive, they require warm temperatures and high atmospheric humidity but little soil moisture. All are semisucculent with leaves that hold water in reserve.

The diversity of foliage of peperomias and the different forms in which the plants grow give each species its distinct character and charm. The variegated foliage of some species is especially attractive, as is the venation which lends pattern and color to the leaves of others. Fleshiness of leaves is common and the leaves of some varieties are fringed with hairs. The curious, slim-flowering spikes attract attention standing above the leaves.

There are many ornamentals, but one species of *Peperomia*, *P. vividaspica*, is cultivated for food rather than ornament. Leaves and stems of this epiphytic species are eaten uncooked in parts of Central and South America.

The word "pepper" is incorporated in the names of various plants other than those of *Piperaceae*. There are the hotly pungent capsicums and the red peppers previously mentioned. The spicy essential oils of *Mentha X piperita* account for its being called the peppermint. The whole plant of California peppertree, *Schinus molle*, is rich in volatile essential oils which smell very much like true pepper; in addition, the pendulous clusters of its fruit have some resemblance to the little fruits of *Piper nigrum*. The pleasantly pungent rootstock of *Dentaria* gives it the name pepperrout. And there are more!

But true pepper has an identity all its own in the plant kingdom, and we can appropriately acknowledge it when we use this ancient seasoning. Its ornamental relative—*Peperomia*—by its very name reminds us of their botanical kinship.

—Jane Steffey

Jane Steffey is an editorial advisor to *American Horticulturist*.

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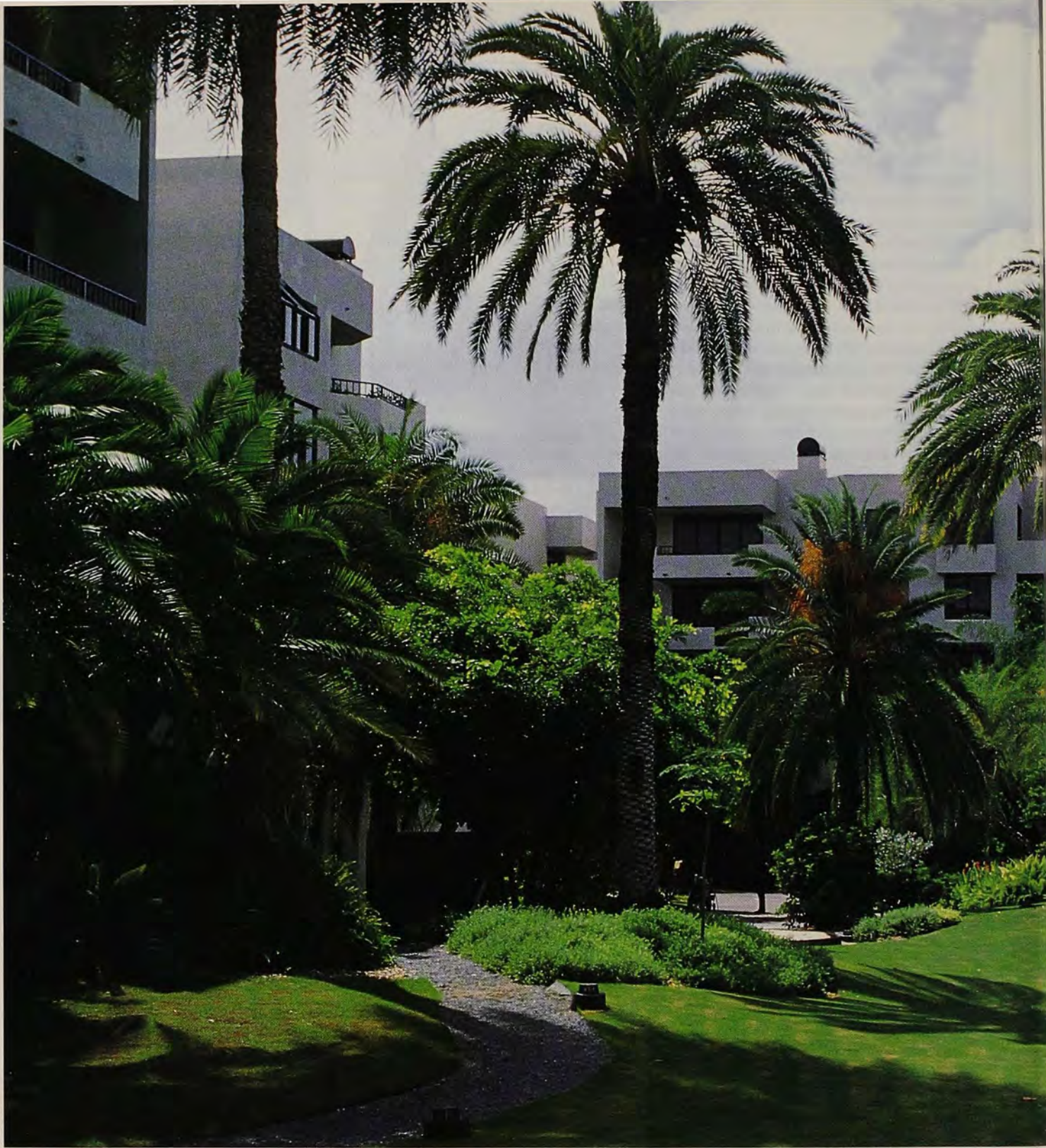
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Ron Oprzadek

Botanica *at Key Biscayne*



BY RUBY WEINBERG

Many a gardener has wondered what it would be like to live in a botanical garden. Few of us can create a garden so large and so varied that each day, as we walk outside, we can discover some extraordinary plant unfolding into a new phase of growth.

When Fritz Scharenberg decided to build residential housing in Key Biscayne, Florida, he planned a condominium project on forty-five acres called Key Colony. Although three areas were built in a fairly typical style, Scharenberg had a keen interest in horticulture and was inspired to plan the fourth differently. The twelve acres of landscaping were to include over five hundred species of tropical shrubs, trees, vines, and other exotic plants. He named it Botanica.

Scharenberg hoped that Botanica would appeal to homeowners who, for a variety of reasons, have found home and garden maintenance difficult or impossible. To some, not having a private garden is a particularly painful loss. Botanica's condominium owners would be more than compensated for such a loss by their surroundings.

Key Biscayne is a remarkable place. It is located on Florida's southeast coast about five miles below Miami. "Key" comes from the Spanish word *cayo*, meaning "little island." The string of keys that meander off this part of the Florida peninsula is connected to the mainland by bridges or causeways. But they are distinct ecosystems, barrier islands protected from climatic extremes by coral reefs and the Gulf Stream. While most of southern Florida is subtropical, below freezing winter temperatures are a sometime occurrence. The Keys, however, are truly tropical and can support plant and bird life that would not long survive in most of the continental United States.

The world's rain forests are quickly disappearing, and with them many species of tropical plants. Every fifteen minutes land clearers level a jungle area equal to the size of Central Park in New York City. It has been estimated that it would take up to a thousand years for the flora of these areas to regenerate if left undisturbed. Plant collections of rain forest species are thus becoming more precious. Whether or not developer Scharenberg realized it, even small botanical gardens such as Botanica may save a few species that might otherwise become extinct.

Botanica's plantings are selected to illustrate many kinds of exotica. From the climbing vine *Vanilla fragrans* (an orchid) to the epiphytic bromeliads perched in its tallest deciduous and evergreen trees, Botanica is a microcosm of tropical areas throughout the world.

In 1979, before developing Botanica, Scharenberg called in landscape architect



Ron Oprzadek to plan the gardens and coordinate them with construction of the buildings. A recipient of numerous awards for his innovative landscape designs, Oprzadek was put in charge of a landscaping budget of over \$2 million. The project was what most architects might have considered the ultimate opportunity, especially for a designer with a fine horticultural appreciation. But it was also a difficult job complicated by timetables, lack of space, and other logistical problems because the gardens had to be installed simultaneously with the condo construction. Throughout, heavy building equipment hampered ease of passage. Protecting rare trees and shrubs from damage was a difficult undertaking.

From the outset, the developer and the architect decided to plant ornamentals as mature specimens. Tall trees were needed to shield and shade understory plants from excessive sun and salt spray. Handling sizeable trees was not easy and timing was critical. On one occasion, forty-five large trees had to be planted in an hour and a half. Many others were lowered into their confined spaces by means of a helicopter. Merely trucking the trees to the site involved obstacles because of a narrow drawbridge. One magnificent forty-five-foot Queen's crape-myrtle lost most of its branches as it encountered obstructions at the tollbooth on the bridge. Fortunately, the tree recovered and is now one of the garden's most beautiful specimens.

As in all fine gardens, careful attention was given to soil preparation. Before man invaded Key Biscayne its sandy soils had been a hardwood hammock. Much of the land in southern Florida is low and swampy; hammocks are areas on higher ground supporting entire communities of plants, often carried in by birds or ocean currents from the Caribbean Islands. In 1910 the Key Biscayne hammock was cut down and planted as a nutrient-consuming coconut plantation; in more recent years it was a golf course. Soil replacement throughout Botanica was therefore of the highest priority.

Topsoil brought in from parts of Dade County in tandem trucks was augmented with quantities of peat from bogs in central Florida. Ron Oprzadek also supervised the salvage of soils retrieved from filled-in golf course ponds. Carefully dried and mixed with topsoil, this heavy soil proved excellent for new tree plantings. The many waterproof planters throughout the gardens required gravel bases with a lighter soil mix incorporating large amounts of peat and cypress sawdust.

Botanica's basic design consists of eight



Ron Oprzadek



Ron Oprzadek



Lani Provo

four-story buildings connected in a labyrinth. Every apartment has an outside deck with a view of part of the gardens. Homeowners are encouraged to grow seasonal flowers in deck planters equipped with automatic irrigation. A workroom and botanical library are available to residents.

Each cluster of buildings overlooks an interior atrium. The atria plantings were positioned over the parking garages to make effective use of available space. Corridors are rimmed with handrail planters from which plants gracefully cascade. These "spillover" plants are on three levels; the atria are lush gardens of plants, pools, and fountains.

FACING PAGE: Tall, slender palms, *Ptychosperma elegans*, are contrasted with *Neoveitchia storckii*, a Fiji Island solitaire palm, in front of the white buildings. TOP: *Ixora* 'Nora Grant' has brilliant flowers; it is just one example of the exotic flowering shrubs found throughout Botanica's grounds.

ABOVE, LEFT: *Pistia stratiotes* grows on the surface of Botanica's lagoon. ABOVE, RIGHT: Hawaiians make skirts from the leaves of *Cordyline terminalis*, known as the ti plant. Botanica provides an opportunity for visitors to see plants that they may previously have seen only in greenhouses or as house plants.

A series of hallways, ramps, steps, elevators, and coral and gravel pathways connect the entire garden and lead in and out of five lobbies, each with a special plant collection. There are also two ground level courtyards, Lagoon and Phoenix Court. Walking and bicycling trails twine around the gardens, each with an ecological theme: the Palmatum, the Sanctuary, the Mahogany Trail, and the Hammocks.

This complex design has been diagrammed by the architect in a book that is available to condo owners. Ron Oprzadek has divided the garden into a hundred observation stations; each area and its plantings are described in detail. Visitors may ask for tour guides to identify interesting plants. None are labeled, since Botanica was planned as an estate garden rather than an arboretum.

My first view of Botanica unfolded as an elevator took me from the parking garage to the fourth story. On the rim of a four-sided corridor, I observed plants hanging out and over the atrium. As Scharenberg put it: "Foliage hangs like embroidery." The white stucco walls are enhanced with the purple blooms of *Lantana montevidensis*, the rosy flowers of *Hibiscus* 'LaFrance', the red tubes of *Russelia equisetiformis* (coral plant), the powder blue of *Plumbago auriculata*, or the ever-blooming yellow of *Allamanda cathartica*. Some, such as the hibiscus, are uprights that have been pruned into trailing forms. Two plants not usually seen as cascaders

are *Schefflera arbuticola* and *Ligustrum sinense* 'variegatum', the Chinese privet. The latter appears all white in the sunshine and provides a splendid contrast to the surrounding greenery.

To this northern gardener, a palm tree had been the romantic symbol of the tropics, and one palm was much like another. After examining Botanica's extensive collection, I realized that palms are exceedingly diverse. Leaves can resemble fans, feathers, or fish tails, some smooth, some shaggy. Trunks vary from the fat to the slender. The *Balaka* of Samoa is tall and slim. (Samoan natives use them for spears.) Some palms have multiple trunks, still others are bottle-shaped. An oddity, a *Coccothrinax*, or old man's palm, has a trunk covered with beard-like fibers.

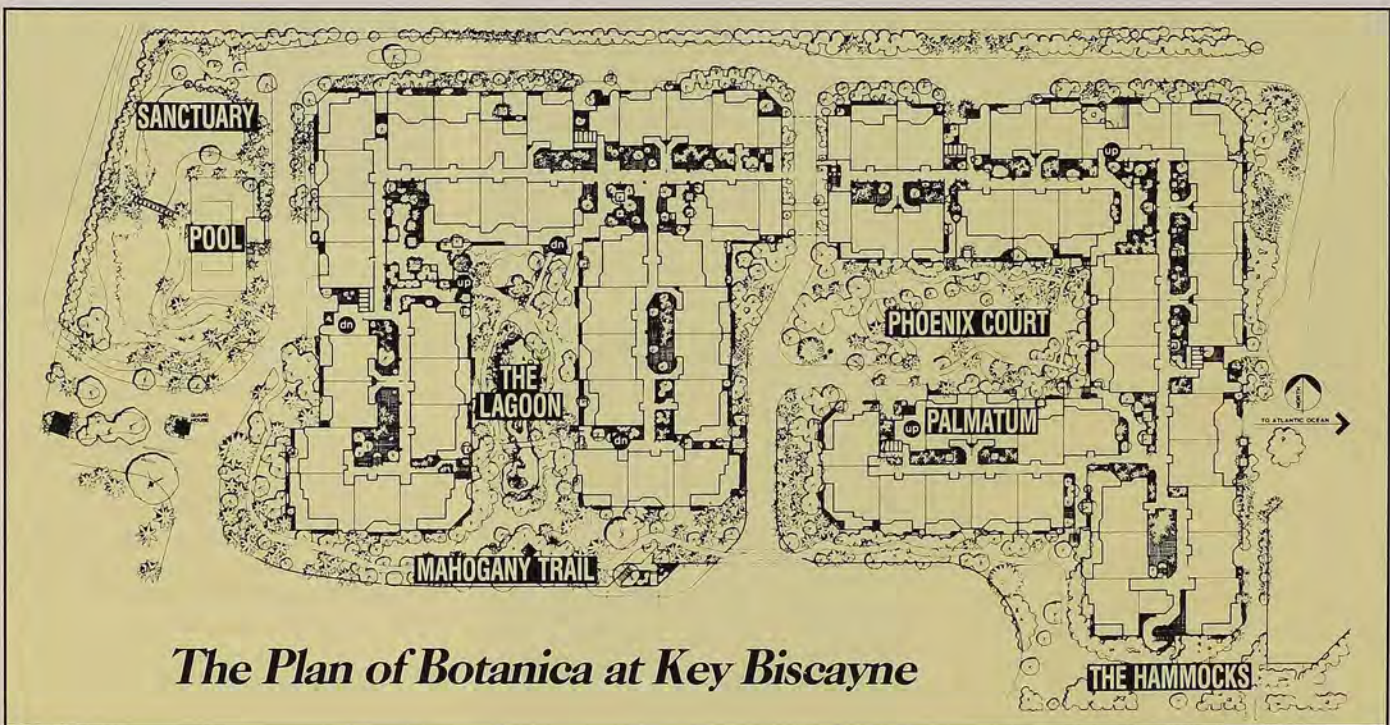
Various palms are scattered throughout Botanica, many displayed in the Phoenix Courtyard. Phoenix is the name of date palms, but in Florida's humidity this edible fruit is of poor quality. *Phoenix reclinata* has a special charm of its own; it is found on the edge of cliffs in Africa. It reclines and then snakes back to one side, so for a designer it has dramatic landscaping possibilities. Ron Oprzadek searched for unusual specimens of this tree. He located and transplanted one shortly before a bulldozer leveled the site for a fast food outlet. Another he discovered in a rundown area of Sarasota on the front lawn of a halfway house. The owner, a woman who cared for a dozen foster children, was overjoyed when she was told that she would receive a substantial sum of money for her tree.

Other unusual palms include *Caryota ochlandra*, the Canton fishtail palm, one of the few of its kind outside of China; *Archontophoenix*, a rare palm from Queensland, Australia; and *Chamaedorea tuerckheimii* from Costa Rica. The latter, called the potato chip palm because of the shape of its leaves, grows only an inch or two per year.

One palm is, at the moment, only a seed. But what a seed—the largest in the world! It is the rare Coco-de-mer, described in detail in David Attenborough's book, *The Living Planet*. The enormous nut looks like two coconuts joined together. Because it is filled with hard flesh, it floats below the surface when it falls into the ocean. Thus submerged, salt water kills it. For hundreds of years, sterile nuts were washed up on the shores of the Indian Ocean—hence its name Coconut-of-the-sea—but not until the eighteenth century did man discover the home of these huge trees—the Seychelle Islands.

A viable Coco-de-mer takes two years to germinate. Botanica's was brought to Oprzadek by a U.S. agricultural agent. It will remain half-buried in gravelly sand until it shows signs of life. It is hoped that a successful attempt to germinate the nut will increase the tree's restricted habitat.

Botanica's gardeners, like plantsmen everywhere, have had some disappointments. Not long ago, a curious form of *Arecastrum romanzoffianum*, the queen's palm, was carefully planted. This tree has grown as a three-crowned specimen, rare in nature. Unfortunately, hurricane-force



The Plan of Botanica at Key Biscayne

winds toppled all three crowns, destroying the treasured specimen.

Ron Oprzadek is particularly interested in cycads. There is a collection of these in both Phoenix Court and the Mahogany Trail. Cycads, probably the food of herbivorous dinosaurs, existed 225 million years ago. (See article on page 27.) Cycad branches and leaves have characteristics of ferns, palms, and pines. The cones are usually quite decorative. *Zamia furfuracea* (same as *Z. pumila*) has a large female cone with bright red, bean-like seeds. But *Encephalartos villosus* has a large male cone, yellow in color, also filled with red seeds!

Throughout Botanica, flowering trees are used as dramatic accents. Almost every tropical area of the world is represented; *Bombax ceiba*, the kapok from India; *Cochlospermum vitifolium*, the buttercup tree from Central and South America; *Brachychiton acerifolius*, the Australian flame tree; and *Syzigium jambos*, Malaya's rose apple. Bauhinias, though common in Florida landscapes, are among my own favorites, especially *Bauhinia variegata*, the orchid tree, in bloom from January to May.

Botanica's kapok tree was difficult to obtain. In spring, kapoks bear magnificent red flowers, followed later by fruits filled with silky white seeds that are carried miles by the wind. Curiously enough, even in the hands of experienced horticulturists the seeds are difficult to germinate. Cuttings, too, root with difficulty. Ron Oprzadek found a large tree in Boynton Beach, the property of a retired couple who previously ran a nursery. The nurseryman had tossed prunings from the tree onto his compost heap. One, a two-foot log, had started to grow. Over a period of time, Botanica's gardeners root-pruned the log until it was ready to be moved. The tree has been brought to Botanica where it is now growing beautifully.

Northerners seeking exotics for their solariums and greenhouses will find many interesting flowering shrubs throughout the development. Some are improved cultivars of familiar tropicals such as the brilliant hybrids *Ixora* 'Nora Grant', 'Super King', and 'Maui'. *Clerodendrum* is often grown under glass, but I had never before seen *Clerodendrum speciosissimum*, the glory-bower. Its foliage has a white cast and its red flowers are distinctly showy. A few other perennials, used as understory plants here, have possibilities as northern

Phoenix canariensis, a date palm, graces the entrance to the Palmatum Lobby. Each of the gardens has a particular ecological theme; the Palmatum contains *Balaka* of Samoa and *Coccothrinax*, or old man's palm.



Ron Oprzadek



ABOVE: *Lantana montevidensis*, or weeping lantana, cascades from a handrail planter. Lantanas, natives of South America, grow wild in parts of Florida. ABOVE, RIGHT: A species of *Calyptrogyne*, an Australian swamp palm. BELOW, LEFT: *Dioon emvercottum*, a native Mexican cycad. BELOW, RIGHT: *Bombax ceiba*, India's kapok tree, is also called the silk cotton tree.

container plants. They include the ginger-like *Dichorisandra warscewicziana*, with purple flowers; the bat flower, *Tacca chantrieri*; and the Australian brush cherry, *Syzygium paniculatum*. The latter "down under" shrub has small, shiny leaves (red when young) with white flowers, followed by edible red fruit.

Many common house plants can be seen in their natural environment. To me, it was quite a shock to see the schefflera *Brassaia actinophylla* grown to full height as a landscape plant and topped with spikes that protrude high above it. The spikes bear fascinating clusters of red fruit.

Fruit, spice, and nut trees are used ornamentally. Pesticides, especially fungicides, keep the trees clean and attractive but are applied too heavily for consumption of the edible parts. Many fruit trees were placed around The Lagoon. The Lagoon is a free-form, manmade pond, shaped like a large and small pear with the narrow ends joined together. A bridge crosses at the narrows, and two falls of recirculated water create a naturalistic effect. Here, amid lush tropical foliage, three terraces of gravel, coral, and wood ties, connected with steps and paths, completely surround the shallow waters.

A sweet fragrance permeates the air around The Lagoon in autumn when the Chinese loquat, *Eriobotrya japonica*, blooms. Two of these evergreens face each other on the upper landing. The delicate flowers are followed by yellow fruit which ripens in midwinter.

Near a waterfall at The Lagoon is the

dwarf banana, *Musa rosea x velutina*. Bananas have colorful bracts rather than bright flowers and this hybrid's are hot pink. The fruit is small and yellow. A local hobbyist made the cross.

Also at this site is a little known African shrub called Miracle Fruit, *Synsepalum dulcificum*. Its tiny red fruit affects the taste buds in such a way that when an acidic fruit is consumed after the Miracle Fruit, it tastes sweet.

Ron Oprzadek revealed that of all the trees in the garden, the Brazilian jaboticata, *Myrciaria cauliflora*, is his favorite. It is a small evergreen located near The Lagoon bridge. Oprzadek searched for some time for this particular specimen because he wanted a mature tree. Jaboticatas must be at least ten years old to fruit. Ron finally discovered a twenty-five-year-old jaboticata in Delray Beach. The elderly couple who owned it were loath to part with it; only the fact that it would be displayed in a botanical garden persuaded them to give up their treasure. Jaboticatas, unlike most fruit trees, bear individual purple "grapes" on their trunks and stems. The tree is not easy to grow in southern Florida unless the soil around it is amended with iron and other missing elements. Jaboticatas are worth it, according to Oprzadek, because "the grapes" are utterly delectable. Raccoons think so, too, for wherever these animals are present, man seldom gets to harvest much of the fruit.

Behind Botanica's swimming pool is an area called The Sanctuary. At the entrance to this peaceful retreat is the lychee, *Litchi chinensis*, a spreading, moderate-sized tree. Chinese restaurants sometimes offer lychees as a dessert fruit. The nuts grow in clusters on the branches. When the thin, leathery shells turn red, the nuts are ready to be harvested. The fruits within are white and juicy.

The Sanctuary is so thickly planted that it is difficult to realize that just beyond the thirty-foot hedge is the busy thoroughfare, Crandon Boulevard. Nature-loving condo owners and visitors are undoubtedly drawn to this area because it is a wild bird refuge. Key Biscayne provides a habitat for northern migrating birds, West Indian species, and "exotics"—caged pets that have escaped from captivity. There are also permanent residents; Green or Great Blue Herons are often seen feeding in the shallow waters of The Sanctuary's pond. Frogs, turtles, iguanas, and herbivorous birds munch on aquatic plants.

The Hammocks is the last stop on Ron



Lani Provo



Ron Oprzadek



Joanna Pavia

Oprzadek's diagrammed tour. This area, centered by the new Hammocks Recreation Center, was landscaped with the intent of restoring vegetation originally found here and on the other Florida Keys. A hundred trees and shrubs were transplanted from a site in Key Largo that was being cleared. Moving them was a gamble for they had grown in a shallow topsoil consisting mostly of coral rock. Little or no soil clung to the roots, making successful transplantation difficult.

No other site here looked as leafless and forlorn as The Hammocks area when first planted, Oprzadek admits. But Botanica's gardeners were advised not to treat the planting in the same way as nursery-grown ornamentals. Fertilizer, water, and mulch were used sparingly to emulate natural conditions. Close setting of the trees protected the lower shrubs, and sporadic irrigation imitated the wet and dry seasons of the Keys. In a short period of time, the Hammock's trees and shrubs burst forth with new leaves and took on the appearance of a long-established, indigenous community. As a bonus, The Hammocks now requires the least amount of maintenance of all the gardens.

A few native nut- and spice-producing plants are located in The Hammocks. Jamaican caper, *Capparis cynophallophora*, is one of them. It is closely related to the southern European species of caper whose flower buds are used for the pickled condiment. Also at The Hammocks are two species of *Psychotria*, with berry-like fruit. The Conchs, the original inhabitants of the Florida Keys, used the berries for "wild coffee."

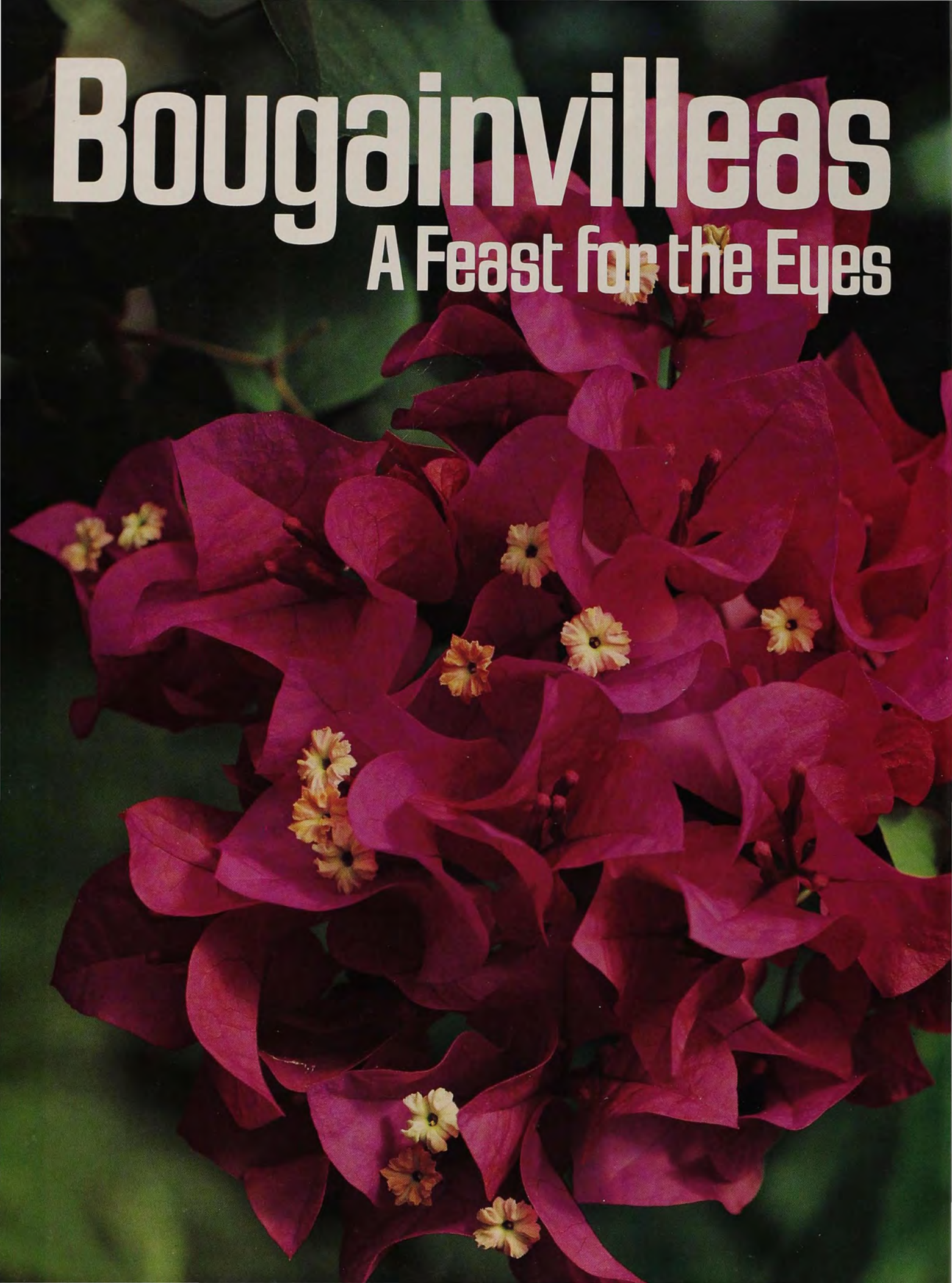
The gardens, the developer, and the architect have won some twenty awards. Oprzadek has visited botanical gardens and conservatories throughout the United States, contributing seedlings of rare tropical plants in a "Share the Wealth" program. Distribution of unusual ornamentals to those who can grow them will always be one of his goals.

As he says in his book, "The intent of the gardens is to be enjoyed by all who visit." Whether homeowners and visitors merely stroll through the gardens soaking in the spectacular scenery or spend time studying the plants, enjoyment is the key word. Few of us can travel, as David Attenborough did, to every tropical country in the world to see exotic flora. At Botanica the task has been made much easier. North Americans don't even need a passport to travel to southern Florida.

Ruby Weinberg is a gardener and writer living in Califon, New Jersey.

Bougainvilleas

A Feast for the Eyes



TEXT AND PHOTOGRAPHY BY
TOVAH MARTIN

One cannot escape the feeling of veneration associated with bougainvillea. Those paper-thin bracts attached precariously to roaming branches invite awe. Each floral cluster appears ephemerally fragile and daringly impossible to cultivate: we assume that what is delicate must be difficult. Bougainvilleas offer the gardener a challenge. This, of course, is part of their beauty.

In temperate regions, landscape designers employ the vine liberally for a splash of color. In tropical and semi-tropical regions, it is ubiquitous. In the northern United States, the cultivation of bougainvilleas is generally confined to the windowsills and greenhouses of a few brave souls. So it is entirely possible that you have never seen that glorious vine of South America.

Bougainvilleas climb as sturdy, brittle-stemmed vines bearing sparse, dark green leaves. Each branch might be a rotund inch or more in diameter at its base, tapering gradually in its ascent. These clumsy branches bear thin, woody “thorns” which appear cumbersome when bare against the old wood, but they daintily carry the blossoms when new. The flowers themselves are long, tubular, and very insignificant. But each blossom is shielded by its attendant bract—and those bracts have won the bougainvillea its fame.

Bougainvillea is a member of the *Nyctaginaceae*, a family shared with the popular four o'clock (*Mirabilis jalapa*). However, the bougainvillea remains an aloof aristocratic relative. There is nothing common about such an exotic vine. The bracts are tissue paper thin and nearly translucent. An ever-changing triangle is formed, composed of the gracefully curved bracts gently camouflaging their flowers nestled within. It is art in nature.

Bougainvillea cultivars are all similar in appearance, and there are only three species of bougainvillea in popular cultivation. These three have become happily integrated until even the experts are reluctant to make claims concerning a hybrid's parentage. Most cultivars are the confused

offspring of *B. glabra*, *B. peruviana*, and *B. spectabilis*, sharing deceptively similar floral characteristics but gaining their diverse temperaments from a medley of sources. The only hybrid on which the lineage is a matter of general agreement is that of the magenta bougainvillea, *B. 'Crimson Lake'* (also known as *B. 'Mrs. Butt'*). The most widely grown bougainvillea, ‘Crimson Lake’ was probably the initial child of the union between *B. glabra* X *B. peruviana*. This duo has been so long in cultivation and is responsible for producing so many progeny that it has become known as *B. X Buttiana*.

The bougainvillea's gaudy bracts compensate for its modest blossoms. The shades of bougainvillea bracts run the gamut from riotous to reserved. Most common is the magenta, *B. 'Crimson Lake'*, which is planted profusely throughout the Southwest. But perhaps more worthy of recognition are the subtler hues such as salmon, yellow, pink, and luminous white. Many a gardener who is not normally a white flower aficionado will fall head over heels for the pearly white bougainvillea. That sensational floral display features pristine white bracts set off by a network of delicate green veins accentuated by the green and white tubular blossoms nestled deep within the cluster.

Bougainvillea cultivars possess the uncanny habit of changing color in mid-bloom. You might witness an umbel unfurling on its opening day and describe it as crimson. One week later, a visitor might view the same umbel and characterize the floral bracts as blush pink—and both observers might be correct. The bracts of all bougainvilleas tend to fade from their opening brilliance to a more subdued hue before dropping. On the other hand, an occasional hybrid might turn color completely in a matter of days. For example, *B. 'Camarillo Fiesta'* makes its debut as orange, but the bracts waver on the brink of pink throughout its display until they finally surrender and drop to the ground rose-tinted.

Other bougainvillea hybrids are adorned with unique dual coloration. *B. 'Mary Palmer'* produces neighboring umbels of both pure white and red bracts on the same vine. The harlequin effect is quite spectacular, even a bit bizarre.

Bougainvillea 'Camarillo Fiesta' is a quick-change artist: it begins its career with orange bracts which gradually change to rose.



Do bougainvilleas deserve their reputation as finicky plants to grow? Possibly so. But real gardeners never balk at a challenge.

Less predictable than the single bougainvilleas are the pigments in the multibracted hybrids. A multibracted bougainvillea bears no flowers at all, but exhibits a frilly cluster of many paper-thin bracts instead. The colors of these bracts tend to fade more noticeably in the doubles than their single counterparts. The floral bracts of the double varieties are smaller but more profuse. They lack the graceful majesty of a single bougainvillea but have a more festive appearance. The coloration of those multiple bracts is muted, with a hint of green evident toward the center of each cluster.

Variiegated bougainvilleas are attractive even when not in bloom. Many cultivars sport creamy markings throughout their foliage which resemble that of *B. 'Raspberry Ice'*, the most common variegated cultivar available. 'Raspberry Ice' has leaves which are sizeable and generously mottled with a milky edging and a hint of rose toward the midrib. Accented by the red floral bracts, the overall effect is unexcelled.

Perhaps the bougainvillea's prime attribute is its affection for our climate. The vine grows to greater perfection and produces a more glorious floral exhibition in this country than is possible in Britain. When the bougainvillea was first introduced into the glasshouses of England from South America in the mid-1800s, the vine was abandoned as worthless because it refused to blossom in Britain's foggy climate. However, in sunnier France the vine proved more obliging, and there its true virtues were discovered. Having redeemed itself in France, the plant was named for the French explorer who circumnavigated the globe in the 1760s, Louis Antoine de Bougainville.

Being a South American native, bougainvilleas enjoy basking in the radiant sun of our southern regions. However, they are not winter-hardy in areas where temperatures drop below freezing; they can be considered reliably hardy only in Zone 10. With special planning for their planting, this can be extended slightly into Zone 9. If temperatures do not drop below freezing for more than twelve hours in a region, then bougainvilleas can survive with a seasonal dormancy period. Many southerners report that *B. X Buttiana* is the most du-

erable of hybrids, and they further protect the vine with the use of heat-retaining walls.

B. 'Crimson Lake' (syn - *B. X Buttiana*) is found so extensively in the Southwest that the vine has become a tradition. Its bright bracts adorn whitewashed villas and complement crude adobe huts. Due to its stamina, *B. 'Crimson Lake'* is often used on concrete walls in desert regions where the temperatures exceed 100° F. by day but plummet suddenly at nightfall.

Bougainvilleas are also extremely popular in South Asia. In India they are a favorite ingredient in government-sponsored urban beautification projects, and Asian gardeners typically cultivate a diverse range of hybrids and display a broader spectrum of colors than we commonly find in this country. Asian plantings tend to be more imaginative. Hedges of breathtaking bougainvillea adorn the countryside and soften cityscapes throughout Asia.

Those of us dwelling in less moderate regions are tempted to cultivate bougainvilleas indoors. The bougainvillea is capable of choreographing an extravaganza far grander than the modest smattering of color which we are accustomed to producing in our greenhouses and on our windowsills. In summer, a bougainvillea puts on its most impressive show, but during the winter we most appreciate its efforts. Suddenly it is possible to endure three more months of winter and another foot of snow.

Growing bougainvilleas indoors requires the gardener to simulate a tropical environment. Even though bougainvilleas are not fussy plants (they do not require fiddling with pruning shears and soil mixes), they have climatic preferences, and they remain rather stubborn about compromising in the matter of atmospheric comfort. To meet this challenge there are three things to remember:

- All bougainvilleas require sun and the more generously that ingredient is furnished, the more enthusiastically the tropical vine performs. If the plant is grown on a windowsill, a southern exposure is

Bougainvillea 'Crimson Lake' is a top performer and is found draping walls and hill-sides throughout the world.





ideal if it is unencumbered by porch or tree shade. During the dark winter months it is absolutely essential to provide the vine with direct sun. A bay window facing south, but also receiving east and west light, is the best possible windowsill environment.

- Bougainvilleas do not flourish at temperatures below 63° F. They might silently endure a few cool nights, but a protest is inevitable if the chilly conditions persist. The first symptom of complaint is a tell-tale pink tinge to the foliage. This warning is followed rapidly by the decisive foliar drop, one leaf at a time. Bougainvilleas might survive, but they will stubbornly refuse to blossom or grow while being subjected to less than ideal conditions.

- Humidity is the third crucial factor. A bougainvillea's humidity requirements are not unreasonable, but it does insist on a relative humidity of at least 50 percent. Fortunately, this atmosphere can easily be created even in the driest home by the addition of pebble trays or a humidifier.

When choosing a bougainvillea cultivar for nurturing in your home or greenhouse, choose well, as few indoor environments can accommodate more than one specimen. But when you adopt a bougainvillea, it is likely to become a friend for life. The vine is noted for its longevity.

Since bougainvillea hybrids hail from such mixed parentage, their growth habits are a matter of great diversity. *B.* 'Crimson Lake' and *B.* 'Texas Dawn' (a pink bracted hybrid) are two of the most ambitious climbers in the genus. *B.* 'Barbara Karst' (with large pinkish-red bracts) does not grow as rapidly, but compensates with spectacular floral displays exhibited on fledgling vines. The more muted hues such as salmon, yellow, and white tend toward slower growth and less rampant coverage, while the multibracted bougainvilleas are almost dwarf in comparison to their single counterparts.

Multibracted bougainvilleas can be effectively cultivated in hanging baskets due to their lethargic growth rate and modest root room requirements. Bougainvillea baskets are created by winding the branches into an orb. If done well, the effect can be breathtaking. Be warned, however, that this is a difficult feat to master, and until the branches are thickly interwoven, be prepared to have only sparsely leaved, woody stems dangling before you at eye level.

Bougainvillea Harrisii variegated lends itself naturally to a hanging basket. This cultivar is gracefully scandent, and its small, cream-and-green leaves are adorned in

summer with profuse lilac blossoms, borne singly rather than in umbels. The thin but prolific stems fill out the basket ambitiously and produce a cascade of color unmatched by the upright varieties.

Most bougainvilleas prefer to be trellised, and this is one of the simpler methods of accommodating a roaming bougainvillea. The framework must be sturdy; thin plastic trellises will never hold the weight. Eventually a thick, wooden, three- to four-foot trellis will be necessary to hold the vine, so you might as well offer the sturdier support initially. Run the vine up to the top of the trellis, then begin to encourage it to the side, down and around. Side shoots will soon appear, and they can be woven to fill in the center, balancing out the floral display.

There are other methods of disciplining a bougainvillea. An overhead arbor is aesthetically satisfying and not a difficult feat to accomplish. Unfortunately, this is one of the more space- and time-consuming of growing methods. Years may elapse before the bougainvillea reaches the top of a greenhouse, and many more years will slip by before its branches can be effectively pleached to form an arbor. However, walking beneath a canopy of paper-thin flower bracts is quite a heady experience and one worth the investment in time.

Unless you are sculpting your specimen into a topiary or standard form, it is not essential to prune a bougainvillea. Keep in mind that the flowers are produced on the thick, older stems and they appear on tip growth only. If you remove all of your tips, you will have sacrificed that year's blossoms. So prune sparingly and cut off only thin, whip-like growth which is competing with the main stem. In this manner, you will be encouraging larger and more profuse floral umbels on the leading vine.

Watering is also not a difficult task to master. However, bougainvilleas have the disconcerting habit of fainting into a death-like wilt when watering is delayed a few hours later than scheduled. They also tend to lapse into an equally dramatic wilt when the sun reappears after a long absence. By remaining unfazed by a bougainvillea's melodramatics, you will be toughening the new growth and at the same time discouraging similar performances in the future. Pot-grown plants will require more water than vines sunk directly into the ground, but do not overwater, especially during the winter. Water your specimen

when it is dry, and do not overpot the plant.

A note here concerning the repotting of bougainvilleas might serve to prevent many heartaches. The watchword is "proceed with caution." The bougainvillea's roots are extremely brittle and precariously attached to the woody stem. Such roots are easily severed, and a mature bougainvillea specimen will rarely survive to form new roots following the accident. When repotting, take care not to wiggle the stem, and never handle the specimen by yanking at that stem. Also, be sure that your trellis is buried deeply in the soil. Many a top-heavy vine has suddenly fallen over, pulling the base free of its anchoring root system. Finally, keeping the soil firmed around the stem will prevent the vine from precarious and potentially disastrous wobbling.

Any good, rich soil will suffice for a bougainvillea, but bear in mind that a heavy soil is necessary to support the weighty top growth. Fertilizing should be undertaken in spring and summer when a bougainvillea enjoys its prime growing season. At that time, 20-20-20 (or any balanced fertilizer) is recommended and should be applied in dilution every three weeks.

Bougainvilleas are not pest prone. They can be the victims of red spider mite, but they are not a favorite host of that insect, and mites are rarely a problem. More prevalent are mealy bug infestations which occur between the crevices of the woody branches and the leaf axils. A swab of alcohol should do the trick in controlling this foe.

Consider the rewards—colored bracts dancing airily from wandering branches. And periodically those bracts fall lightly to the ground, strewn the floor with color. Single bougainvilleas are self-cleaning and send their spent bracts floating downward like colorful tissue paper confetti. If you find the residue objectionable, grow multibracted bougainvilleas; their spent bracts remain on the stem rather than dropping dramatically at your feet.

A final hint: the double bougainvillea makes an excellent cut flower, and bougainvillea bracts hold their color admirably for pressed flower arranging. With a little artistic skill, you can create new ways of displaying this flower's color and delicacy and add to your enjoyment of this species.

Tovah Martin, a frequent contributor to *American Horticulturist*, is the begonia specialist at Logee's Greenhouses in Danielson, Connecticut.

The Mystery of Flowering Plants



This reconstruction of an early Mesozoic landscape shows the dominance of cycads and conifers. It was at the end of this period and the beginning of the next—160 million years ago—that flowering plants emerged.

TEXT AND PHOTOGRAPHY BY
DR. GILBERT A. LEISMAN

Late in the "Age of Dinosaurs," perhaps 135-150 million years ago, the earth's climate grew warmer and wetter than in the preceding age. As the first birds appeared and small mammals prospered and diversified, the first flowering plants emerged. Within a brief span of geologic time—a few million years—these plants became botanically dominant, eclipsing more primitive classes.

Today there are some 250,000 known flowering species, ranging in size from the duckweed (a floating aquatic plant one-sixteenth inch in diameter) to the *Eucalyptus* (three hundred feet tall). From what ancestors did angiosperms (flowering plants) spring? Why did they spread so rapidly? What can paleobotany—the study of plant fossils—tell us about their evolution? Science can provide us with a wealth of information—and some answers—but intriguing questions remain. Our current estimate of the age of the earth is 4.5 billion years. We know very little of what this primitive earth was like. Probably it was hot; water was present but only in vaporous form. The atmosphere was hardly conducive to life, consisting of such toxic gases as ammonia, methane, and carbon dioxide. And there was *no* oxygen.

As the earth began to cool, vast areas of water covered its surface. Erosion of bare land carried large quantities of nutrients and minerals into the sea, building up a "primordial soup." From this primordial soup organic molecules arose and from these the forerunners of living cells.

The oldest identifiable organic fossils were discovered about seven years ago in western Australian rocks called stromatolites. These rocks have been dated at 3.5 billion years old. In appearance, the cells in the rocks resemble modern bacteria, as do later fossils of younger age from other localities. Somewhere along the way certain of the bacteria became photosynthetic, an event of great import, since a by-product of the process is oxygen, a gas required by all aerobic organisms. Within a short period of time, geologically speaking, many different groups of algae, all marine and photosynthetic, came into ex-



Cooksonia is the oldest known terrestrial, vascular plant.

istence. They grew in number and continued to add to the supply of oxygen in the atmosphere. Eventually a concentration of approximately 20 percent of oxygen made it possible for organisms to venture onto the land surface.

However, a low level of oxygen was only one of many problems. Protection against desiccation, anchorage and absorption, a conducting system, pores to allow oxygen to enter—all these and many, many more adaptations had to evolve. It does not take much imagination to realize that all these things could not have happened at once. There were doubtless many attempts to transcend these barriers, attempts of which we have no record, but eventually these most important evolutionary events in the history of the plant kingdom came to pass.

The oldest known terrestrial, vascular plant of which we have any record is *Cooksonia* of middle to upper Silurian age

(400 to 440 million years ago). It was an extremely simple plant, at least when compared to the complex plants of today. It had an upright stem, no leaves or roots, dichotomous branching, terminal sporangia, a conducting system, cuticle, and air pores (stomata).

All evidence points to the green algae as logical ancestors. All essential cellular details are the same. If we accept the premise that the simple green algae are ancestral to vascular plants, is *Cooksonia* really so primitive? Obviously it depends upon which end of the telescope you are looking through.

The next geological period, called the Devonian (350-410 million years ago), saw the more recent relatives of *Cooksonia* fan out over the landscape and evolve into more and more complex forms. It was a period of very rapid evolution (again from a geological standpoint); this is at least partially due to the variety of habitats and niches available. An aquatic habitat is fairly constant in all respects; a terrestrial habitat is considerably more variable, affording a multitude of areas and niches. With such variety available, and little if any competition, it is small wonder that many new categories of plants evolved to fill these vacancies. Every major group of plants, even the seed plants, came into existence. The only major group missing was the flowering plants, and they did not make their debut until much later.

Lycopods (club mosses), horsetails (scouring rushes), ferns, and gymnosperms (plants whose seeds lie naked in cones, e.g., conifers) all prospered, forming new families, genera and species, and preparing the way for the famous geological period, the Carboniferous (270-350 million years ago). The climate during the Carboniferous period was moist, warm, and uniform the year round, resulting in a very lush growth of vegetation and many marshy and swamp-like areas.

From this period come lycopods, numbering five genera, all diminutive in size. *Lycopodium*, still fairly widespread in New England and the only economically valuable plant in the group, is picked for Christmas decorations. Fossil lycopods were plentiful, large, and very tall. Three dif-

So far, botanists have been able to ascertain reasonable evolutionary pathways—ancestors and offspring—for most of the major groups of plants. A notable exception is the origin of the flowering plants.

ferent genera, all referred to as scale trees, grew up to one hundred fifty feet tall. They were called scale trees because they left leaf cushions and scars on the bark of the tree resembling fish scales.

Another large group of Carboniferous plants were the calamites, represented today by only one genus, *Equisetum*. None of the ten or twelve living species is more than a few feet high. The calamites of the Carboniferous age reached fifty or more feet.

Ferns were most common, and many of them were quite similar to those growing today. Tree ferns were especially common.

Gymnosperms were prominent, at least in certain areas. *Cordaites* was a very large and tall tree, growing to one hundred feet or more. It had long, strap-like leaves unlike those of other gymnosperms. Perhaps the most unusual group of gymnosperms were the seed ferns (pteridosperms). They had fern-like foliage but bore seeds and pollen organs.

Variations did exist in the swamp forest. For example, “coal balls” (see accompanying article) collected in Iowa and Kansas are almost completely dominated by cordaite fragments with few lycopods. Just the opposite prevails in Illinois coal balls. The reason for this variation is not known.

At the end of the Carboniferous period a sudden and dramatic change in climate occurred with devastating effect on the vegetation. The temperature became considerably colder and the precipitation level dropped. The swamp forests essentially disappeared, with only gymnosperms surviving. Xerophytic characteristics, already “pre-formed,” enabled them to survive other conditions. Not only did existing gymnosperms survive the next period, the Permian (225 to 270 million years ago), but two other families evolved as well, the cycadeoids and the cycads. The Triassic and Jurassic (135-225 million years ago) were the “age of the gymnosperms.”

Toward the end of the Jurassic the cli-

mate became warmer, wetter, and favorable for temperate and tropical vegetation. It was then, or more likely at the beginning of the Cretaceous (160 million years ago), that flowering plants emerged. Angiosperms, like gymnosperms, are seed plants, but their seeds are enclosed in an ovary, rather than exposed.

So far, botanists have been able to ascertain reasonable evolutionary pathways—ancestors and offspring—for most of the major groups of plants. A notable exception is the origin of the flowering plants. Over a century ago, Charles Darwin termed their origin an “abominable mystery.” New discoveries and new ideas and hypotheses have provided clues but no definite answer.

One problem is that classification of living angiosperms is based on reproductive structures: flowers and fruits. Fossil flowers and fruits are rare and, when found, seldom contribute to our picture of a primitive flowering plant.

The magnolia family is considered by many botanists to be among the most primitive of angiosperms. Some recent finds support this concept, but others do not. Various groups of plants have been proposed as ancestors to the angiosperms: seed ferns, cordaites, and cycadeoids among others. None satisfy all the requisites.

Regardless of its origin, once the flowering habit was firmly established, flowering plants began to fan out into new ecological areas and to establish new taxonomic categories. Why did angiosperms become dominant so rapidly? Was the climate more favorable to them? Was the genetic plasticity of the gymnosperms wearing out?

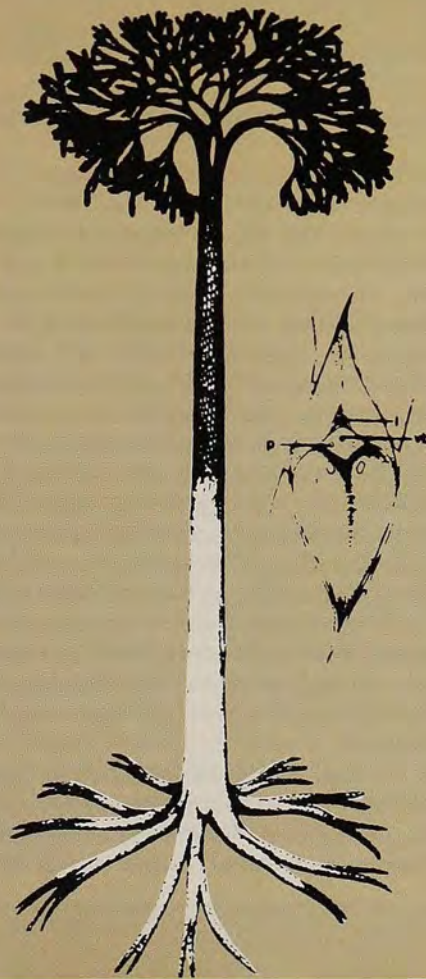
Gymnosperm plants are all woody and take many years to reproduce. Most angiosperms reproduce very rapidly, especially the herbaceous ones. Genetic adaptation, therefore, would logically proceed much faster than in the gymnosperms.

A most spectacular event was the co-evolution of multitudes of new flowers and new insects, each adapted to reproductively accommodate the other. A little logic makes this imperative: no bees, no flowers; no flowers, no bees.

Beetle pollination was probably one of the first methods of pollination and is still used by many flowers. The beetle is attracted by the very strong odor of the flower, frequently similar to rotting meat. If the flower is thick and fleshy, the beetle will often chew its way to the center of the flower to get to the pollen.

Bees have special mouth parts and body hairs for collecting pollen. The eye of the bee is quite different from ours. Ultraviolet is perceived as a distinct color while red becomes part of the background. As on the foxglove, the bee-pollinated flower often has special markings to lead the bee to a nectar gland and landing platforms with guidelines leading to the center of the flower.

Flowering plants dominate the landscape today, and we are completely dependent upon them for all our grains, fruits, and vegetables. Not only do they make life on this planet possible, they add immeasurably to its beauty—and leave eager botanists with yet another evolutionary mystery to solve.



Five genera of *Lycopodiaceae* were present at the beginning of the Carboniferous period.

Plant Fossils: Sermons in Stone

A paleobotanist is a scientist who searches for clues to the structure and evolution of ancient plants through their fossilized remains. Under the right conditions, the most fragile fern can leave an imprint legible to a paleobotanist millions of years after its brief life.

A fossil can be defined simply as any identifiable trace of an organism that lived in prehistoric times. Such "traces" are highly variable, be they plant or animal. The oldest plant fossils found to date are over three billion years old. Of the three basic types of rocks in the earth's mantle—igneous, metamorphic, and sedimentary—only sedimentary rocks are prime candidates for plant fossils. Sedimentary rocks include limestone, sandstone, siltstone, shale, and even coal and volcanic ash.

Fossilization occurs when sediment is rapidly deposited on an organism which is shielded from the normal activity of decomposer organisms by submergence in deep water, extreme alkalinity or acidity, or heavily charged mineral water allowing rapid infiltration. There are four types of fossils which may form in the sediment:

- **Impressions.** The simplest of the plant fossils is an impression. As the name implies, this is merely an imprint of an organism (or a part thereof) with no organic matter preserved. We have all probably seen imprints from falling leaves on a newly laid cement sidewalk. In essence, this is what fossil impressions are. One can ascertain such things as dimensions, general morphology, and venation patterns, but nothing of internal structure.

- **Compressions.** A very similar type of fossil is the compression, the only difference being the presence of organic matter. In leaf compressions, this organic matter is in the form of a black film which usually represents remnants of the cuticle, the most highly-resistant part of the leaf. By carefully applying several layers of clear nail polish (let dry in between), you can build up a clear coating that can be easily pulled off the specimen. If you are fortunate, the black organic film will come along with the coating and can be examined under the microscope. The size, shape, and orientation of epidermal cells, hairs, and stomata can be ascertained, and very often



TOP: An impression fossil of a seed fern leaf. BELOW LEFT: Ginkgo leaves in a compression fossil. RIGHT: Petrified cycadeoid stem from the Cretaceous period.

such information is of prime diagnostic value in identification.

- **Molds and Casts.** Impressions and compressions are most often formed from two-dimensional objects. Three-dimensional objects, such as branches, roots, cones, etc., often form molds and casts instead. The terms "mold" and "cast" mean exactly what they mean in art. For example, if a branch fell in an area of rapidly accumulating sediments, the sediments would quickly envelop the specimen and harden before the branch began to decay. Following decay, a cavity would be left in the hardened sediments—the mold. If the cavity became filled with additional sediments, these would form the cast. The cast is morphologically identical to the original branch but, of course, has no internal structure.

- **Petrification.** Internal preservation, for the most part, can be achieved only through permineralization, or petrification. The only exception is unaltered remains, such as are

occasionally found as wood specimens in glacial till. Permineralization can involve several different mineral compounds, but silica and limestone are the most common. Contrary to what many people believe, petrification usually does *not* involve molecule-by-molecule replacement of the organic matter by the mineral. Rather, the mineral (in solution) simply impregnates the specimen, leaving the organic matter relatively unmodified but now imbedded in mineral.

The Petrified Forest in Arizona consists of wood impregnated chiefly with silica. The beautiful colors of the wood, however, are not due to the silica, which is a rather bland tannish-gray in color, but rather to mineral "impurities" such as iron and aluminum compounds. To verify the exception to the rule on petrification, many of these beautiful pieces are of little scientific value since most of the organic cells and tissues have been totally replaced by mineral. In general, petrified wood that is dark

brown or almost black in color exhibits the best preservation.

Such wood is usually studied by thin-section techniques. These involve gluing a small piece of the wood to a microscope slide, grinding with carborundum powder (or something similar) until the wood is thin enough to transmit light, and then gluing on a cover slip for protection. If preservation is good, microscopic examination should reveal enough histological (cellular) detail to make identification possible.

Coal Balls

Limestone impregnation is most common in nodules called "coal balls." Most of the first nodules discovered in the coal fields of Europe in the 1800s were spherical, hence the name, coal ball. Almost without exception, coal balls are found in coal seams dating from the Carboniferous periods (270 to 350 million years ago). They are extremely important to a paleobotanist, since they contain permineralized plant fragments, often in a near-perfect state of preservation. Intracellular details, such as nuclei and plastids, are occasionally present, and there is one report of thread-like strands within a nucleus that look very much like chromosomes. And this is material over 300 million years in age!

Much of our fundamental knowledge of coal ball plants is due to the work of European paleobotanists in the 1800s and early 1900s. Coal balls were not recognized as such in North America until the 1920s, when they were spotted in the coal mines of Illinois. Subsequently, American coal ball paleobotany flourished. Coal balls have been found in many areas of the central and east-central United States, including Ohio, Kentucky, Indiana, Illinois, Iowa, Missouri, and Kansas.

The climate during the Carboniferous periods was very favorable for plant growth—uniformly warm and moist year-round as evidenced by the absence of annual rings in tree fossils. Such conditions favored vast areas of swamp forests, the organic debris of which formed our modern coal deposits. But what about coal balls? Where do they fit into the picture? Al-



Coal ball peel shows the longitudinal section of a scale tree cone.

though no one knows for sure how coal balls were formed, the presence of limestone strongly suggests a marine environment either close by or actually covering the organic litter. There is convincing evidence that during the Carboniferous period, a shallow ocean moved back and forth several times over the area which is now the central and east-central United States—precisely the area where we find coal balls.

The earliest technique for studying coal ball plant fragments was the same thin-section technique used for petrified wood. This resulted in beautiful slide preparations, but a great deal of the specimen itself was ground away in the process.

In 1928 a new technique was introduced that overcame this problem of wastage. After the coal ball has been sectioned with a diamond saw, the flat surfaces are "etched" with dilute hydrochloric acid. The acid dissolves a very thin layer of the embedding limestone and leaves the cell walls and other organic matter from the plant fragments projecting in very slight relief. A cellulose-based liquid is then poured onto the etched surface. After a twenty-four-hour drying period, the hardened cellulose film can be peeled from the surface, bringing along the organic projections which are now embedded in the peel. The film can be examined by conventional microscope techniques. If something of interest is observed, the surface can be re-etched and a new peel made. This re-etching and re-peeling can be repeated as often as desired, resulting in a sequence of serial peels of even tiny fragments.

The only disadvantages to this liquid cellulose technique are the long drying time and the necessity of positioning the etched

surface in a perfectly horizontal plane to avoid an unevenly thickened peel. Both of these were overcome by the acetate film technique (1956) in which a coal ball need only be approximately level. The peel would dry in less than two hours and would always be of uniform thickness.

What does a paleobotanist do besides wasting his time and making a lot of noise cutting coal balls? He is constantly on the lookout for new, undescribed specimens. He also looks for material imperfectly described before; in other words, better specimens. The ultimate goal is to put all these parts together into one plant. This is most often the hardest part of the job.

For those who are intrigued by paleobotany and would like to collect plant fossils for pleasure or study, here are a few suggestions: Make friends with a good fossil hunter, write to the State Geological Survey for suggestions, study museum specimens, visit the local college or university where you might find some old, eccentric paleobotanist like myself, or visit national parks and monuments where portions may be set aside as fossil sanctuaries.

Look along road cuts, especially new ones. When the Kansas Turnpike was first opened we found some beautiful fossil plants.

As a last resort, head for a local rock shop. That's what my wife does and it quickly depletes my wallet. Let me emphasize that this is a last resort!

Dr. Gilbert A. Leisman, a professor of biology at Emporia State University in Emporia, Kansas, contributes frequently to technical, scientific, and popular journals. He edits the Kansas Wildflower Society Newsletter.

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THE INDOOR GARDENER

Continued from page 8

blooming. Some orchids wait years after reaching apparent maturity before they finally bloom. However, once they have bloomed they usually continue to do so annually if they are well treated. Plants in bud or flower are more expensive than unbloomed plants, but for a beginner, they are worth the extra cost.

Light

Paphiopedilums will get adequate light if grown in an east- or west-facing window. East is preferable, as the leaves are less likely to be burned than in a west window. If you grow paphs in a south window, either put tissue paper across the glass to diffuse the light, or put them behind taller plants so that they are partially shaded. They need about a thousand foot-candles of light. Ladyslippers are also easily grown under fluorescent lights. They can take higher intensities of light under fluorescent tubes than on a windowsill, as the fluorescents will not burn the leaves unless the leaves actually touch the bulbs.

Humidity

Set the plants on trays of gravel or small pebbles, partially filled with water. The water level should be below the top of the gravel so that water never touches the bottom of the pots. This will help to provide necessary humidity, which ideally should be 40-50 percent. Misting the foliage will also help to increase the humidity. Be sure to do this in the morning so that the foliage has time to dry before nightfall. If you get water in the crown of the plant where the new leaves grow, or in the pouch of a flower, it will rot. If water accidentally gets into the crown, tip the plant so it runs out, or blow hard into the crown to force the water out.

Potting

Never pot paphs in soil. I have found that medium-grade fir bark is the best potting medium for my mature paphs. I use a mixture of medium- and fine-grade bark for most seedlings, but very small seedlings need fine-grade fir bark as they should stay somewhat wetter than larger plants. Provide good drainage at the bottom of the pot, using an inch or two of clay potsherds, styrofoam packing chips or marble-sized pebbles below the fir bark. Sometimes, when the plant I am potting has long roots, I put the roots all the way into the bottom of the pot and lay the drainage material over

them, then fill in around the rest of the roots with bark.

Ideally, paphiopedilums should be repotted every year, with all the old bark removed. If your plant is firmly attached to its pot, soak the pot for fifteen minutes, then try to remove the plant. Turn the pot upside down and bang the rim against a hard surface. If you are transplanting to a larger pot and are having difficulty removing the plant from its pot, you may have to slide a thin-bladed knife around the inside to sever the roots from the pot. If you will be repotting in the old pot and the roots do not shake free, it is not necessary to detach them, just be sure to remove and discard all the old medium. If the roots are clinging tightly to a few large pieces of bark or drainage material, these may be left attached. Tear off any old, decayed roots. Living roots are covered with fuzzy root hairs and have white or yellowish tips. Try not to damage these when repotting. Replace the drainage material in the bottom of the pot, and fill in around the roots with fresh fir bark until the bark comes up just barely half an inch above the base of the leaf fans. Tamp the pot on a firm surface to settle the bark, and add more bark if necessary to cover all the roots. Always water thoroughly after potting; then resume your normal watering schedule.

Pot your paphs in the smallest pot into which the roots will fit. If the plants have several mature fans of leaves and you would like to increase the number of plants rather than the size of the pots, grasp the bases of the fans just above the roots firmly in your hands and pull them apart. They will usually separate with minimal damage to the plant, each fan having its own set of roots. These may then be potted as individual plants.

Be sure to label each division with its name and the date it was repotted. If you are giving a division to a friend, give the plant a clonal name if it does not already have one. That way, as the plant gets divided and passed along to additional friends, everyone knows it is the same plant as your original. An example of a plant with a clonal name is *P. X Maudiae* 'Magnificum'. 'Magnificum' is the clonal name, which should always be offset by single quotation marks.

Watering

Correct watering is essential to growing paphiopedilums. The roots should be kept

slightly damp at all times. On the other hand, they must never be allowed to remain soggy, or they will rot. In their native rain forests, paphs live on steeply sloping hillsides. They receive frequent showers, but the steepness of the terrain prevents water from collecting around their roots. Be sure your pots have large drainage holes. Always water from the top, and never leave the pots standing in water. Remember that although the top of the fir bark is dry, the bark further down in the pot may still be moist. If in doubt, test for moisture by sticking your finger down into the pot. If you lift the pot daily, you will soon learn to judge moisture content by the weight of the pot.

How often should you water? Dr. Gustav Mehlquist, *professor emeritus* of horticulture at the University of Connecticut, a grower of superb paphiopedilums, is fond of recounting the following rule for watering orchids: If a cattleya appears to need watering, wait a week to water it. If a cymbidium appears to need watering, water it. If a paphiopedilum appears to need watering, you should have done it two days ago.

After a paphiopedilum has flowered, it is normal for the leaves on that fan to yellow and die in the course of the year or two after flowering. By this time, it should have initiated one or more new growths at the base of the old fan, so that there will be new leaves maturing as the old ones die. If an entire plant begins to pale and the leaves are shrivelled, suspect that the plant is not getting enough water. This could be either from underwatering or because the roots have rotted from overwatering or decayed potting medium.

If you suspect root damage, knock the plant out of its pot to examine the roots. If they are shrivelled or soggy, repot immediately in fresh bark and take special pains to see that the plant is well misted to make up for the water the plant can't get from its roots. It takes months of tender loving care to repair the damage caused by careless watering. Never be afraid to take a plant out of its pot to inspect the roots. If you are careful, you will not hurt the plant, and what you learn about the condition of the roots and potting medium may save its life. When I buy a new plant, I always repot it.

Air movement (highly desirable), temperature, humidity and the type of pot used will all determine how frequently you should water. I keep my plants in plastic

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Barry L. Wulff

One of the easiest species to cultivate, *Paphiopedilum hirsutissimum* is a good choice for the gardener who doesn't have a greenhouse.

pots so that they will not dry out too rapidly. Consequently, I need to water only once or twice a week. Clay pots permit constant evaporation of moisture out of the growing medium, so if your plants are in clay pots, you will need to water more frequently—perhaps daily. In cloudy weather, you will not need to water as often as during periods of sunshine. Adjust the frequency of watering to your growing conditions. When in doubt, it is better to err on the side of less water rather than more. The only exception to this rule is for plants in bud.

When a lady'slipper is in bud, it should be watered more often than usual as it needs the extra water for flower production. This is especially true for the waxy complex hybrids, which make huge blooms.

I had one which made buds year after year, only to have the buds dry up before opening. Since Dr. Mehlquist told me to water it, water it, and water it, I have had no problem getting the flowers to open. After the flowers have been fully open a few days, I resume my normal watering schedule, and the flowers last for months.

Feeding

Paphiopedilums do not require much fertilizer. Since the fir bark uses nitrogen as it decays, a 30-10-10 formulation will be necessary for your lady'slippers, but this should be applied at a quarter to half the dosage recommended by the manufacturer. Fertilize your plants twice a month during spring and summer and once a month during the shorter days of fall and

winter. Be sure to water thoroughly with plain water between fertilizings so that you wash out fertilizer salts which might accumulate in the fir bark and damage the roots.

Temperature

So you've bought a paphiopedilum, potted it in fir bark, watered and fertilized it properly, given it good humidity and adequate light, and it is growing beautifully. The leaves are large and firm and the roots are healthy. The only trouble is, you've lavished attention on this plant for more than a year and it won't bloom. What's wrong? In a word, temperature.

I bought my first paphiopedilum, a yellow *Paphiopedilum insigne* complex hybrid, in flower at the Philadelphia Flower Show in 1960. It somehow survived the dismal light and low humidity of my parents' house and the baking sun and low humidity of my college dormitory, although over the years it got smaller and smaller. When I acquired my own house, I put it on the windowsill on a pebble tray, read up on and put into practice proper potting and watering procedures, and the plant began to thrive. In a few years, it had filled a five inch pot with leaves, but there was never a bloom to be seen. Finally, in 1976, I told a nearby orchid grower who had hundreds of paphs blooming in his greenhouse about my healthy but flowerless plant. He told me to give it cold nights for a month and see what happened. I put the plant in a sunny window in our unheated basement, and the plant rewarded me with three flowers. Temperature made all the difference.

Daytime temperature is probably not as important a factor in paphiopedilum culture as some orchid books would lead one to believe. In general, the mottled-leaf paphs prefer somewhat warmer temperatures than most of the plain-leaf types, but a range of 65-85° F. suits them all just fine. If temperatures go higher than that for short periods, they will survive, but for extended periods of 90°+ F. temperatures it is very important that they have constant air movement and frequent misting to cool the leaves. I solve this problem by putting my plants outside for the summer on shelves in the shade of tall trees.

Summering the plants outdoors also solves the problem of dropping the night temperature enough to initiate flower buds. I leave the plants outdoors in the fall until night temperatures are consistently drop-

ping below 50° F., but I keep a careful eye on weather forecasts which might warn of frost. The plants can survive temperatures in the high thirties, but freezing temperatures will kill them.

According to some authorities, the cooler growing plain-leaved *Paphiopedilum* need night temperatures of 50 - 60° F. for two weeks to a month in order to set flower buds. The mottled-leaf kinds, and a few plain-leaved ones such as *Paphiopedilum hirsutissimum*, will set buds with night temperatures of 60 - 65° F. More important than a specific night temperature is the need for a difference between day and night temperatures of preferably ten degrees.

When a lady slipper has been grown in sufficiently cool night temperatures, a flower bud should appear in the center of each mature leaf fan. After the bud has emerged above the level of the leaves do not turn the plant. This could result in the flower's opening upside down! As the flower stem grows taller and leans toward the sun, insert a slender stake into the medium near the base of the fan, being careful not to damage the roots. Gently tie the stem to the stake so that the stem remains straight and the bud is supported by the stake. After the flower has been fully opened for several days, you may move the plant to display the flower. The cooler it is kept, the longer the flower will last.

Once your lady slipper flowers, the only complaint you may have is that the flower lasts so long you get tired of seeing it! The next step is to join an orchid society and learn how to grow orchids whose flowers don't last three months.

Articles, like plants, take time to grow. Since I began this one, the fat little bud on my English import, *Paphiopedilum mitylene*, has lived up to its promise. The flower is really a bonus; I bought the plant for its beautifully mottled leaves, knowing nothing of its background. If I had, I might not have bought it, for it is closely related to *P. X Maudiae*. However, now that I know I can keep a *Maudiae* relatively happy, maybe it is time to try growing *P. X Maudiae* again. After all, if some people call it a beginner's orchid, *Paphiopedilum X Maudiae* can't be all that difficult, can it?

—Ella May T. Wulff

Ella May T. Wulff, a freelance writer living in North Windham, Connecticut, has been growing orchids since 1976 and is the current president of the Connecticut Orchid Society.

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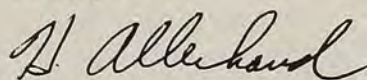
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Dracunculus Vulgaris

My Heirloom Plant

Some of us own what can only be termed "heirloom plants." Grown from cuttings, bulbs, and seeds that have been passed along from generation to generation, no one seems to know much about their origins. We keep them around for sentimental reasons, kindly remembering the folks who gave them to us. Some of the plants are real oddities—take my Devil's-tongue, for instance. It is an easy-to-grow plant adaptable to many areas and fascinating to watch as it develops.

An elderly neighbor who liked to collect out-of-the-ordinary plants gave my mother a "start" of Devil's-tongue back in the days of the Great Depression. Trading plants was then a pleasant diversion in a time of stress, a way of obtaining new plants without putting a strain on pocketbooks that were already well worn and short of cash.

My Devil's-tongue has been in the family ever since those lean days, but where our neighbor acquired it is anyone's guess. Many seasons have come and gone and hundreds of revisions have been made to plant catalogs, burying the original source in oblivion.

This much I do know—Devil's-tongue originated somewhere in the region of the Mediterranean. It is a member of the *Araceae*, or arum family, and is known as *Dracunculus vulgaris*. The arum family also includes some plants more familiar to us, such as the unique Jack-in-the-pulpit (*Arisaema triphyllum*)—that well-known native of America's rich, moist woods—and the lovely calla lily (*Zantedeschia aethiopica*). The latter has been developed for floral use and is grown commercially for cut flowers and potted plants. A number of years ago its cream colored, wax-like blossoms were very popular in bridal bouquets. It is doubtful, however, that the calla lily's kinsman, *Dracunculus vulgaris*, will ever attain the same distinction.

A practical man who leaned toward the more edible aspects of gardening, my father was not fond of the Devil's-tongue. (If one



If you have a taste for the unusual try *Dracunculus vulgaris*, or Devil's-tongue. This spectacular member of the arum family is sure to draw attention, both for its unusual blooms and for its prominent, long-lasting foliage.

gets downwind from it, the carrion-like odor will announce its presence.) Unfortunately for Daddy, the Devil's-tongue had been planted just outside the south fence of his vegetable garden in a spot where my mother liked to plant her colorful array of dahlias, perennial phlox, and zinnias.

My friends would look at the Devil's-tongue blossoms and hold their noses. "Ooh, look at all the flies!" "Phew, what a terrible smell!" Neighbors would drop by to view the curiosity. All stood at a respectful distance, moving around if the wind shifted.

Nothing detracted from the flourishing growth of the Devil's-tongue; it continued to grow and multiply, sending up more leafage and flowers as the years went by. Finally, there came a time when the house was to have new occupants, traumatic for plants if new owners are not plant-conscious but prefer a neat lawn, shade trees, and nothing more. That was the case, so I rescued the Devil's-tongue and some of its descendants (as well as other plants) and moved them to my own home. Not only is the Devil's-tongue a link to the past, but it is an outstanding—and beautiful—plant. As for the odor—well, hold your nose! There's no decree saying all flowers must smell like roses.

In early spring, while the weather is still quite chilly and mornings are tinted with frost, the Devil's-tongue pushes its way up through the earth, soon unfolding its tightly rolled green leaves streaked with white. As the plant grows, the leaves grow larger, until they are quite prominent. The foliage is an outstanding feature of this plant because the leaves are deeply cut, giving the appearance of having ten or more segments. The plants grow with surprising speed as the stout, straight stems—white, spotted with purple—continue their upward thrust, adding to their tropical appearance. At their maximum height, the plants are well over three feet tall and the flowers measure twenty inches or more in length.

Dracunculus vulgaris comes into bloom in mid-spring, with a flamboyant display of its royal colors—variations of deep red. When our neighbor gave my mother the Devil's-tongue, she stressed that it would be blooming in time for Mother's Day. Sure enough, in southwestern Arkansas the blooming period is in early May, usually centering around that celebrated day.

The flower-bearing stems are easily identified, as they are larger than the leaf stems. When the proper time comes, the closely wrapped, spotted spathe gradually rises from the center of a stem and unfolds its ruffled edges to reveal the beautiful, wine-red, velvety interior and the almost black spadix. The bloom is followed by a seedhead that matures into a cluster of orange-colored seeds resembling the seedhead of a Jack-in-the-pulpit, and as summer heat comes on, the whole plant dies down and goes into dormancy.

Devil's-tongue likes rich, well-drained, loamy soil with a pH factor of 6.0-8.0 but needs plenty of moisture to develop prop-

erly. It prefers semi-shade and does not tolerate heavy shade such as that underneath magnolias and live oaks. The flickering shade of mimosas or a place that catches only morning sun is ideal. If grouped with other plants, remember that Devil's-tongue is going to be gone by summer, creating a gap that must be filled with something else.

My plants are planted away from the house in their own spot next to a compost enclosure beside the vegetable garden. There they get the benefit of rich soil and partial shade, and their full-blown blossoms may be admired as long as one stands upwind from them. As attention-getters and conversation pieces, there is nothing else around that resembles them.

Devil's-tongue is an early riser, so tubers should be planted in the fall and spaced about fifteen inches apart—that is, if you live in the South. In our Zone 8, I plant the tubers three inches deep and they remain in the ground year-round. Dormant tubers have withstood temperatures down to 1°-10° F., with only moderate mulch. Infrequently, we have what is considered a severe winter for our area, when the ground will freeze an inch or so deep, but Devil's-tongue does not seem to suffer any damage. From this, it is fair to conclude that this is a fairly hardy plant and adaptable to many areas. But if you live where winters are consistently bitter and harsh, you should winter the tubers indoors, planting them outside again in early spring after the ground thaws and is workable.

This spectacular plant is also a novelty to grow in the greenhouse, but again, the odor must be considered. It is an ideal plant for large outdoor planters, as the tubers can be removed after they go into dormancy and the planters used for another flower that likes hot weather. Blossom odor is a determining factor in placing the planters, but *Dracunculus vulgaris* is well worth growing for its outstanding foliage alone. The leaves come up early in the season and are in evidence much longer than the flowers.

If you, too, are a connoisseur of the unusual, try growing the Devil's-tongue. It is easy to raise, and with a little TLC, you will be rewarded by its extraordinary beauty—not to mention the notoreity you'll receive.

—Alice B. Yeager

Alice B. Yeager, a freelance writer and artist, lives and gardens in Texarkana, Arkansas.

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1987 Index

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AUTHOR

Adams, Richard M., II. Careers in Horticulture, Part III. Feb., 25.
Barnes-Svarney, Patricia. S.U.N.Y. Greenhouse. Jun., 5.
Bonta, Marcia. Bowman's Hill State Wildflower Preserve. Apr., 23.
DeBlasi, Anthony. Growing Tuberous Begonias. Apr., 4.
Harmon, Stanley M. Liatris. Jun., 25.
Harper, Pamela. An Artist's Garden. Aug., 18.
Hensel, Margaret. Garden Illusions. Feb., 5; Garden Illustrations. Apr., 35; Garden Reflections. Dec., 5; Spring Bulbs. Oct., 42; The White Garden. Jun., 11; Woodland Gardens. Aug., 34.
Hillstrom, Judith E. Lycoris Magic. Aug., 44.
Hynes, Erin Monica. Public Gardens: Practical but Spectacular. Jun., 42.
Jackson, Faith. A Garden for Maryland. Aug., 26.
Leisman, Gilbert A. The Mystery of Flowering Plants. Dec., 27; Plant Fossils: Sermons in Stone. Dec., 30.
Loebel, JoAnn Schowalter. Flowers for Drying: Everlasting Perennials. Oct., 10.
Loewer, Peter. An Autumn Garden. Oct., 21; Tree and Shrub Suppliers. Feb., 8.
Lynch, Lynn M. Celebrating Sunflowers. Aug., 22.
Martin, Tovah. Bougainvilleas: A Feast for the Eyes. Dec., 22. Foliar Fragrance. Aug., 15.
Meerow, Alan. Hardy Palms. Apr., 26.
Miller, Lynden B. Miracle on 104th Street. Feb., 14.



Parke, Margaret. Botanical Prints. Jun., 18; Giverny. Apr., 17.
Reddell, Rayford. Choosing the Best Rose. Oct., 35.
Scott, Barbara. Blackberry Lilies. Aug., 10.
Sheldon, Elisabeth. Hardy Geraniums. Oct., 4; Jane Loudon: First Lady of Gardening. Jun., 15.
Steffey, Jane. The Basella Family. Apr., 14; Cacao Beans and Cola Nuts. Feb., 30; The Pepper Family. Dec., 10; The Phlox Family. Aug., 5.
Stone, Doris M. Longue Vue. Jun., 28.
Weinberg, Ruby. Botanica at Key Biscayne. Dec., 14.
White, Jane Baber. Restoration of a Poet's Garden. Oct., 27.
Wulff, Ella May T. Ladyslippers to Grow on your Windowsills. Dec., 7.
Yeager, Alice B. Dracunculus Vulgaris — My Heirloom Plant. Dec., 42.

SUBJECT/TITLE

Aromatic Foliage. Foliar Fragrance. Aug., 15.
Artist's Garden, An. Aug., 18.

Autumn Garden, An. Oct., 21.
Basella Family, The. Apr., 14.
Begonias, Tuberous. Growing Tuberous Begonias. Apr., 4.
Blackberry Lilies. Aug., 5.
Botanical Prints. Jun., 18.
Botanica at Key Biscayne. Dec., 14.
Bougainvilleas: A Feast for the Eyes. Dec., 22.
Bowman's Hill State Wildflower Preserve. Apr., 23.
Bulbs, Spring Bulbs. Oct., 42.
Cabbage, Ornamental. An Autumn Garden. Oct., 21.
Cacao Beans and Cola Nuts. Feb., 30.
Careers in Horticulture, Part III. Feb., 25.
Catalogue Review, A. Tree and Shrub Suppliers. Feb., 8.
Celebrating Sunflowers. Aug., 22.
Choosing the Best Rose. Oct., 35.
Design Page, The. Garden Illusions. Feb., 5. Garden Illustrations. Apr., 35. Garden Reflections. Dec., 5; Spring Bulbs. Oct., 42; The White Garden. Jun., 11; Woodland Gardens. Aug., 34.
Devil's-tongue. Dracunculus Vulgaris — My Heirloom Plant. Dec., 42.
Dracunculus Vulgaris — My Heirloom Plant. Dec., 42.
Dried Flowers. Everlasting Perennials. Oct., 10.
Educational Facilities. S.U.N.Y. Greenhouse. Jun., 5.
Employment in Horticulture. Careers in Horticulture, Part III. Feb., 25.
Everlasting Perennials. Oct., 10.
Foliar Fragrance. Aug., 15.
Fossil Plants. The Mystery of Flowering Plants. Dec., 27; Plant Fossils: Sermons in Stone. Dec., 30.
Garden for Maryland, A. Aug., 26.
Garden Hints. Choosing the Best Rose. Oct., 35.
Garden Illusions. Feb., 5.
Garden Illustrations. Apr., 35.
Garden Reflections. Dec., 5.
Gardens. An Artist's Garden. Aug., 18; An Autumn Garden. Oct., 21; Botanica at Key Biscayne. Dec., 14; A Garden for Maryland. Aug., 26; Giverny. Apr., 17; Longue Vue. Jun., 28; Miracle on 104th Street. Feb., 15; Restoration of a Poet's Garden. Oct., 27; Woodland Gardens., Aug., 34.
Gardens, France. Giverny. Apr., 17.
Giverny. Apr., 17.
Growing Tuberous Begonias. Apr., 14.
Hardy Geraniums. Oct., 4.
Hardy Palms. Apr., 26.

- Helianthus. Celebrating Sunflowers. Aug., 22.
- History of Gardening. Botanical Prints. Jun., 18; Jane Loudon, First Lady of Gardening. Jun., 15; Restoration of a Poet's Garden. Oct., 27.
- Horticultural Careers. Careers in Horticulture, Part III. Feb., 25.
- Horticultural Research Facilities. S.U.N.Y. Greenhouse. Jun., 5.
- How-To Guide, A. Growing Tuberous Begonias. Apr., 4.
- Indoor Gardening. Ladyslippers to Grow on Your Windowsills. Dec., 7.
- Jane Loudon: First Lady of Gardening. Jun., 15.
- John J. Tyler Arboretum, The. Oct., 15.
- Ladyslippers to Grow on Your Windowsills. Dec., 7.
- Liatris. Jun., 25.
- Linanthus. The Phlox Family. Aug., 5.
- Longue Vue. Jun., 28.
- Lycoris Magic. Aug., 44.
- Miracle on 104th Street. Feb., 14.
- Mystery of Flowering Plants, The. Dec., 27.
- New Plants for 1987. Feb., 18.
- Paleobotany. The Mystery of Flowering Plants. Dec., 27.
- Paphiopedilum. Ladyslippers to Grow on your Windowsills. Dec., 10.
- Pepper Family, The. Dec., 7.
- Perennials. Flowers for Drying: Everlasting Perennials. Oct., 10.
- Phlox Family, The. Aug., 5.
- Piperaceae. The Pepper Family. Dec., 10.
- Plant Collections. The John J. Tyler Arboretum. Oct., 15; S.U.N.Y. Greenhouse. Jun., 5.
- Plant Fossils: Sermons in Stone. Dec., 30.
- Plants for the Landscape. Blackberry Lilies. Aug., 10; Hardy Geraniums. Oct., 4.
- Polemonium. The Phlox Family. Aug., 5.
- Public Gardens: Practical But Spectacular. Jun., 42.
- Restoration of a Poet's Garden. Oct., 27.
- Roses. Choosing the Best Rose. Oct., 35.
- Seasonable Reminders: Lycoris Magic. Aug., 44.
- Spencer, Anne. Restoration of a Poet's Garden. Oct., 27.
- Spring Bulbs. Oct., 42.
- Strange Relatives. The Basella Family. Aug., 5; Cacao Beans and Cola Nuts. Feb., 30; The Pepper Family. Dec., 10; The Phlox Family. Aug., 5.
- Sunflowers. Celebrating Sunflowers. Aug., 22.
- S.U.N.Y. Greenhouse. Jun., 5.
- Theobroma. Cacao Beans and Cola Nuts. Feb., 30.
- Tree and Shrub Suppliers. Feb., 8.
- Tulips. Spring Bulbs. Oct., 42.
- White Garden, The. Jun., 11.
- Wildflower Preserves. Bowman's Hill State Wildflower Preserve. Apr., 23.
- Woodland Gardens. Aug., 34.



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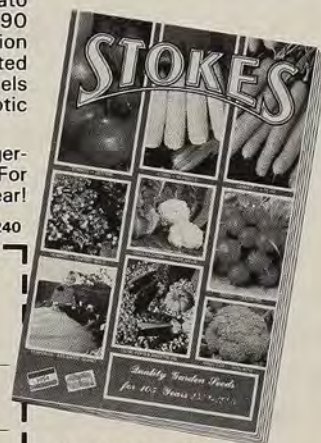
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