

June 1984

# American Horticulturist





# The AHS Garden Diary



*Our Garden Diary sold so well last year, we couldn't keep up with the demand. So if you didn't get your copy, here's another chance. Surprise your gardening friends with an unusual gift, or treat yourself and your garden to this useful record-keeper. Inside this lovely cover (laminated to prevent staining) we've included 96 ring-bound pages to record all sorts of garden information: cultural instructions for favorite plants, month-by-month events in the garden (enough space for three years' data), graph paper for drawing landscape and border designs, a blooming sequence chart to keep track of color in the garden from week to week; useful blank*

*pages for you to do with as you please. We've also provided a pocket to hold informative newsclippings or catalog information, tabs for handy, quick reference and a preprinted rule to make measuring flowers or seedlings easier.*

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# Contents



Researchers throughout the United States are trying to develop blackspot-resistant roses. Here, roses grow in the southern California fields of Jackson & Perkins, one of the country's major rose growers. In recent years, blackspot has become a major problem in this part of the country. For more information on the battle against blackspot, turn to page 14. Photograph courtesy of Jackson & Perkins.

**On the Cover:** Peonies, such as these delicate single pinks, are a feature of spring gardens across the country. In the south, they grace us with their blooms in May; farther north, in June. June also brings thoughts of mountain laurel, whose showy trusses light up eastern hillsides. For information on the exciting new cultivars of this great American plant, turn to page 5. June's warm days bring to light many less well-known inhabitants of our gardens. Read about spiders in the garden on page 31. Photograph by Pamela Harper.

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# The Fragility of Knowledge

When I first visited River Farm, I noticed the hundreds of books that sit, uncatalogued, on shelves all over the River Farm house. Some rare volumes lean gracefully on the shelves in the parlor, the oldest part of the house, patiently waiting to be read. Books of our own era are stacked everywhere. The effect is a homey one, and, though I knew the collection should be catalogued, it did not seem an urgent need, particularly since staff members had organized many of our most frequently used books.

Then, not long ago, I began to hear of books in the attics of the River Farm house and the nearby Carriage House. Apparently, the Society's move to its new River Farm headquarters from a rented office in 1973 had posed an enormous challenge: 26 acres of grounds that needed immediate attention, and one large house and several smaller buildings that had to be converted somehow into practical office and storage space. In the course of the adjustment, the thousands of volumes that are now in the attics became the victims of higher priorities.

Most of the older books in our collection were given to the Society by Harold B. Tukey, well known for his contributions in the field of horticultural science. But, because of lack of staffing and funds, these wonderful books have remained upstairs, uncatalogued and unused.

Looking at these long-untouched books recently, I felt a great sense of frustration; here at the hub of our national gardening organization are literally hundreds of years of knowledge stored in leather bindings, but for all intents and purposes, the information in them is inaccessible. In glancing through one box of treasure, I found several bound volumes of *The New York Farmer and Horticultural Repository*, covering the years 1830-33. The browning pages reflect a sense of the writers' pride and wonder in their new country, an immediate sense of the frontier we seem to have lost. The twentieth-century reader begins to understand what this vast new land meant to the horticultural world as he reads one correspondent's report: "Since the discovery of the New World, English

gardens have received 2,345 varieties of trees and plants from America . . . until the list of plants now cultivated in this country [England] exceeds 120,000 varieties." This modest number obviously created excitement among plant lovers.

Turning up another dusty volume, *The American Gardener's Calendar* by Bernard McMahon (Philadelphia, 1806), I read that the author sincerely hopes that garden-rocket (*Hesperis matronalis*) might some day "be found on this side of the Atlantic." This plant is now listed by *Hortus Third* as naturalized throughout this country. Mr. McMahon also lists over 50 plants to be collected in the American wild that are now commonly cultivated and actively hybridized.

From a quick glance at this treatise, we have an idea of how horticulture has changed in these 180 years, but we also see a common thread of puzzlement. Mr. McMahon speculates with wonder about the workings of *Mimosa pudica*, sensitive plant, and concludes that its leaves fold up when touched because it is a highly delicate plant, and that this reaction is akin to the fainting of animals. He finds this sensibility admirable. Although we, in our late twentieth-century sophistication, avoid anthropomorphizing plants and lean on sounder theories, we can share the frustration of thinking men through the ages as we read Mr. McMahon's inquiring essay: "The cause of this, seemed so hard to be discovered, that a curious Malabrian philosopher, upon his observing the nature of this plant, without being able to discover the cause of its sensibility, ran mad; just as Aristotle is said to have flung himself headlong into the sea, because he could not comprehend the reason of its ebbing and flowing."

The next page tells us that Venus's fly-trap closes its lobes over insects to protect itself against the creatures' depredation. Perhaps because a stray horticulturist here and there has "run mad" over the years, we now know better, but see in our forebears' wonderings the root of all science: the need to know.

Tending to be more literary than sci-

entific in my browsing, I have only a vague sense of how much data there is in these old works. I do know, however, that without the written history of plants and gardens, horticulturists would lose much of the richness of our scientific heritage.

Just as modern hybridization has, in some cases, overlooked some positive characteristics of plants, we professional and amateur gardeners stand to lose much wisdom if we neglect the resources left for us by our predecessors. The Society's beautiful old books with their ornate bindings and meticulous engravings were treasured by past generations; we cannot leave them to decay in our attics. A few hardy volunteers (Alice Bagwill, Barbara McGlone and Elaine Logan) have started a cataloguing program, undertaking the immense task of organizing our uncounted books, but they have yet to start work on the attic depositories. Even if the Society continues to receive their generous help, we will need funds for cataloguing materials, shelving, and book repair and preservation—the minimum requirements for putting any kind of library together.

Now they rest, rarely disturbed, in the dusky attics, waiting for us to fulfill our mission as an organization: to provide information that will promote horticulture in this country. I quote again from *The New York Farmer and Horticultural Repository*, February 1830: "Horticultural Societies have sprung up with amazing rapidity in some of the Northern and Eastern states, and are likely to prove of much benefit. . . . The members are zealous, and . . . new trees, plants, fruit, vegetables, seeds &c. are numerous."

In a new country, horticultural societies paved the way for the flourishing horticulture and agriculture that enrich us today. I hope our "zealous members" will help retrieve from dusty storage the reminders of our humble beginnings and the basis for our future growth, by contributing to the Society's Harold B. Tukey Memorial Library Fund.

*Edward D. Dore*



# AHS Best Sellers

Choose long-lasting gifts for your gardening friends from our list of best-selling books reviewed in *American Horticulturist*. All available at a special discount to AHS members.

## Manual of Woody Plants.

Michael A. Dirr. *Stipes Publishing Company, Champaign, Illinois.* (3rd edition.) 1983. 826 pages; softcover, \$19.80; hardcover, \$28.80. AHS discount prices, softcover, \$17.85; hardcover, \$25.95 including postage and handling.

This updated edition of a very useful book includes 300 new species and 500 new cultivars not found in earlier editions. There are also over 300 new line drawings. Excellent information on size, hardiness, habit, growth rate, culture, diseases, landscape value, cultivars and propagation of each woody plant.

## Gardens of a Golden Afternoon.

Jane Brown. *Van Nostrand Reinhold.* New York, New York. 1982. 208 pages; hardcover, \$29.95. AHS discount price, \$22.50 including postage and handling.

Tells the story of the gardens designed jointly by Gertrude Jekyll and Edwin Lutyns. Beautifully illustrated with many color photographs and details of garden design. Recommended reading for the lover of English cottage gardens or for the garden history buff.

## A Dictionary of Botany.

R. John Little and C. Eugene Jones. *Van Nostrand Reinhold Company.* New York, New York. 1980. 400 pages; hardcover, \$18.50. AHS discount price, \$16.05 including postage and handling.

A botanical dictionary covering all aspects of the plant sciences. Indispensable to the professional or the serious amateur who makes frequent use of the literature. The perfect gift for the student of botany or horticulture.

## Japanese Maples.

J. D. Vertrees. *Timber Press.* Forest Grove, Oregon. 1978. 178 pages; hardcover, \$39.50. AHS discount price, \$30.89 including postage and handling.

An authoritative work on a group of plants with tremendous variety—Japanese maples. Describes and illustrates the more than 250 cultivars of *Acer palmatum*, plus many other species of *Acer* found in Japan. Enjoyable reading and beautifully illustrated.

## Gardens Are for People.

Thomas D. Church. (Edited by Grace Hall and Michael Laurie.) *McGraw-Hill Book Company.* New York, New York. (2nd edition.) 1983. 256 pages; hardcover, \$37.50. AHS discount price, \$31.50 including postage and handling.

An updated edition of a classic work in landscape architecture that includes Thomas Church's thoughts on design principles. All of the illustrations are new, and most of the gardens shown are ones Church designed after 1955. Destined to set new standards in the field of landscape architecture.

## The Complete Book of Roses.

Gerd Krüssmann. *Timber Press.* Portland, Oregon. 1981. 436 pages; hardcover, \$50.00. AHS discount price, \$43.75 including postage and handling.

Updated and translated from the original German edition of 1974, this is THE definitive study of the rose from prehistoric times to 1981. Describes each variety of rose, with information on the originator, date of introduction and parentage of the hybrids. Various rose-related topics include paleontology, mythology, commercial production, propagation and plant breeding. Includes rose species, old garden roses and modern hybrids.

## The Life and Travels of John Bartram.

Edmund Berkeley and Dorothy Smith Berkeley. *University Presses of Florida.* Tallahassee, Florida. 1982. 376 pages; hardcover, \$25.00. AHS discount price, \$22.50 including postage and handling.

A fascinating account of the life and travels of John Bartram, one of America's foremost botanists and plant collectors. His travels in search of plants took him to most parts of the eastern United States, and his unusual plant collections had a profound influence on horticulture and botany in the eighteenth century. A book for all plant lovers.

## The Englishwoman's Garden.

Alvide Less-Milne and Rosemary Verey (editors). *Merrimack Book Service.* Salem, New Hampshire. 1980. 156 pages; hardcover, \$24.95. AHS discount, \$17.95 including postage and handling.

The story of 36 English gardens as told by their owners, including plant likes and dislikes, climatic and architectural problems, gardening practices and the history of each garden. Describes many gardens developed or rejuvenated since World War II. A truly inspirational work.

## Japanese Gardens—Design and Meaning.

Mitchell Bring and Josse Wayembergh. *McGraw-Hill Book Company.* New York, New York. 1981. 214 pages; hardcover, \$27.50. AHS discount price, \$23.25 including postage and handling.

Analyzes in detail 10 outstanding gardens and discusses the origins of the Oriental garden design concepts. Chapters on Principles of Design and Construction Details as well as extensive garden plans and excellent photographs throughout.

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# A New Look at Mountain Laurel

**M**y tiny plants growing in tubes and plugs reveal little of their potential beauty, but each label is marked with an intriguing name: 'Shooting Star', 'Bullseye', 'Silver Dollar', 'Freckles' . . . These are only a few of the exciting new cultivars of an old favorite, *Kalmia latifolia*, mountain laurel.

The plants growing in these strange-looking capsules originated in tissue culture laboratories, and these cultivars represent, at long last, new possibilities for the garden use of mountain laurel. Nurserymen have been planting them for two or three years; today, these beautiful new forms are becoming available.

Mountain laurel is a broad-leaved evergreen that lights up the deciduous winter woodlands on rocky, acidic hillsides of the eastern United States. From Maine to northern Florida, and as far west as Mississippi, mid-spring is a time for rejoicing, when the mountain laurel is in bloom. Less than half a mile from my home in northwestern New Jersey, nature has dressed an entire slope with these dense understory shrubs. One of the most splendid displays occurs in June in Pennsylvania's Pocono Mountains. Both Pennsylvania and Connecticut have recognized the beauty of *Kalmia latifolia* by designating it as their state flower.

Early colonial settlers were the first to admire this native American shrub. They called the plant ivy, dug it up from the wild and planted it in their gardens. Mountain laurel's virtues were appreciated by such noteworthy gardeners as George Washington and Thomas Jefferson, both of whom used it as an ornamental. The shrub transplants easily and is adaptable to many garden uses.

Calico is another common name for the plant; each flower somewhat resembles that cotton cloth, which is printed with a figured pattern. The calico effect can be seen

in the full-blown flower, whose petals carry a uniform design of pink or purple spots. Each blossom in a cluster is usually white infused with a delicate pink. From a design point of view, the intensity of the bud color is of equal importance to the open bloom, because buds and expanded petals appear together for quite a long time during the three-week flowering period.

Most of us tend to treasure the exotic far more than the familiar. Perhaps because of its widespread distribution, mountain laurel was accepted in its natural state, and hybridizers paid little attention to improving it. Nor were there many attempts to identify clones with superior qualities. However, during the recent winters of 1980-1982, some gardeners experienced hardiness problems with other broad-leaved evergreens. These gardeners are now taking a new look at rugged *Kalmia latifolia*, which survives, without damage, in temperatures as low as -20° F. In my own garden, mountain laurel has bloomed profusely following a month in which lows reached -15° F. Frequently, I have observed budded branches that had been encased in ice over an extended period of time flowering with no apparent damage the next spring.

The major obstacle in growing and improving mountain laurel has been propagation; from the plant's earliest recorded history, gardeners have found it notoriously difficult to reproduce.

Laurels were first noticed in 1726 by the English botanist, Mark Catesby. However, seeds and plants introduced to his native land did not thrive. (They were misidentified as well.) In 1747 Sweden commissioned naturalist Peter Kalm to search for valuable New World plants that might grow in the frigid Scandinavian climate. Kalm found the mountain laurel, which he thought was exceptionally beautiful, and brought it home. Linnaeus examined it and found it was a member of an entirely new genus. He honored its discoverer by naming it *Kalmia*.

*Kalmia latifolia*, commonly called mountain laurel, growing in the Connecticut wild.

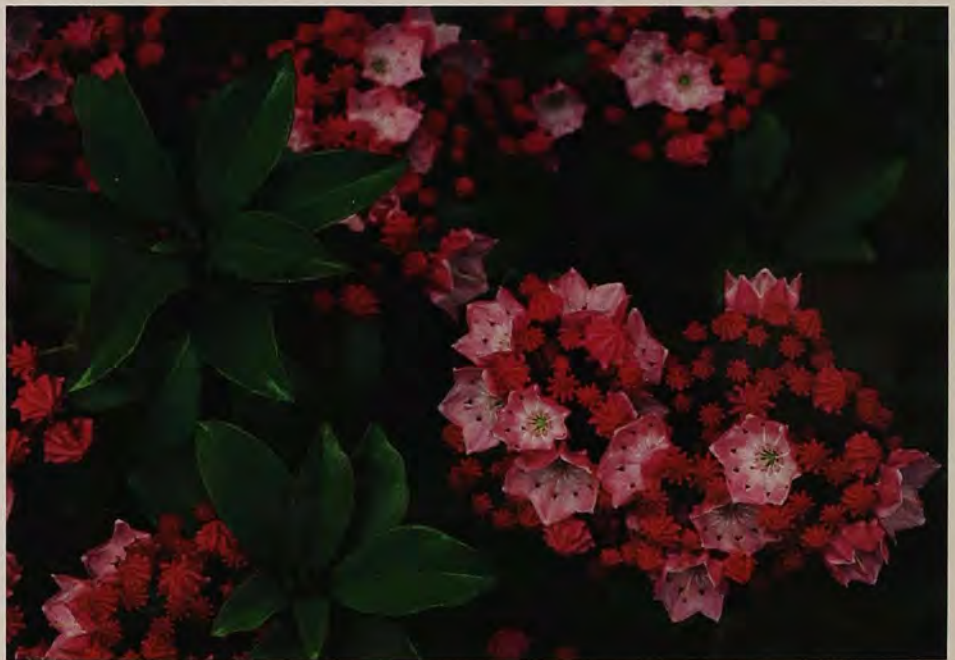


## SEASONABLE REMINDERS



Over the years, the secret of germinating and growing the seed has gradually been revealed, but it is such a slow and difficult process that American nurserymen found it more practical to collect mountain laurel from the wild and either grow it further or resell it immediately to gardeners. Ironically, it was English horticulturists who finally looked at this native American plant more closely and, in 1886, sent the first recorded cultivar to the United States, calling it *Kalmia latifolia* 'Rubra'. Unfortunately, cuttings of mountain laurel, which could be used to reproduce a mother plant exactly, are difficult to root. So, despite the availability of improved selections, the northeastern mountainsides continued to be used as collecting grounds. As the human population increased, so did the demand for this beautiful garden plant. Only within recent years has the importance of conservation of natural resources become more apparent. Americans learned that environmental hazards such as soil erosion and flooding can occur when hillsides are denuded of an entire species of plant. Clearly, better methods were needed so that mountain laurel could be improved, propagated and made available to the gardener without depleting wild populations or destroying its natural habitat.

Early in the 1960s, Dr. Richard Jaynes of the Connecticut Experiment Station began studying the plant. In addition to finding a way to collect cross-pollinated seed



ABOVE LEFT: These blooms illustrate the banded color pattern called fuscata. ABOVE RIGHT: A form of mountain laurel with almost pure white flowers. BELOW: A hybrid with bright red buds that open into paler flowers.

whose parentage has been carefully controlled, he has also discovered some forms of mountain laurel that will breed remarkably true from seed. Through his work with several *Kalmia* species, he has selected, hybridized and introduced many new ornamental types. Dr. Jaynes also has discovered that successful rooting is more likely to occur when cuttings are taken

from seedlings rather than from mature plants. As a result, many growers who have been working with newly selected cultivars have had better success in rooting than was formerly possible.

Any gardener who has ever attempted to propagate mountain laurel can testify to the problems involved. Seed must be collected at exactly the right time of the



year and carefully separated from the chaff. When seedlings finally appear, they are so tiny and slow growing that they can scarcely be handled. Researchers have attempted to accelerate this stage by treating seed with growth hormones such as gibberellins. They have also experimented with lighting the plants to supplement the low levels of light available in winter, and with adding carbon dioxide to greenhouse atmospheres to speed growth. With cuttings, horticulturists face another problem: even when roots are initiated, it is difficult to coax the little plants out of their deep, extended dormancy.

Until Dr. Jaynes studied mountain laurel, the occasional discovery of an unusual form of the plant was of little significance. Plants have been found with features such as unusual dwarf stature, red or yellow stems, feathered petals, variegated foliage and willow-shaped leaves. Now, at last, with these propagation breakthroughs, new cultivars of *Kalmia latifolia* are becoming a reality.

The most promising development in mountain laurel research appears to be the meristem, or tissue culture, method of propagating plants. Many genera, such as *Rhododendron*, *Amelanchier* and *Malus*, are now being successfully reproduced using this technique. Fortunately for gardeners, the culture is being perfected simultaneously with new methods for rooting mountain laurel cuttings. Already, home gardeners are able to buy some of the splendid new cultivars, and, in time, more will appear on the market.

Much attention has been given to the red-budded feature of mountain laurel. The flower buds can be distinctive and prominent, and clones with unusually deep velvety red buds have been identified. As a general rule, the open flowers are pink. Some selections have the added feature of red-tinged stems.

Connecticut Indian tribal names have been given to two cultivars with red buds: 'Nipmunk' and 'Quinnipiack'. These cultivars are red in bud but light pink when the flowers open. Others are 'Ostbo Red', 'Sarah' and 'Olympic Fire'. Although growers have not yet found a laurel red in open flower as well as in bud, the search is on, and it is very possible that some day an observant nature lover may discover such a plant.

Pure white flowering is also a desirable landscape feature, and several white cultivars of mountain laurel are being grown.

'Silver Dollar' is white with exceptionally large flowers and foliage. 'Stillwood' is white in bud as well as in flower. A late-blooming white called 'Shooting Star' has also been found. This plant has deeply cut, reflexed petals, which give it a frilled appearance when the plant is in bloom.

The term "fuscata" is sometimes used in descriptions of mountain laurel. It means brownish and refers to the banded pattern on the petals. Instead of the tiny spots found on the flowers of most wildlings, mountain laurel has various kinds and colors of bands. Some cultivars are solid, such as the reddish brown 'Bullseye'. 'Goodrich' is a cultivar with a slim white rim encircling a wide band of an odd color that might be called grape. Other bands, as in the cultivar called 'Freckles', are splotchy and have been termed "interrupted."

Perhaps the new selections with pure pink flowers will prove to be the most popular of all. 'Pink Charm' has deep pink buds and flowers of a medium intensity. An exceptionally hardy cultivar is 'Pink Surprise', which has pink flowers and broad green leaves.

A rare dwarf form of the mountain laurel, *Kalmia latifolia* 'Myrtifolia', has resulted in the development of 'Elf', a so-called miniature cultivar. Other low-growing plants may soon appear.

Since tissue culture permits the production of enormous numbers of plants in a relatively short period of time, it is highly likely that these and other mountain laurel cultivars will become more widely available in the near future. One distinct advantage of this method is that the propagator needs only a few stock plants of each cultivar to begin his work. Stock plants are grown under controlled conditions designed to minimize disease, and the new tissue-cultured plantlets start life free from disease problems that could be passed on to plants that are propagated from cuttings.

In tissue culture, a piece of plant tissue (called an explant) containing a bud is removed from the stock, and its surface is sterilized. The material is then placed in a laboratory culture vessel containing a carefully composed chemical medium. Sterile conditions are maintained at all times in order to prevent contamination.

The little shoots that arise from the bud multiply rapidly and in great numbers. When they are approximately an inch long the shoots are removed from the vessels and placed either in covered glass containers or under intermittent mist. This is

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## SEASONABLE REMINDERS

the stage in which most of the rooting occurs. Since laboratory light levels are low, it is important to acclimatize the plants gradually to the higher amounts of light needed for rooting.

By using tissue culture propagation, a small laboratory can produce thousands of cultured plants every month.

### *The major obstacle in growing and improving mountain laurel has been propagation.*

Propagators deliver tissue-cultured plants growing in tubes or plugs to nurserymen, who either plant them in the field or into containers. A well-grown cone is filled with a matted root system topped by a few stems and leaves. Some growers produce plantlets in small plugs of peat moss.

Nurserymen are now experimenting with various methods for growing on mature specimens. One Oregon grower pots each plant individually and places them outdoors in the spring under lath. The pots are placed on sandy beds over heating cables to accelerate growth. According to this grower, by following a program of maximum fertilization, he can produce a two-foot plant in only two years. However, this procedure may be possible only under the temperate conditions of the northwestern United States.

Mountain laurel is a landscape shrub with many uses. Planted as a single specimen, it looks solemn and dignified, but nature demonstrates a far better use: colonizing. Placing odd-numbered groups of plants in drifts under high-limbed trees will create a naturalistic effect. Like rhododendron, mountain laurel flourishes in light shade in an organic soil. Laurel, however, will also grow (though slowly) in a soil that is poor to moderate. Heavy shade results in sparse flowering. In fact, some of the new cultivars seem to bloom best in full sun. If interplanted with rhododendron, foliage of the two ericaceous plants will meld, as they are quite similar. The designer can develop continuity of bloom by planting April- and May-flowering azaleas and rhododendrons followed by June-blooming laurels.

Except for dwarf types, mountain laurel grows quite tall. Low-growing shrubs that

do well under the same conditions as mountain laurel are a useful addition to any planting. In partial shade, *Fothergilla gardenii* and *Hydrangea quercifolia* are two good choices. If planted along the house foundation, laurel can easily be kept to six feet in height. Space plants a minimum of five feet apart.

Mountain laurel requires an acidic soil. At least one grower is searching for laurel that will thrive under alkaline conditions. Although laurel is sometimes discovered growing naturally near swampy areas, it is by no means tolerant of wet soils, and needs a well-drained location in the garden. Transplanting is easy, because root systems are wide rather than deep; collected, balled and burlapped plants often have root systems that look like big pancakes.

An additional feature of mountain laurel that is worth noting is its autumn display. Cheery seed capsules turn rosy brown in late fall. These are sometimes removed by deadheading—a quick twist of the wrist to remove the capsules. While this procedure does insure compactness and the production of more flowering shoots, it is not altogether necessary. The seed pods are rather interesting when left on the plant or cut for indoor arrangements.

Until recently, landscaping with mountain laurels has been somewhat limited. However, the new cultivars of this American plant provide garden makers with a great many options. Variations in height, texture, period of bloom and flower color provide interesting new possibilities. Fascata types make glorious single specimens; a grove with pure white or glowing pink flowers can be combined nicely with lower growing perennials. Dwarf types are perfect small shrubs in the rock garden.

One of the few cultural problems that sometimes appears is leaf spot disease. However, spraying with a fungicide such as Benomyl at bud break and again 10 days later, with a repeat in 20 days, is highly effective in controlling the blight.

When the ancient Greeks crowned their heroes with laurel, they were dealing with an entirely different genus from *Kalmia*. But here in our country, it is *Kalmia latifolia* that deserves our laurels. There is cause to celebrate the introduction of new forms of mountain laurel. ♣

—Ruby Weinberg

Ruby Weinberg, a landscape designer and a former instructor of vocational horticulture, grows broad-leaved evergreens on her farm in New Jersey.



# The Spurge Family

This month's "Strange Relatives" resumes the description of the spurge family, Euphorbiaceae, with a focus on family members of economic importance. As mentioned in April's column, this is a large family of cosmopolitan distribution, chiefly tropical. The spurges are known for their milky sap or latex. The wide variation in size and habit of growth of these plants is notable, as is the distinctive character of flower types.

Ornamental plants in the family, such as poinsettia, have commercial value in their sphere, but the worldwide economic importance of certain other family members is of far greater significance. Chief among the latter are rubber, cassava and oil seed.

Ninety-nine percent of all the natural rubber in the world comes from one member of the spurge family: *Hevea brasiliensis*, commonly called Para rubber. (*Hevea* is the Latinized form of the Brazilian name for these tropical trees that are native to northern South America.) This Amazon Valley tree, 60 feet or more tall, has milky sap and thick, leathery leaves. Its flowers are small and petalless, with male and female flowers separate but borne in the same inflorescence. The fruit is a large capsule, splitting into three, one-seeded sections. *Hevea* was probably first used by aboriginal natives of the Amazon Valley, who ate the seed as food.

Wild rubber was harvested in the Western Hemisphere and the use of rubber there was already well established before the time of Columbus. The earliest visitors to the New World reported that Indians had many uses for rubber, and documented the use of protective garments, balls for games and syringes. Trees whose exudations could be made into rubber were systematically cultivated.

Many plants were tested for rubber production before *Hevea* became established as the principal commercial source of natural rubber. The discovery of the process of vulcanization spurred interest in the cultivation of rubber as a crop. Vulcanization is a chemical treatment in which the physical properties of rubber are changed to



Photo courtesy of Goodyear News Bureau

At a Goodyear rubber plantation on the Indonesian island of Sumatra, a tapper uses an extension knife to draw latex from a rubber tree. The rubber produced will be sold to manufacturers of surgical gloves, balloons, overshoes and carpet backing.

improve strength and resilience and to reduce stickiness and odor. Demand for rubber grew as knowledge of its suitability for innumerable uses increased.

Cultivation of *Hevea* did not get a real

start until the British took seeds of *H. brasiliensis* from Brazil in 1876 and brought them to the British colonies in the Far East. The centers of the rubber plantation industry today are the Malay Archipelago



## STRANGE RELATIVES

and Sri Lanka (formerly Ceylon).

Despite the existence of synthetic rubber, manufacturers continue to rely on natural rubber; its resistance to heat build-up makes it valuable for tire treads for racing cars, trucks, buses and airplanes.

*Sapium*, a genus of 100 tropical species of both the Eastern and Western Hemispheres, is one of the least known of the important rubber-bearing genera of Euphorbiaceae. Rubber-bearing *Sapium* species occur only in the Western Hemisphere, principally in Andean regions. During World War II the United States Government made intensive studies of the possibilities of obtaining rubber from native stands of *Sapium*, and a great deal of data was collected on the quality and productivity of different species. However, *Sapium* sp. are more difficult to tap than other rubber-bearing trees, and they yield less latex than does *Hevea*. Today, *Hevea* retains its lead as the principal commercial source of natural rubber.

The genus *Sapium* is better known for the Chinese tallow tree, *S. sebiferum*. Cultivated for its white, waxy seeds, which yield a substance used for soaps and candles, this poisonous-juiced, 50-foot tree from South China and Japan is somewhat poplar-like in shape and gives brilliant autumn color. Sometimes grown for ornament in the United States, it is not hardy north of Zone 7 but has become naturalized from South Carolina to Florida and Louisiana.

Amusing, if not of economic interest, is *S. biloculare*, the Mexican jumping bean. Its seeds contain a moth larva whose activities cause the beans to tumble.

*Manihot*, another spurge genus of economic importance, includes about 160 species of herbs, shrubs and trees native to North and South America. Among the herbaceous species, the most important is *M. esculenta*, which is extensively cultivated throughout the tropics for its immense, starchy root, which has both food and industrial value. Natives who eat it as a staple food call it manioc; elsewhere, it is called cassava. It is the source of tapioca.

The root of this valuable tropical food plant is similar to a dahlia or sweet potato in appearance. Raw roots or peelings of the tubers can develop a concentration of prussic acid sufficient to cause death from cyanide poisoning; however, prussic acid can be destroyed by boiling or other processing. It is this root from which cassava flour, tapioca, laundry starch and even an

alcoholic beverage are derived. Tapioca is the only cassava product found in northern markets. Other food items, such as the gelatinous *fufu* of West Africa and the *bami* mush of Jamaica, also come from cassava. The tuberous roots of sweet cassava, *M. dulcis*, are largely free of the poisonous prussic acid.

In the industrial world, the tuber usually goes by the name of manioc. It is used in leather tanning and in the manufacture of textiles, explosives, glues, dextrin and alcohol.

The six species of *Aleurites*, natives of East Asia and the Hawaiian and Pacific Islands, yield a number of valuable oils. The name of the genus is supposedly derived from the Greek word for flour, in reference to the mealy appearance of some species. The stems, foliage and inflorescences are hairy. Flowers are borne in terminal panicles and have petals. In *The World Was My Garden*, David Fairchild described them as "charming pink and white flowers. . . I was enchanted when I first saw a tung oil tree in bloom," he wrote.

*A. fordii* is the tung-oil tree or Chinese wood-oil tree. The fruits are about the size of large plums. Inside their hard, shell-like husks are three hard-shelled seeds. The meat inside the shells contains the oil. Although extremely purgative, the seeds are not poisonous.

Tung oil is used in varnishes and paints, as a waterproofing agent, and in making linoleum, oilcloth and insulating compounds. Development of tung oil culture started in the United States in 1904, when our consul in China sent a shipment of seeds to Dr. Fairchild at the U.S. Department of Agriculture. Trees were distributed to experimenters in the South Atlantic, Gulf and Pacific Coast states, that is, in those areas that seemed best suited to the trees' extensive cultivation. Soon the industry entered the commercial stage of exploitation, and thousands of acres were planted. Unfortunately, hurricanes 10 or 15 years ago along the Gulf Coast wiped out commercial production of tung oil in the United States.

Japanese wood-oil tree, *A. cordata*, is another source of oil for paint and quick-drying varnish.

*A. moluccana*, the candlenut or varnish tree, is cultivated in China and the Philippines for oil. The oil produced from the seeds is more like linseed oil than tung oil. Kernels are good to eat when roasted; natives of the Moluccas string them on palm spines and use them as candles. This spe-

cies grows and fruits in South Florida.

*A. montana*, mu-oil or mu-yu, from South China and Burma, yields an oil of inferior quality. It was discovered and named by E. H. "Chinese" Wilson, the eminent American plant explorer.

*Ricinus communis*, castor bean, is a giant tropical herb used as an annual in temperate zone gardens for the foliage effect of its handsome, lobed, green or bronzed leaves. The fruiting branches are ornamental, with dense clusters often one to two feet high. The individual flowers are small and petalless. The fruit is a bristly pod containing beautifully marked, bean-like, poisonous seeds.

Castor oil, a non-volatile fatty oil, is obtained from the beans by pressing or by solvent extraction. Both the beans and the oil are produced principally in India and Brazil, and used primarily in the United States, largely in industry. Castor oil is commonly used in the production of plastic, paints, cosmetics, printing inks and lubricants. As a cathartic, it can be harmful.

*Jatropha* is a genus of tropical trees that are particularly abundant in the American and African tropics. The name comes from the Greek words for physician and food, in reference to the medicinal value of some species. Of about 160 known species, only two are of commercial interest.

Unlike most other genera of Euphorbiaceae, *Jatropha* has complete flowers with both a calyx and a corolla. The flowers are unisexual and appear simultaneously in abundantly branching inflorescences. Terminal flowers are female, lateral flowers, male.

*J. curcas*, physic or Barbados nut, produces seed from which soap, a cooking oil and a powerful purgative are made. The seeds themselves can be eaten if thoroughly roasted to remove the poison. The latex can be used directly as a chewing gum, as it coagulates in the mouth. This species is widely cultivated as an ornamental in Florida and Hawaii. *J. multifida*, coral plant, has showy scarlet flowers and is common in Florida.

The yield of milky, poisonous latex from *Jatropha* species is too low for commercial exploitation as a source of natural rubber. During World War II, intensive studies of native stands in Mexico indicated that plants were much less plentiful than originally reported. A form of *Jatropha* known as 'Chilte' has been known and used in Mexico for many years, mostly for making figurines and toy balloons; when broken, the





LEFT: A variegated form of *Manihot esculenta*; the starchy, sweet-potato-like root of this plant is the source of tapioca. ABOVE: *Euphorbia antisiphilitica*, commonly called candelilla, is a spineless desert shrub whose branches are covered with a hard, white wax.

Block's

Howard Scott Gentry

balloons are used as chewing gum.

*Croton* species are strong-scented herbs, shrubs or trees of the tropics and subtropics, some of which are of economic importance. Seeds of *C. tiglium* are the source of the strongest of all purgatives, croton oil. This oil is now considered unsafe for use as a purgative and has been removed from the pharmacopoeia of several countries. *C. lacciferus* is the host plant for lac-producing insects and thus is important to the varnish industry. *C. linearis*, granny bush, is a wild shrub growing on rocky land near the sea on islands in the Caribbean. Odd foliage and sweet fragrance characterize this bush. This plant yields a brew or tea that is reported to have local medicinal uses. *C. eluteria*, a small, fragrant tree, is similarly used as an "aromatic stimulant."

Several herbaceous, annual *Croton* species are found growing in Mexico and in waste places and sandy barrens of the United States, from the warm eastern states, into the Midwest and south into Louisiana and Texas. Among these is prairie tea, *C. monanthogynus*.

Crotons are infrequently grown as ornamentals. *Codiaeum* is the popular, colorful florists' croton.

The genus *Euphorbia*, the largest in the spurge family, was discussed in the previous column in reference to the ornamental uses of many species. We return to it now to consider its value in industry and agriculture.

The latex of some euphorbias, as well as of many other spurges, was tested for

rubber production. Experimenters attempted to produce rubber commercially in West Africa from *E. tirucalli*, pencil tree or milk bush, but the project was not successful. This spineless, succulent, shrub-like plant is often grown as a pot plant for house and patio. The pencil-like branches are green, cylindrical and about one-half inch thick, with very small leaves at branch tips, which drop soon after they appear. The toxic properties of the plant's milky sap can cause dermatitis; however, in bush medicine it is reportedly effective in removing warts.

The rubber from *E. intisy* of Madagascar is of high quality and is the best produced by any species of *Euphorbia*. Wild stands were ruthlessly exploited until the plant almost became extinct. Several other *Euphorbia* species also produce appreciable amounts of latex.

*E. antisiphilitica*, candelilla, is a spineless shrub from desert areas of northeastern Mexico and West Texas. It grows to three feet and has many cylindrical, almost leafless branches. The branches are covered with hard, white wax, which is collected from wild plants for commercial use. Mexico has been producing and exporting the wax to the United States for many years, but no effort has been made to develop candelilla into a crop. According to a report published by the U. S. National Academy of Sciences, "About half the candelilla wax imported in the U.S. is used in coating and polishes; about one-third is used in chewing gum." The NAS report states that "research could adapt the plant to culti-

vation, reduce harvesting costs, and improve the wax-extraction process. With these improvements, candelilla could become an important source for bringing foreign currency to arid developing nations."

*E. antisiphilitica* took its name from its use by cowboys and early settlers in the Chihuahuan Desert and adjacent regions as a preventive of syphilitic infection. The edible wax obtained from processing the plant is now used by millions of people in the United States, Mexico and elsewhere for a quite different purpose: the wax remains hard under conditions of heat and humidity, and, when combined with chocolate or other confection coatings, the result is the ever-popular "melt in your mouth but not in your hands" candy nuggets.

The diverse spurge family has served the family of man well. Evidence abounds of man's reliance upon these plants throughout time, from toy balloons to tires for automobiles and airplanes; from candles and chewing gum to candy coatings for all seasons; from starchy flour to explosives and tapioca; from oily seeds to lubricants, cosmetics, and varnish and waterproofing agents; from native wildflowers to immense commercial enterprises. Even a limited introduction to this family makes apparent the key role it has played in world history and geography, agriculture and industry, food and medical research. ♣

—Jane Steffey

Jane Steffey recently retired as the Society's Horticultural Advisor. She is now an active AHS volunteer and serves as Editorial Advisor to *American Horticulturist*.



# Book Reviews

## CLIMBERS AND TRAILERS.

Julie Grace. Timber Press. Portland, Oregon. 1983. 114 pages; hardcover, \$19.95. AHS discount price, \$18.45 including postage and handling.

Anyone who is looking for something different to climb a wall or cover the ground will find this book to be an excellent reference. The author provides color photographs and cultural information on 260 climbing and trailing plants. Written by a New Zealander, the majority of the plants included are particularly suited to the warmer parts of the United States. However, many of the plants described are also well suited to even our most extreme winter climates.

## CACTI AND SUCCULENTS.

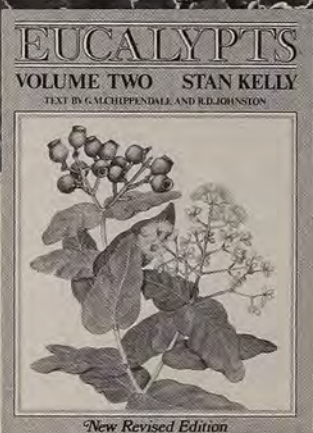
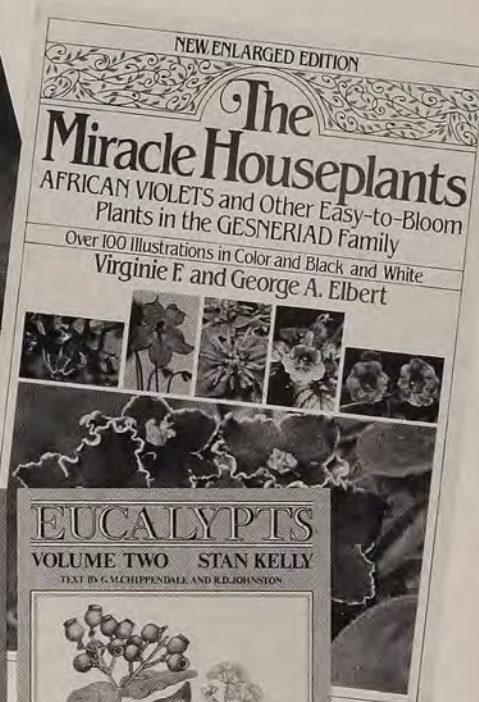
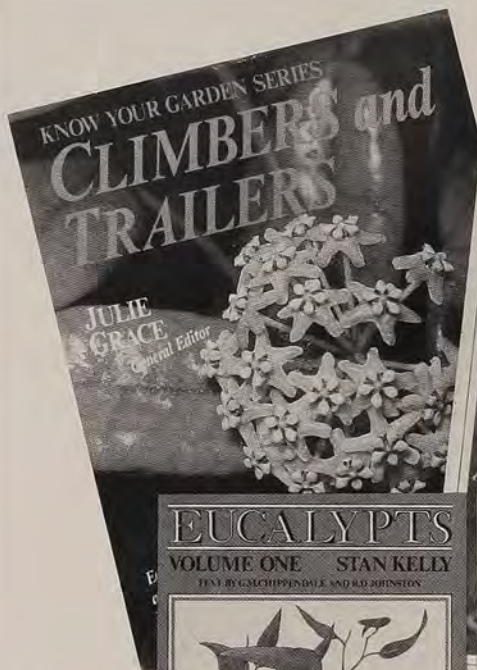
Gunter Andersohn. EP Publishing Ltd. Wakefield, England. 1983. 312 pages; hardcover, \$19.95. AHS discount price, \$15.95 including postage and handling.

This book is an excellent introduction to all aspects of cacti and succulents. Not only are there chapters devoted to cultivation, propagation, indoor gardening, outdoor gardening and a review of principal genera, but the excellent introductory chapters give a clear picture of the unique place these plants occupy in nature. Clear, well-illustrated discussions of the underlying physiology, areas of natural distribution and the floral biology of these plants, as well as of the economic importance of succulent plants, are very readable and provide a good background for the gardener who wants to get even more pleasure from this hobby.

## BEING A PLANT.

Laurence Pringle. Thomas Y. Crowell. New York, New York. 1983. 88 pages; hardcover, \$10.95. AHS discount price, \$10.25 including postage and handling.

This well-written children's book describes clearly and accurately how plants grow and reproduce, and how plants are different from animals. If you have a young gardener in your household, here are the answers to a lot of questions you may be asked. Recommended for ages 12 and up, this book could stimulate a lifelong interest



in plants, and has some good basic information every gardener (even the older ones) should know.

## EUCALYPTS.

Stan Kelly. Van Nostrand Reinhold Co. New York, New York. 1983. 368 pages (Vol. 1), 388 pages (Vol. 2); hardcover, \$50.00. AHS discount price, \$43.20 including postage and handling.

This two-volume work, suitable for the layman, is a complete survey of all species of *Eucalyptus*. The author provides information on each species, including its region of origin and cultural requirements. The color plates illustrating each species make this a unique work. The 535 plates reproduce the watercolor drawings prepared over a lifetime by Stan Kelly. The text that accompanies these remarkable drawings was prepared by G. M. Chippendale and R. D. Johnston, both bota-

nists who have specialized in the taxonomy of the eucalypts.

For gardeners in the warmer regions of the United States, this work represents a valuable resource for the selection and introduction of new trees that are highly decorative. Our past experience with *Eucalyptus globulus*, a widespread weed tree, should not discourage the introduction of more suitable species from this worthwhile genus.

## THE BUTTERFLY GARDENER.

Miriam Rothschild and Clive Farrell. Michael Joseph/Rainbird. London, England. 1983. 128 pages; hardcover, \$14.95. AHS discount price, \$13.95 including postage and handling.

Although this book was written for the English gardener, the subject matter is so unusual that I can still recommend it to American gardeners. Lots of books have



been written about attracting birds to the garden; here is one not only about attracting butterflies but also about raising butterflies and enjoying their beauty in the small home greenhouse. While most of the butterfly species are not found in North America, the garden plants that attract butterflies are, and are attractive to butterflies no matter what their species may be. Here is a new and rewarding way to expand the interest and beauty in your garden.

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**THE MIRACLE HOUSEPLANTS.**

Virginia F. and George A. Elbert.  
Crown Publishers. New York, New  
York. 2nd Edition. 1984. 272 pages;  
softcover, \$11.95. AHS discount price,  
\$11.05 including postage and handling.

If your acquaintance with the Gesneriad family is limited to African violets, you are missing a lot in your gardening life, as the subtitle of this book, *African Violets and Other Easy-to-Bloom Plants in the Gesneriad Family*, suggests. The Gesneriad family abounds in plants that are ideally suited for indoor gardening, and even includes a number of genera that can add beauty and interest to the hardy alpine garden.

The authors have done a remarkable job of consolidating and presenting a great deal of information that normally would be lost in the technical publications of botany. In addition, they not only clarify the taxonomic confusion of the last few years, but they also describe many of the new species that are available. Complete cultural information and up-to-date lists of cultivars give added value to the work. This is an excellent book for the indoor gardener who wants to know more about gesneriads and who wants to grow a wider variety of these remarkable plants. ☉

—Gilbert S. Daniels

Gilbert S. Daniels is the Immediate Past President of the American Horticultural Society.

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# Research Battles Blackspot

BY ROSALYNE B. DOBBS

Every rose grower dreams of bushes that need no spray for blackspot, the most destructive disease of garden roses the world over. Now science is taking giant steps to combat this troublesome disease, and spray-free roses are no longer an impossible dream.

As millions of rose growers know, there is no cure for blackspot; it can only be controlled by regular, preventive applications of fungicides. Blackspot is more widespread and damaging than mildew or rust, and without regular spraying, it may cause bushes to lose their leaves, produce fewer blossoms and weaken or die. Yet fungicides are expensive, time-consuming to use and carry potential for damaging the environment.

The best way to conquer blackspot is by developing genetically resistant roses that fight the disease without spray. This is the goal of studies at the United States Agricultural Research Center in Beltsville, Maryland. Begun in 1965, the work has received partial funding from the American Rose Society. Three cultivars that will serve as the foundation of breeding lines that carry genetic resistance are the result: 'Spotless Pink', 'Spotless Yellow' and 'Spotless Gold'. The floribunda-like pink cultivar is the most promising. Peter Semeniuk, research horticulturist on the project since it began, hopes that crossing these new resistant cultivars with modern garden roses will eventually create an improved race of spray-free plants. Although the center released the parent lines to about 100 professional and amateur breeders in 1979, Semeniuk stresses that "the 'Spotless' roses are just the beginning, not the ultimate rose."

To produce the "ultimate" rose, blackspot resistance must be combined with hybrid tea qualities—beautiful colors, exquisite form and large blossoms. Although the 'Spotless' roses have tenacious resistance to blackspot, they must be crossed

and recrossed with modern cultivars many times before their descendants will exhibit the other desired traits. This entails solving a maze of problems.

The main problem is "the very high susceptibility" of modern garden roses to blackspot, says Dr. Eldon Lyle, plant pathologist of Tyler, Texas and former chairman of the ARS research committee.

Blackspot has invaded rose gardens for centuries. The early hybrid teas and hybrid perpetuals had it, but historians blame today's increased problem on the introduction of the extremely susceptible *Rosa foetida* 'Persiana' (commonly called Persian yellow rose) by Joseph Pernet-Ducher of France in the late 1800s. This rose brought marvelous orange, yellow and flame tints to modern cultivars. Unfortunately, it also brought a susceptibility to blackspot.

Roses vary in their susceptibility to this disease. Those with smooth leaves are less prone to infection, explains Semeniuk, because fungal spores need from six to nine hours in water to germinate, and water may not remain on a smooth surface that long. Rough leaves encourage invasion by trapping water.

According to Semeniuk, breeding roses with genetic resistance is difficult, because it involves so many variables that surround two living things—the plant and fungus. Both react to "nutrition, temperature, environment and everything else," he says. In addition, they interact with each other. Ideally, disease-resistant roses would also resist mildew and rust, adding even more variables. However, Semeniuk's research deals with blackspot only.

The difficulties in creating resistance to blackspot are similar to those encountered in developing resistance to any disease, but the extreme variability of blackspot sets it apart from most. "Blackspot is like the common cold in humans," Semeniuk declares. It is not one disease but over 50 strains, and new ones keep appearing. Some

are more virulent and damaging than others, and the fungus mutates as does the flu virus. In comparing blackspot to other plant diseases, Semeniuk says it poses a problem similar to that of wheat stem rust, where hundreds of strains of the disease exist.

The 'Spotless' cultivars, which will serve as parent plants to new disease-resistant lines, carry resistance to seven strains of blackspot from eight states: Maryland, Delaware, New York, Ohio, Pennsylvania, Iowa, Texas and Georgia. The great variability of the fungus explains why the 'Spotless' roses may be free of disease in one area and not another; the resistance of these cultivars might also change. Semeniuk expects them to spot in certain areas of the country, but the only report thus far comes from Ames, Iowa, where U.S.D.A. ratings show blackspot is most virulent.

Considering the great obstacles, is it possible to develop the ultimate rose? "It should be possible," says Herbert C. Swim, who has created a record number of beautiful All-America Rose Selections award-winning roses (with 12 of his own and 13 as co-producer). The problem, he says, is finding those rare roses that are not susceptible to blackspot in order to introduce the resistant trait through breeding programs.

The researchers tested many species roses and found that a great number are indeed resistant to numerous races of blackspot. Although the blossoms of species roses are small and bear little resemblance to hybrid teas, the undesirable bloom traits can be bred out, says Semeniuk. The critical factor is resistance to the fungus.

For superior resistance, Semeniuk chose *Rosa rugosa*, a tough species rose. However, when he tried to cross it with modern cultivars, the result was a dismal failure.

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Roses growing in the Jackson & Perkins fields in southern California.







## Controlling Blackspot

Fungicides for blackspot are far better today than the sulfur dust first used to combat the disease. Several excellent chemicals are available, and most of them control other fungal diseases, too. Ortho Funginex carries the endorsement of the American Rose Society for controlling blackspot, mildew and rust. It is a liquid containing triforine, and has systemic action. Other fungicides for blackspot include Benlate (benomyl), Phaltan (folpet), and Daconil 2787 (chlorothalonil).

Start your spray program right after spring pruning. Apply fungicide every week to 10 days throughout the growing season, more often in rainy seasons. Mix an insecticide as needed with the fungicide, but apply miticide for spider mites separately.

To prevent the disease from becoming resistant, alternate one fungicide with another every few weeks rather than using one constantly.

For good coverage, spray the underside and top of leaves and use a spreader-sticker that is compatible with the chemical.

When temperatures soar into the 90's, reduce the amount of fungicide by half to prevent leaf burn.

After a season of severe infestation, use a dormant spray once or twice while plants are inactive, provided you live above the frostline.

If you spray regularly and still have many spots, check to see if they really are blackspot. Another fungus often mistaken for it is rose anthracnose, *Sphaeceloma rosarum*. Blackspot's lesions are coal-black with feathery edges, usually enlarge to over a quarter inch across, and cause leaf yellowing. In anthracnose, spots are seldom over a quarter inch across, and change from dark brown or purple to black and upon aging to white. At the white stage, spots may drop out, creating a shot-hole effect in the leaf. The best control for anthracnose is Phaltan.

A nutritional problem may also trigger leaf spots. Manganese excess causes tiny black peppery specks all over older leaves.

Good cultural practices help deter diseases. Since blackspot spores need at least six hours in water to germinate, keep the bushes dry when possible. Avoid splashing water on the leaves while watering to prevent spores from spreading, and keep fungicide intact. Spray early enough so that leaves will dry before dark.

Plenty of air circulation also keeps the

bushes dry. Leave enough space when planting bushes to avoid crowding, and prune to open the center of bushes.

Other tips: Rake and discard diseased leaves and clippings to get rid of spores and prevent disease spread. Choose highly resistant roses, discarding the disease-prone. The best defense against blackspot or any disease is to keep the bushes in robust health.

See "Sources" on page 35 for an excellent reference on rose diseases.

### BLACKSPOT-RESISTANT ROSES

Many beautiful roses have resistance to blackspot. Here is a list of those rated as most resistant to the disease in a study of bushes growing in 10 public gardens across the nation. Participating in the study were gardens located in Pennsylvania, Ohio, Texas, Oklahoma, Minnesota, Oregon and California.

Those receiving top ratings were not totally immune to blackspot but were rated as resistant if the first flush of disease did not infect them. Indicated by an asterisk are the ones also identified as having most overall disease resistance. This list appeared in *The American Rose Annual 1978* and is reprinted with permission of the publisher.

#### Blackspot-Resistant Hybrid Teas

'Tropicana'*	'Proud Land'
'First Prize'	'Duet'
'Miss All-American Beauty'*	'Peace'*
	'Electron'*
	<i>Others:</i>
'Mister Lincoln'*	'Pascali'*
'Tiffany'*	'Sutters Gold'
'Portrait'*	'Granada'
'Pristine'*	'Carla'
'Pink Peace'*	'Cayenne'

#### Blackspot-Resistant Floribundas/ Grandifloras

'Queen Elizabeth'*	'Ivory Fashion'
'Prominent'*	'Sonia'
'Rose Parade'	'Carrousel'
'Razzle Dazzle'	'Angel Face'
'Gene Boerner'*	'Sun Sprite'
'Europeana'*	'Betty Prior'
'Montezuma'	'The Fairy'
'First Edition'	'Pink Parfait'
	'Redgold'

To add to the tally, Dr. Walter Lammerts says he finds that 'Frau Dagmar Hartopp', a hybrid rugosa, has very high resistance to blackspot.

The offspring were sterile because the parents did not have the same number of chromosomes; modern roses usually have four sets, and *R. rugosa* had only two sets. The sterile offspring had three sets. Solving this problem took several years. Semeniuk artificially created two additional sets of chromosomes in *R. rugosa*, using a process similar to that used in breeding apples, blueberries and other plants. Then he successfully made the cross, and the 'Spotless' roses came into existence.

Genetics is unpredictable in many ways, Semeniuk explains. "When you make your cross, a lot of roses turn out single. They may carry resistance, but that's not the kind of flower you want. In rose genetics you don't know just what your next generation will be."

Semeniuk continues to explore the pattern of genetic inheritance of blackspot resistance. As the parent lines undergo trials, he is also studying how many individual genes are involved in the inheritance of the resistant trait.

Scant reports are available on the performance of the parent lines. The Conard-Pyle Company in West Grove, Pennsylvania grew them for about a year but not under true test conditions, since the test plants were sprayed along with all of their non-resistant bushes. Despite the use of the fungicide sprays, blackspot was a considerable problem with the non-resistant roses. The 'Spotless' test plants were free of blackspot and "quite impressive in that respect," says Richard J. Hutton, president of Conard-Pyle.

Armstrong Nurseries of California also tested these parent lines, saying they were "weak in growing habit, prone to mildew and rust . . . and of poor flower quality."

Jackson & Perkins Company is trying them, says William A. Warriner, research director in Tustin, California. He is well known for developing All-America Rose Selections award-winning roses. In fact, he swept the 1980 selections with 'Love', 'Honor' and 'Cherish', and garnered two more awards in 1984 (his lifetime total is 11). "Breeding with the 'Spotless' group may be effective," Warriner says. "We don't know yet, but are trying. Other types of spotless varieties may be developed."

Warriner says they rarely saw blackspot in southern California until recent years, and, for this reason, it was difficult to include blackspot resistance as a measure of quality. However, for four or five years they have been "hit hard with the disease."

Southern California is home base for three of the largest commercial rose breeders in the country. Blackspot's migration right into their midst offers a first-time





'Carefree Beauty', a new cultivar that is highly resistant to blackspot, needs little or no spray.

opportunity to observe and cope with the disease.

According to Warriner, normal hybridizing, in which plant breeders have kept an eye out for blackspot-resistant plants, has not been very productive in developing such resistance. Unless it is made a primary goal of breeding programs, there is not likely to be much progress in this respect.

In a great departure from normal hybridizing, researchers at Iowa State University used a survival-of-the-fittest technique to produce a rose that is highly resistant to blackspot and seldom ever needs spraying. The objective actually was hardiness—the ability to withstand harsh temperatures (to -20° F) with little winter protection—but researchers also selected for disease resistance, according to Dr. Griffith J. Buck, horticulturist and hybridizer. This work was also funded in part by the American Rose Society.

Buck explains that he started the plants in the greenhouse and moved them outside for field trials after about a year, when they were large enough to live through winter cold. In the field, the roses were cultivated and fertilized like corn or field crops, except that no fungicides or insecticides were used. He selected seedlings for breeding that survived the severe winters and onslaught of insects and disease.

'Carefree Beauty' is the outcome of three decades of work. Buck, who is now chairman of the American Rose Society Research Committee, says the new rose shows

"high tolerance" to Iowa's extremely virulent strains of blackspot as well as to those in many other parts of the nation. Although the leaves may spot slightly, 'Carefree Beauty' is not affected by blackspot and other diseases, and will grow vigorously with little or no spray.

The cultivar's long line of ancestors include *Rosa laxa*, a wild species rose from Turkestan, and several modern roses, including 'Queen Elizabeth', 'Carrousel' and 'Prairie Princess'. Researchers dub 'Carefree Beauty' a "shrub-floribunda," because its habit of growth resembles both classes. Introduced in 1979, the plant is showing up in more and more gardens.

Dr. Walter E. Lammerts, a prominent rose hybridizer, is striving to develop bushes that are not only totally resistant to blackspot but also to mildew and rust. His "ultimate" rose would also bear flowers with classic form. He has pursued this goal for over 40 years, during which time he has won 12 All-America Rose Selections awards for enduring roses like 'Charlotte Armstrong', 'Queen Elizabeth' and 'Chrysler Imperial'. Now he is crossing his roses with Dr. Griffith Buck's 'Music Maker' and 'Prairie Princess' as well as 'Hazeldean' from Percy Wright of Canada. 'Music Maker' and 'Prairie Princess' are light pink shrub roses, while 'Hazeldean' is an old hybrid-tea-like garden rose with pale yellow flowers. All three plants have superior disease resistance.

Concerning his new seedlings, Lam-

merts says, "One which I have great hopes for, that seems so far to be completely immune to all diseases, is under number 81002/7." Another promising rose has advanced from a number to become 'Coral Pink Pillar'. It is still undergoing tests and has not yet been introduced. Although 'Coral Pink Pillar' gets a few spots on the lower leaves, "it is very, very resistant to blackspot," says Lammerts, who lives in northern California. His progress is very encouraging, since some of the resistant "hopefuls" have blossoms with good form, too.

In the future, new approaches to fungus control may come from an exploration of the mysteries surrounding plant-fungus skirmishes. It has been known for some time that a plant "senses" a fungal attack and produces chemicals called phytoalexins to kill invading diseases. Thus far, researchers have identified over 100 phytoalexins, or natural fungicides.

Most plants produce these chemicals, says Dr. Hans D. VanEtten, plant pathologist at Cornell University. Although none have been identified in the rose, they are found in its relative, the strawberry.

Genetic studies at Cornell have concentrated on 200 strains of *Fusarium* fungus, which attacks peas and other plants. Researchers have found that the fungus uses certain enzymes to counteract a plant's natural fungicides. This work opens up the possibility of developing chemicals or devising genetic means to help suppress the enzymes produced by fungal diseases or to increase the potency of the plant's natural fungicide, or both. Elsewhere, scientists are taking a similar approach in combatting insects that use their enzymes to break down toxins in pesticides. Unfortunately, mapping out new fungus controls will take a long time.

Advanced hybridizing techniques could offer new possibilities in the area of disease resistance. According to Warriner, for roses this is fairly far down the road. "When genetic engineering, gene transfer and somatic hybridization [a new type of tissue culture] are more commonplace and affordable, it might be possible to do great things," he says.

Much work remains, but science is gradually conquering blackspot and other rose diseases. For those who enjoy growing this favorite flower, a glorious spray-free age is on the way. ♣

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Rosalyn B. Dobbs is a free-lance writer whose articles have appeared in *Organic Gardening*, *Garden* and *American Rose Magazine*. A consulting rosarian and a member of various rose societies, she is currently writing a book on growing roses.



# An English Gardening Love Affair

TEXT &  
PHOTOGRAPHY BY  
JERALD HARPUR

There is something psychologically uplifting about a garden that rises, via steps and slopes, through vistas to a point at the top that looks straight back at the roof of the house. This is the exhilarating effect on arrival at "Yeomans," an Elizabethan malt house cottage in the North Oxfordshire village of Tadmarton, England. Set on half an acre with lawns and ancient stone walls, the garden is part of a love story, one that began 20 years ago when Mr. and Mrs. Albert Pedder (he was 59 at the time, she was 48) married and came to live here.

They admit to having had a pretty limited experience with gardening before then. The tall and scholarly Mr. Pedder, an oil company geologist, had spent most of his life in the Middle and Far East, where he usually made a patch of lawn, grew things like zinnias, and longed for a garden in England, particularly with lush green lawns. Marion Pedder, small and energetic, had always kept some sort of a garden, although most of her time was devoted to running the homemade cake shop and restaurant that she kept in Marlow.

"I don't think either of us had ever realized how much joy there was in gardening and how much we would enjoy sharing it with others," said Marion. "We originally planted things which people gave us

until, through the Women's Institute, I had the opportunity to go on a course at the Waterperry Horticultural School. One day a month for six months I went over there during the winter to learn about general gardening. It was so interesting that I went on for another year, learning about more specific things like fruit trees and pruning, and then for a further year working in the greenhouses. We do have a glassed-in bit here, but I've noticed that greenhouses very often get used as storehouses, so I bring up all my seedlings in the kitchen, and then they go on the windowsill. After that, they go out to harden off and to be pricked out and then to a cold frame. That's my routine every year from March onwards. In winter I also use the spare bedroom to store the geraniums."

"Yes, it's a bit inconvenient for visitors sometimes," said Albert.

Laughing, Marion continued: "The things I learned at Waterperry gave me more confidence, and so we both learned plant names, turfed out all the ordinary things from the garden and went in for plantsmanship. Nearly all the books we borrowed from the library were to do with gardening. Christopher Lloyd's book *The Well-Tempered Garden*, for example, is excellent; he's very good because he never hesitates to

say if he's lost things or if he's done something wrong."

"He's very human," agreed Albert. "He's also a great help with lilies and clematis. We've got 19 different varieties of those, although we lost our favorite clematis, 'Elsa Spaeth', this winter. It's a sort of purply blue, you know, with rose-red stripes."

"From the books," Marion said, "we went on and found out about planting and plant associations and types of soil and all that sort of thing."

Said Albert, "Our soil is sandy, with a pH of 7.5—just a little on the alkaline side."

"The soil is so light that our biggest problem in the garden is drought," Marion said, "especially up in the top garden, which we bought from a neighbor 10 years ago. We continually have to water all over in the summer, top to bottom, like painting the Eiffel Tower."

Originally, the top garden was full of old rubbish, all of which had to be dug out (the Pedders got help with that), but it happened to include a large, old piggery bench that now sits as a focal point at the top of the lawn. In this garden, Albert was able to further his lifelong ambition of creating green lawns between curving borders, giving the appearance, as

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A gravel walk leading between free-form beds filled with a variety of plants leads toward the Elizabethan malt house cottage called Yeomans.









YEOMANS







Marion said, of a river of green. The borders were filled with plants like rugosa and shrub roses, barberries, heathers and shrubs, as well as colorful perennials.

Marion herself took over a third of the new part of the garden to create a large vegetable garden on the other side of the border. She loves working in this garden, but confesses to not being very good at making straight rows.

"The only vegetable I ever tried to grow was asparagus," said Albert quietly, "but, despite trying all sorts of advice

LEFT: Pink, white, and purple petunias and tall, fragrant flowering tobacco line an edge of the garden that faces the street. ABOVE: The wall separating the old garden from the new is lined with perennials such as astilbe. The space along the top of the wall is filled with a collection of alpinines.

and types of plants, it wasn't a very successful project."

"But you can see how successful he is with the lawns," said Marion. "His hard work really pays off; Open Day visitors have been known to ask if they could actually walk on them—really! He looks after the hedges as well as the roses and all the spraying. This garden is sheer hard work and dedication for both of us. And bright ideas on his part, like what plants to put where, and why."

"Oh, no," said Albert. "She's got the green fingers, and I come along with the whip."

Another of Albert's successes involved removing the rounded concrete top on the line of double walling that leads from the old garden into the new one. Here he planted a collection of alpinines (well

labeled for visitors) along the top of the wall, including the pink *Diascia* 'Ruby Glow', gentians, dwarf London-pride and some small euphorbias. Perennials grow against the wall.

The border along the lawn immediately by the house has undergone several planting changes. The Pedders tried things like daffodils and annuals first. These were not a great success, so they tried to make the bed wider. However, finding that this would involve the removal of large rocks and slabs, they replaced the soil, put in new compost and planted moisture-loving plants like hostas, astilbes, *Lobelia cardinalis* and, on the wall, the early-flowering *Clematis macropetala*.

"We don't always agree," said Marion, "but we do like





the same sort of colors. This garden is not very big, so you have to be very careful about what you plant, and our overall idea is to have color all the year round, if at all possible.

"At either end of the year, we can stand at the top of the garden and look down through the heathers and the rose hips to the house and the two lawns below. We love the hips on the *moyesii* roses, which are bright red, and the [*Rosa sweginzowii*] has huge, orangey, flagon-shaped hips. The nerine lilies [*Nerine* sp.] come out in October in the warmest place—

TOP: Columbine and hostas fill a niche in a corner of the garden. ABOVE: The walls of the house are festooned with a variety of climbing roses. RIGHT: Shrub roses, hybrid lilies, campanulas, peonies, foxglove and a host of other plants bloom in gay abandon during the English summer.

at the top, by the wall; they are pink, on a tall stem, and I can take them into the house and they will last for a month. The kaffir lily [*Schizostylis* sp.] is another October flower, reddish pink like a small gladiolus. But, for a long-lasting show of color, we'd never be without potentillas, which flower all summer long."

Marion continued: "I keep a five-year diary, and last year we decided to record the flowers that were out and the progress of the seedlings so that we can compare from year to year. I write it in bed every night and often find that we have done exactly the same thing on the same day each year.

"Gardening often means driving yourself out into the garden to do things at the right time, say, in a howling gale at

the end of February to prune the clematis or the roses. When the snow comes, you have to shake it off the conifers, and your hands and feet get so cold. The rewards do come later."

"Yes, we both love gardening and are thankful for it, but because of our ages (Albert is 79) we shall inevitably have to cut down on the amount of work, so we are planting more shrubs and cutting down on the annuals. This winter has killed a number of shrubs and many roses, especially the climbers and the early clematis on the walls on and near the house. This has meant a lot of new work and difficulty in replacing, so there are not quite so many ambitious plans for the moment." ❀

Jerald Harpur is a photographer/writer living in Essex, England.













# Bee Balm

BY JEANNE GOODE

**F**rom early summer to early fall, fragrant bee balm, *Monarda didyma*, brightens woodlands from Quebec to Georgia and westward as far as Michigan. It is a striking plant—one of the most beautiful of our native wildflowers. Plants can reach a height of four to five feet, and clumps can be four feet in diameter. Each squared stem is covered with soft, woolly leaves and topped by great, ragged clusters of tubular scarlet flowers. Often the upper leaves and surrounding bracts are red or bronze as well. A flourishing colony is spectacular, especially when reflected in the waters of a stream or lake. Crowds of bumblebees, butterflies and ruby-throated hummingbirds add motion, sound effects and even more color to the scene as they feast on the abundant nectar that bee balm provides for them.

Beautiful, hardy and undemanding, it is no wonder that bee balm became a popular garden plant soon after it was introduced into cultivation in eighteenth-century England by the noted plant collector, Peter Collinson. Collinson's garden at Mill Hill in Middlesex was noted for its New World plants. "Very few gardens, if any, excell mine at Mill Hill for the rare exotics which are my delight," he wrote proudly. A good many of these exotics came to him from his friend John Bartram, our first American-born botanist, who traveled up and down the Eastern Seaboard collecting for avid English plant lovers. Bartram had collected seeds of bee balm near the town of Oswego, New York in July of 1743, after a refreshing swim in Lake Ontario. The seeds, sent to Collinson soon after, sprouted successfully, and bee balm bloomed at Mill Hill for the first time in 1745. By 1760, Collinson was able to report that there were "plenty in Covent Garden Market." This was a matter of some satisfaction for him, since an earlier introduction of the plant had not survived.

Bee balm quickly became a fixture in gardens all over England and Europe. It was popular among practical colonial gardeners, too, since it was useful as well as beautiful. The plant belongs to the genus *Monarda*, named in honor of Nicolas Monardes, a sixteenth-century Spanish

physician who, in 1569, wrote a book describing the medicinal plants of the New World.

There are about a dozen species in this North American genus, which is in the Labiatae, or mint family. Several of them have medicinal properties. The Indians taught early settlers to make a stimulating, aromatic infusion from the leaves of *M. didyma* that was used to relieve fevers, colds and sore throats, and the plant became known as Oswego tea. The volatile oil derived from the plant was diluted with olive oil or soap and applied externally to relieve chronic rheumatism, and the same oil was used to perfume hair tonics made from bear's grease. Important in the pharmaceutical industry as late as 1950, monarda oil has largely been replaced by other substances. However, it is still widely used in the manufacture of perfumes and perfumed soaps.

Today, bee balm is grown chiefly as an ornamental. The wild species is a valuable addition to increasingly popular wild or woodland gardens. In more formal settings, the numerous cultivated varieties and hybrids, mainly derived from *M. didyma* and white- to purple-flowered *M. fistulosa*, are preferred. They offer more compact growth and larger flowers in a wide range of colors. 'Cambridge Scarlet' has brilliant scarlet flowers, and 'Mahogany' is a rich, deep red. My favorite, 'Adam', is a cheerful cherry red, while 'Croftway Pink' is a lovely rosy pink. 'Alba' and 'Snow Queen' are white, as you might suspect; 'Snow Queen' is particularly free flowering.

Bee balms are at their best when massed near a brook or stream—not because they need unusual amounts of moisture but for the splendor of the reflection. They are good as bright accents against a darker shrubby background, too, and have been the mainstay for the back of the herbaceous border ever since our great-great-grandmothers first planted them and gathered their long-lasting, fragrant branches and flowers to grace the parlor table. They are certainly appropriate in the herb garden, whether you drink the tea or not. Peter Collinson described its taste as "not unpleasant."

One very pleasant thing about bee balm is that it is easy to please, growing happily in any kind of soil that is fairly rich and moist, in full sun or partial shade. Growth is not exactly rampant, but it is vigorous, and the plants need space; a small specimen of two or three stems will fill a four-foot area in three or four years. Underground runners move from the center outwards and send up new stems. By the fourth or fifth year, the stems in the center will decrease in vigor. These can be discarded, and divisions can be made from the outer sections every four years or so. However, if your bee balm is growing where there is plenty of room for expansion, such major division and replanting will not be necessary. Simply remove the tired center stems and replace them with a couple of youngsters from the outer ring whenever necessary, and you can keep a clump going indefinitely. If you want to restrict a plant to a small area in the perennial border, poke several holes in the bottom of a plastic dishpan, sink the dishpan in the border, and plant the bee balm in the dishpan.

Varieties of *M. didyma* can be grown easily from seed. Seeds sown in July will produce good-sized seedlings by September for planting in a sheltered, mulched nursery bed. The following April they will be ready to set out in permanent positions.

Mildew can be a problem if the planting site lacks good air circulation and the summer is unusually wet. Affected plants, cut back to three or four inches after blooming, will revive and bloom again in September. Winterkill is another occasional problem, because bee balm is shallow rooted; a deep, permanent mulch and regular applications of compost will prevent this and will also help keep the soil moist and rich.

Bee balm is often considered an old-fashioned plant, but for me, that is a large part of its charm. If you love flowers for their associations as well as for their beauty and fragrance, you will grow this one gladly, and you will surely make the bees, butterflies and hummingbirds happy, too. ♻

Jeanne Goode is a free-lance writer whose articles have appeared in *Horticulture* and *Garden*. She gardens in Yonkers, New York.



# The Bickelhaupt Arboretum

BY MARY COAKLEY SMITH

Bob and Fran Bickelhaupt are devoting their retirement to a surprising variety of activities: snipping faded blooms in their naturalized daffodil planting; pruning lilacs, sometimes before breakfast; supervising the annual burning of a small restored prairie; weeding ground cover test plots; and keeping detailed records on all of their horticultural activities. The usual activities of retirement did not appeal to this unique couple, who chose instead to dedicate their resources and the remainder of their lives to a different world of challenges and opportunities.

While still in their early fifties, the Bickelhaupts decided the world had been very good to them, and they wanted to redirect their efforts to benefit others. "We both had a wealth of experience with volunteer work in church and hospitals, and in industrial development and business associations," they explained. (Bob was owner/manager of Bickelhaupt Motors before his retirement.) "So we knew that what we wanted to do with the rest of our lives was to find a worthwhile cause and develop it. After walking 90 miles and more through the city of Clinton, Iowa, where we had spent our entire lives, we were appalled at the devastation caused by Dutch elm disease and the need for renewed beautification. We felt that the grounds around our home could be developed into a public arboretum for the people of eastern Iowa and western Illinois."



ABOVE: Fran and Bob Bickelhaupt, founders of the Bickelhaupt Arboretum. RIGHT: The plant conservatory, formerly the family's indoor pool. In the foreground, ground covers line the steep banks of Rock Creek.

With characteristic thoroughness they investigated the idea. Although it may have seemed to neighbors that the Bickelhaupt garden simply grew without effort, countless inquiries and much research went into the proposed project before a final decision was made to proceed with the venture. In addition to carefully studying the legal aspects involved, Bob and Fran visited arboreta and botanical gardens across the nation.

During the early phases of planning, the Bickelhaupts were also involved with organizing a Heavy Duty Truck Dealers Association, which involved coast-to-coast travel. This gave them an opportunity to collect data and information from nearby gardens wherever they were visiting. Methodically, they observed these gardens and consulted with personnel, all of whom showed interest and were extremely helpful, according to Fran.

After reviewing the information they had gathered, Bob and Fran were convinced that the most important aspect of organizing their arboretum was to keep excellent records of all details. The history of each plant in the arboretum would be extremely valuable, they reasoned, and from the beginning every plant was properly accessioned, recorded and labeled with permanent markers. The Bickelhaupts maintain their plant records on the computers at the Plant Sciences Data Center of the American Horticultural Society. They have found that

The usual activities of retirement did not appeal to the Bickelhaupts; instead, they chose to develop the grounds around their home into a public arboretum.





Photos by Mary C. Smith



maintaining computer records of their collections has helped them enforce the discipline required for good record-keeping.

Furthermore, the store of information would be of inestimable value to international horticulture, they believed. "Unless a given plant has a recorded history, its value is limited," Bob said. "We would any day rather be out pruning, mowing or planting in the garden than inside keeping the records up to date, but it is a discipline we insist upon," Fran added. "We do not even allow ourselves the pleasure of tearing open a packet of slides, no matter how anxious we are to see them, until we have at least an hour to catalogue and cross-reference 20 slides."

Daily journals are catalogued: "No one gets supper until the daily entries are made," Fran said with a smile.

The Bickelhaupts felt that a grid layout of the entire arboretum was also important. Thanks to their foresight, they can now pinpoint any plant at any time. In the garden, permanent markers designate each 70-by-100-foot grid, while on a map in the Education Center, every plant in every grid is noted, along with the location of water hydrants.

Only native plants or those proven hardy in Iowa's winters earn precious space in the 13-acre Bickelhaupt Arboretum. Oaks, ashes, maples, sumacs, birches, poplars and willows thrive. The conifer collection includes species and cultivars not often found in area nurseries; it is hoped that visitors who are exposed to these selections will create a demand for them. Stretching down one slope, a large planting of ornamental landscape shrubs and a viburnum collection provide a long season of color, starting with the bloom of witch hazel, *Hamamelis* sp., in February.

Collections and areas of special seasonal interest include April-flowering crabapples underplanted with thousands of daffodils (5,829 blooms one season, according to Fran's count), lilacs in May and the prairie restoration in late summer. The grass beneath the crabapples is cut only in November, thus providing not only an attractive meadow but also a place for nesting meadowlarks.

A natural amphitheater in a grove of bur oak trees gives one the feeling that it has been there forever. Its unique quality attracts not only its owners but also those who hold church services there. Many weddings are scheduled at this site; lilac time is especially popular. Wedding parties approach the setting through an aisle in the lilac garden, over a footbridge and on to the oak grove.

Owners of today's smaller home properties can appreciate the dwarf garden that adjoins the lilac garden. Most of the proposed 163 conifers and 76 deciduous shrubs are established. If specimens grow too large to be considered dwarfs, they are removed.

The prairie restoration is proving to be as popular in the late summer as the crabapple and lilac displays in the springtime. "It is something different and a rare sight in our cultivated countryside," said Fran. "There will be more prairies," Bob added, "considering the number of inquiries from others who are interested."

Visits to the 6,000-square-foot prairie have resulted in at least two prairie plantings in the nearby Quad-Cities, one at Hansen School in Rock Island and another at Butterworth Center in Moline. Bob also knows of several individuals who have started mini-prairies in their own back yards.

The original plans did not call for the use of valuable space for a prairie display. However, as Bob explains, "Along came the energy crunch, and so we thought the prairie would be of



Photos by Mary C. Smith



Photo courtesy of Bickelhaupt Arboretum

ABOVE LEFT: Pines and maples, fronted by blue-flowered *Ajuga*, form part of a windbreak planting. ABOVE RIGHT: A group of fifth graders on a visit to the Arboretum. BELOW RIGHT: The Arboretum boasts a collection of flowering crab apples as well as a display of small flowering trees (foreground).

BELOW LEFT: The Clinton, Iowa Fire Department supervises the annual burning of the 6,000-square-foot prairie restoration.

public interest, since it would demonstrate a way of saving energy in terms of both fuel and labor." The Bickelhaupts were also motivated by a desire to show what our all-but-vanished prairies look like and how plants of endangered species might be preserved. With these ends in mind, they have made their literature, prints and slides of the prairie, as well as the planting board used in sowing the seeds, available to the public.

The prairie site was prepared in 1976, and in 1977 it was sown with seeds of native grasses and forbs that Bob and a local prairie authority, Dr. George Aurand, collected within a





20-mile radius. A small amount of additional seed was collected about 50 miles away. Sixty-one kinds of seeds were planted in all. During the first growing season, 73 hours were spent weeding; the prairie plants had taken over by the final weeding of the season, in late July of the first year. Burning each year in early spring is the only maintenance now required. Last year Bob clocked the Clinton Fire Department, which performs the task, at 124 seconds.

Gazing over the restored prairie on a breezy Iowa day, it is not hard to visualize the grandeur of a larger prairie. The rustling of the tall grasses and the colors of the late wildflowers are enough to make a person long for the simpler ways of an earlier era.

The natural topography of the Arboretum grounds also lends itself to the displays of ground covers found in many parts of the garden. Bob believes that ground covers will become more and more important as a means of beautifying home grounds while saving precious energy and reducing

maintenance. He is concentrating on those plants that are hardy, easy to grow and economical to maintain in the Upper Midwest. As part of his plan to make ground covers a major feature of the Arboretum, Bob will add at least 50 more varieties to the 105 already established.

To preserve the terrain, ground covers have been established on the banks of Rock Creek, which meanders through seven oxbows, from the northwest to the southeast corners of the property. Some of the banks are very steep, and during extremely heavy rainfall the creek will rise from an average depth of two feet to a crest of 10 feet.

Yellow archangel, *Lamiastrum galeobdolon* 'Variegatum' (formerly *Lamium galeobdolon*), holds one steep bank and covers it with yellow blooms in May. The statistics available on this bed serve as an example of the Bickelhaupt's detailed record-keeping. Six-inch plants, set out on May 12 on north-facing banks, were spaced on 18-inch centers. The slope is, horizontally, 13 feet with a nine-foot drop. The bed is 16 feet by 30 feet long. It was planted in six hours and 45 minutes with an auger and trowels. In June, July and September four hours were spent hand weeding. Plants grew to a two-foot spread in one month and later required very little weeding.

Self-sufficient ground covers, such as a healthy stand of ajuga, beautify a corner grouping of evergreens, and pachysandra covers the ground beneath a row of white pines. Hostas, vinca and sedums carry on farther down the ridge. A magnificent planting of ivy, its evergreen appearance welcome in winter, sets off shrub plants. Many evergreen varieties cover one slope, while others embellish rock walls. Detailed records are kept of the planting and development of each ground cover.

With both daughters grown and no longer living at home, the Bickelhaupt's were able to adapt their large residence to the needs of the Arboretum. Aside from their living quarters, there is the Education Center/Library, formerly the family room, where a photographed family history is part of the decor. This large room comfortably seats 65 people and contains audio-visual materials, microfiche, slides, herbaria and complete plant record-keeping facilities. Off to one side is the maintenance shop and equipment area, and up a few steps in the other direction is the indoor plant conservatory, formerly the family indoor pool, where Bob and Fran still keep fit with a daily swimming session. A potting room and cistern have been added to the back of the Arboretum to accommodate additional activities and storage.

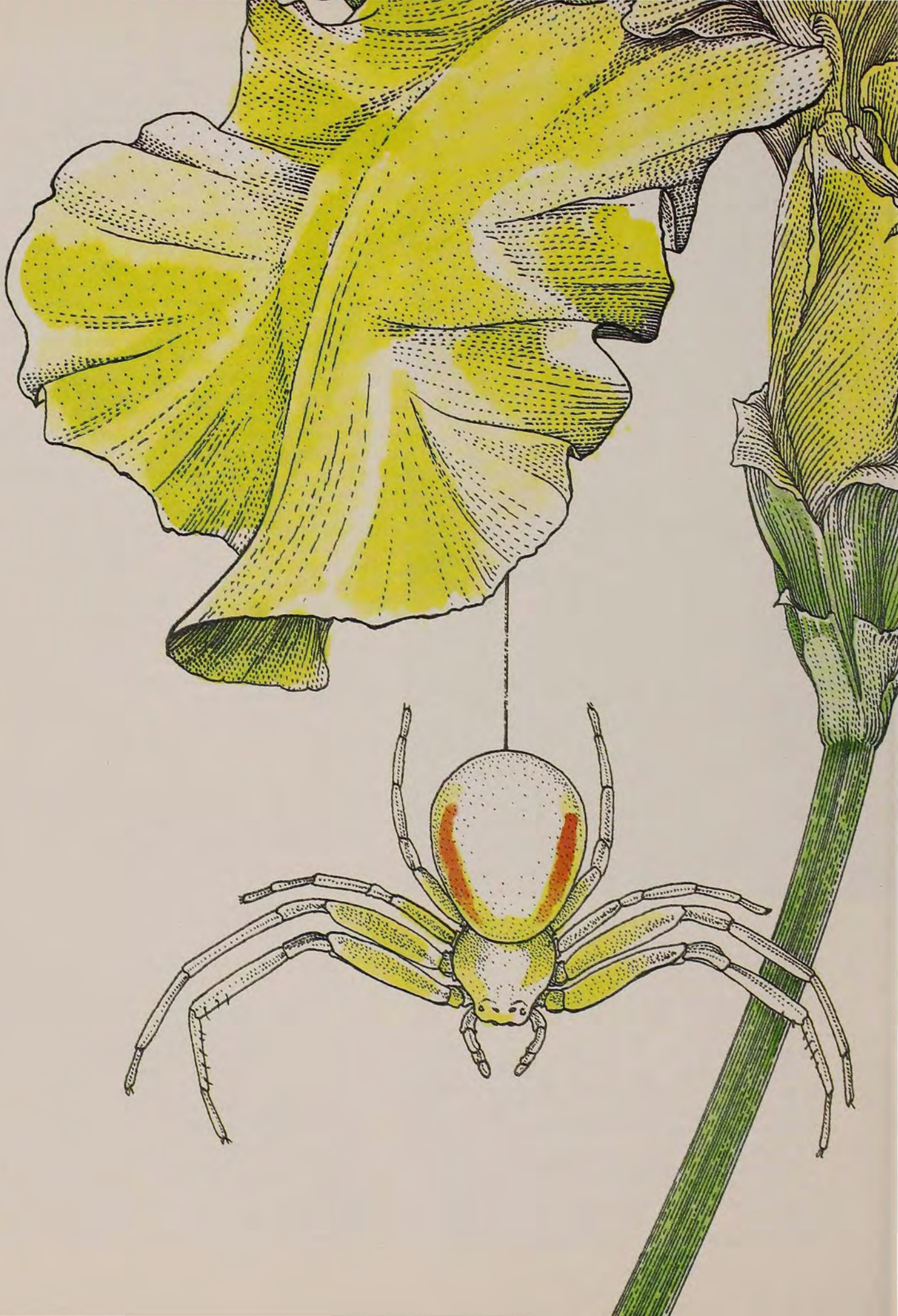
Bob and Fran not only live in the midst of their garden, they don work clothes daily and become hard-working gardeners in the heat of summer as well as in the cold Iowa winters. Obviously, 13 acres soon proved to be more than they could handle alone, so they employed a full-time gardener from the area for several years. In the summers, they employ students for on-the-job training. Now in their late sixties, the Bickelhaupt's are gradually turning the reins over to two younger employees, Joe Hill and Steve Van Akkeren. Hill currently serves as assistant director of the Arboretum, while Van Akkeren is the Arboretum's horticulturist.

Garden columnist and head volunteer Thelma Abbott, who developed the indoor plant collection, serves as plant consultant. There are now a total of 12 qualified volunteers who help the Arboretum staff.

According to Fran, the aim of the Arboretum is basically educational. An important aspect of the Bickelhaupt's work

*Continued on page 43*







# SPIDERS

## IN THE GARDEN

TEXT & ILLUSTRATIONS  
BY PETER LOEWER

**T**hey have the distinction of being among the most hated of all creatures, and yet they are a fascinating and unique group, granted a scientific classification all their own. Although often mistakenly thought of as insects, spiders are arachnids. All spiders have eight legs and are wingless, as opposed to the six legs and one or two pairs of wings that are characteristic of the insects.

Spiders have no true jaws and cannot chew. They must take their food by sucking the blood of their victims rather than masticating them as the insects do.

Spider eyes are simple; that is, each eye is covered by one cornea—as in man—and not faceted like the insect eye. Nearly all spiders have eight simple eyes.

And of course spiders have silk organs. Insects do, too, but spiders have the most complicated known. With these organs they spin egg sacs, draglines, temporary homes, strong webs for scaffolding and sticky webs for holding prey.

Spiders build irregular nets, sheet-webs, funnel-webs and orb-webs. Many spin no webs at all.

They are generally timid, content to follow the spider path.

The following four spiders (and one close relative) are all found in gardens.

### THE CRAB SPIDERS

Crab spiders are exactly what their name implies; not only does their disposition seem testy at best, but they also move back and forth, side to side, with the type of movement characteristic of their larger crustacean relatives. Like crabs, these spiders do not trap food but instead lie in ambush, their flattened bodies easily fitting into tight

LEFT: Crab spider, *Misumena calycina*, hanging from an iris blossom. RIGHT: A jumping spider, *Salticus senicus*.

places, usually where flower petals join or leaves clasp the stem. They can be so patient as they lie in wait that you can cut flowers for a bouquet, gather the blooms in a basket, trim the stems in the kitchen sink, put the flowers in a vase for an honored spot at the dinner table, and only then see a crab spider, wondering where the garden has gone, hanging by her dragline right over Uncle Fred's cup of consommé. And Uncle Fred is usually the only relative with an unnatural fear of spiders.

Their aggressive nature, coupled with a very strong venom, gives them the ability to attack insects far larger than themselves. I was once amazed to see a thirsty wasp, lingering over a drop of water that lay near the attachment of a daisy petal, suddenly confronted by a much smaller crab spider; after a brief scuffle, the spider won.

Although crab spiders do not have the fine vision of jumpers and wolf spiders, studies suggest that they are able to see colors. A. S. Pearse, the American ecologist, noted that 84 percent of white crab spiders studied were found on white flowers, while 85 percent of the yellow species were seen on yellow flowers.

*Misumena calycina* (or sometimes *vatia*) is the common crab spider of North American gardens. In addition to the other traits of the tribe, *Misumena* has the ability to actually change color to match the flower it is on. Willis J. Gertsch, in his classic book *American Spiders*, wrote in 1949: "The ability of *Misumena calycina* to change its color from white to yellow and vice versa was first noted about seventy years ago. This fact engaged the attention of many naturalists and led in some instances to erroneous application of the same principle to other spiders on little evidence, to fantastic claims of change through many hues that have no basis in fact. It can easily be demonstrated, however, that *Misumena*

*calycina* and many of her cousins can change, in the course of a week or more, from white to yellow on a yellow flower or an artificial yellow substratum. The action is reversible, usually requiring only five or six days."

Despite the crab spider's somewhat aggressive nature—notable even for spiders—it should be mentioned that the female is especially well known for her slavish adoration of her egg cocoon. She will guard it with her life, day after day, until she hears the first rustlings of the eggs beginning to hatch. Only then does she cut a hole in the silk, allowing the young to escape. She then promptly dies.

### THE JUMPING SPIDERS

It's a warm afternoon in the garden. Since one o'clock, the edging around the iris bed has been trimmed, piles of pruned branches and twigs have been removed to the compost heap and the brow has begun to reddened a bit, both from welcome sun and





some exertion. It is time to sit back in the freshly painted lawn chair and plan the rest of what promises to be a fine day in late April.

Flies swarm around the white, warm clapboards of the house. A few bees drift about the top edge of the rock garden, looking into every *Allium* bloom, and the ever-present wasps circle about the gutter and the eaves. But there is a closer movement just above your left ear: a small black dot that climbs about the chiseled edge of the top of the chair, stops, then moves again. Not a fly, or a bug or a beetle; it is too small and too direct, and it seems to watch your every move.

You slowly turn your head and see a brightly white-and-black-striped spider looking directly at you with a deliberate stare, yet it is scarcely the size of a tack top. The collar of your shirt shifts as you nervously jerk your neck, and two large and beady eyes follow; move your shoulder a few inches back, and the spider darts a few inches closer. You're being hunted by one of the most developed and most amusing members of the spider family: the Salticidae, or jumping spiders. No patient and slowly creeping insect here; no curling up in a web to wait for prey. This spider is the leader of the pack.

The spider described above is the most common jumping spider in the United States and England: *Salticus scenicus*, the zebra spider. The family is one of the largest, and members have been found in all parts of the world except the polar regions, with species numbering in the thousands.

*Salticus* has traded life in a web for the keenest eyesight in the spider world. Its eight eyes are set in three rows; the four in the front row are large—especially the center pair—while the rest are tiny, little

drops of jet. And make no mistake: those eyes can see at least a foot with clarity, while the shifting images formed by the total eight give the spider a perception that reaches a far greater distance.

Jumping spiders live to hunt and are therefore curious about every movement that they see. Able to leap long distances in a single bound, they lay a dragline wherever they go. If they miss the jump from leaf to branch, the dragline saves them, and they climb back up and try again.

If you are patient, you can coax one to sit upon a finger tip and get close enough to see those black and sparkling eyes. But get too close, and jump it will.

John Crompton, in his book *The Life of the Spider*, wonders why there are trained fleas but not trained jumping spiders. Naturalists have trained *Salticus* to jump onto waiting fingers for food, then to jump from hand to hand until a leap of eight inches was achieved. "So," says Crompton, "the thing could be done."

In addition to their agility in jumping, another gift from nature allows these spiders to climb sheer rock and polished glass. All other spiders are unable to hold tight to smooth surfaces, but jumpers have tiny pads of adhesive hairs on the tips of their feet enabling them to go where they will. You'll often find another species of spider that has slipped into a basin or tub and is unable to climb back to the top—but never *Salticus*.

Nights are spent in tiny silken sleeping bags sheltered by leaves, by stones, or in the corner of a house, safe in clapboard crevices. You will find larger spiders in the house and garden, but none friendlier than *Salticus*. And considering the insect pests that they consume, they are more than worth their weight in gold.

## THE WOLF SPIDERS

Winter comes early to our mountain home, and it stays late. We have a January thaw, but we pay dearly for those few days of comparative warmth; either snow or sleet, with cold fronts that come along for the ride, visit until late March.

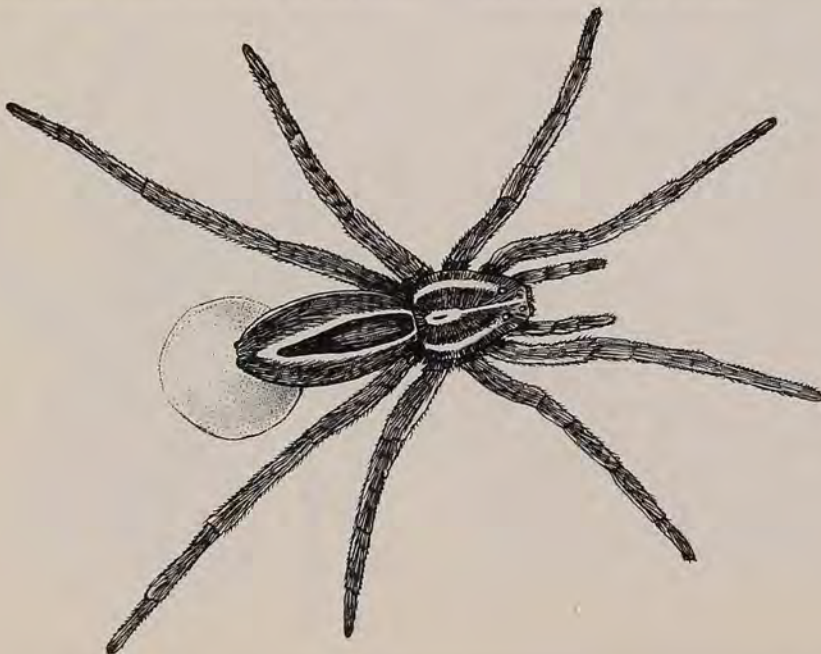
But every year we see a sign of spring next to the woodpile in the living room, usually in mid-February—about the time that maple sugaring begins. The sign must be seasonal, since that corner of the room is warmed by the fireplace that burns continually from the twentieth of November to at least the fifteenth of March.

Just out of the corner of the eye, one sees a sudden movement as a small sleek spider scuttles up the chimney, silhouetted against the white-painted concrete blocks. It's a handsome spider with a body about half an inch long, covered with a well-groomed coat of fur colored black, gray and brown. He stops midway up the chimney for just a moment, as though checking to see if his compass is in order, then darts either to the left or right, and then quickly back to the safety of the woodpile.

*Lycosa* (from the Greek for wolf) is the name of our visitor. His temporary home is probably under the floorboards or down in the basement close to the chimney. We see him as he checks out a new addition to the woodpile, hoping for a few insects that might be hiding under the bark. He might be making these forages all winter long, yet we only begin to see him as thoughts turn to spring. Most wolf spiders live much longer than one year, and ours would be foolish to give up a good home for a cold spot out in the woods or garden.

As spring approaches and nights outside are only cool, not cold, *Lycosa* goes out to the garden, departing through one of the many exits in the unmortared fieldstone of our house foundation. He spends his summers in the garden with others of his kind, usually beneath the flat rock wall of the scree bed.

These spiders are true hunters, purging the garden of pests throughout the summer and fall. They have exchanged the spider web for very good eyesight and strong legs that move with great speed. Their fearsome heads have four small eyes that look slightly down from the front of the face and a little to each side. Just above these are two larger eyes pointing straight ahead, and on the top of the head, two more look up. Thus, wolf spiders are able to see in four directions at once and are known to be able to focus on a future dinner at a distance of several inches.







Later in the season, after mating, the female spins an egg sac of spider silk. Once full of eggs, the sac is often as large as the spider's body, and she will carry it wherever she goes.

I usually scare a wolf spider every day while working in the scree bed, and startle two more as I weed the rock garden. They will dash for cover, holding the precious bag over their heads. Later, when the eggs hatch, the young will ride about on the mother's back for a week or so before they leave the immediate area by ballooning.

In the words of John Crompton, "The little spiders hurry on. They run up short grasses and down again and try others. Already some have reached the tops of railings or tall herbage. It is as if each one carried a banner with a strange device—Excelsior! Shortly, they go higher still. One by one, like prophets snatched to heaven, they are ascending into the blue without apparent agency."

It is interesting to note that the fearsome spider of folklore—the spider that could with one bite send the victim into a frenzy of uncontrolled spastic torment, the "tarantula dance"—is a large European wolf spider, *Lycosa tarentula*. Recent findings suggest that such dances were performed by willing peasants for tourists and that

the magnitude of the bites' symptoms were in direct proportion to the fee paid for the performance.

## THE ORB WEAVERS

When spiders are mentioned, most people think of the aerial web spinners, those builders with spider silk that have given up speed, sharp eyesight and unusual strength, and replaced them with the instinctive gift of making gossamers of amazing durability—webs to trap and ensnare living food. Instead of wandering about in search of prey, these creatures sit quietly in the web's center or concealed in brush nearby and wait for the food to come to them.

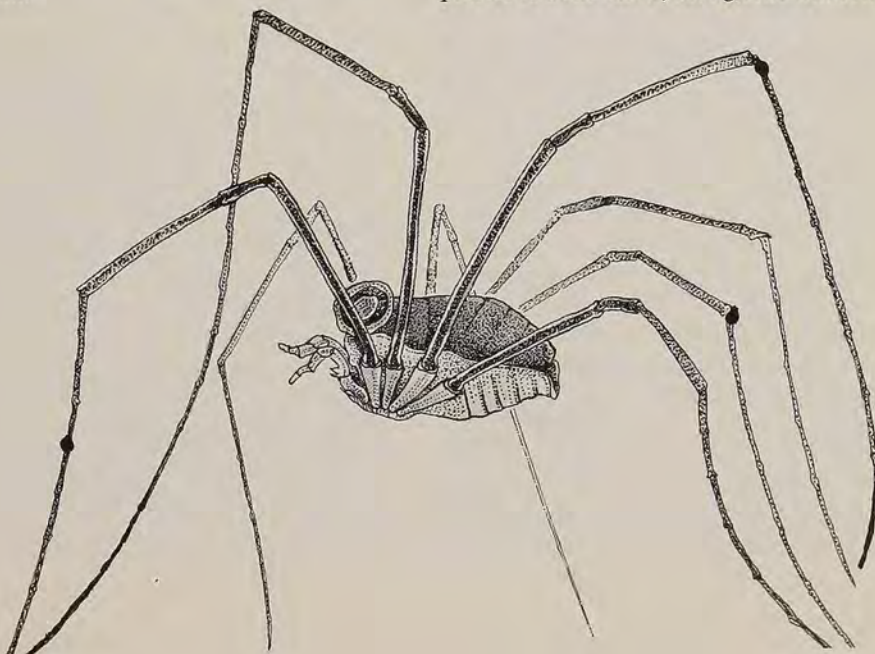
There are many kinds of web spinners: some make horizontal webs that infest corners of the house, gathering dust in addition to insects; others, like the infamous black widow, *Latrodectus hasselti*, have earned a place in spider folklore of such magnitude that no thought is ever given to their maze-like web but only to their power to kill. Contrary to popular belief, the black widow does not always eat its mate, and there are very few recorded cases of its bite being lethal to man. Some webbers are drab, colorless and small, preferring to spin their webs in dark cellars, while others—large and brilliantly colored—sit with aplomb directly in the center of the web and dare all to come near.

An example of the latter is the common garden spider, *Argiope aurantia*. With a body of velvety black usually an inch in length and marked with bright orange or yellow spots, it occupies the center of a web two feet in diameter that is strung between plants or shrubs in the garden or tall grasses in the meadow.

*Argiope* is so fond of her web that she adds zigzags of a heavy white silk, called stabilimenta, across the middle to warn small birds and large butterflies to steer clear. Such warnings seem to work, as these creatures have been seen swerving and flying over the webs.

When I was young I believed these spiders were among the most fearsome creatures in the world. But I learned over the years that their eight eyes are so weak that they cannot comprehend me, and that their only interests lie in food and mating. Their bite is usually less toxic than that of a wasp, and these spiders must be severely pushed to even begin to sever the skin, at least in most of North America.

If her web is severely damaged, *Argiope* prefers to build anew, though she will con-



ABOVE: A common garden spider, *Argiope aurantia*, sits in the middle of her web.

LEFT: A wolf spider, *Lycosa* species, holds a silken egg cocoon beneath her abdomen.

RIGHT: Harvestmen, also called daddy longlegs, are close relatives of spiders.



## SPIDERS IN THE GARDEN

duct minor repairs if the damage is not extensive. It only takes about an hour to replace the whole affair, and construction generally starts at twilight so all is ready

for the next morning.

*Argiope* can be teased by tapping a leaf at the outer edge of the web; she quickly runs to the affected spot, guided by an

unerring instinct for tracing vibrations. Do it too many times, though, and she will just sit still, in an apparent sulk.

When an insect (*Argiope* is especially fond of grasshoppers) does become entangled, she responds to the feel of the victim's struggle. If small, she quickly kills it. If large, a bit more discretion is called for. While a few legs hold the prey, the others wind the panicked victim's body in a tomb of silk. When all danger is past, she bites it and injects a massive dose of poison. She then begins dinner at once or waits for a future time, depending on her appetite.

The males of this genus are smaller than the females and start life in the spring by building a smaller and much less accomplished web. Soon they give it up and move to a place at the outer edge of a female's web, living on leftovers and waiting to mate in the fall.

As the days grow shorter and the nights cooler, *Argiope* produces a great number of eggs. She carefully wraps them in a bundle of silk, which is then suspended within the framework of a bush, plant or shrub and tied with so many loops of thread that the roughest of winter winds will not tear it loose. Then, with the first killing frosts, the adult spiders die.

### CONSTRUCTING A WEB

After finding the "perfect" place for a web, the spider begins by constructing a horizontal bridge. In this case, a female climbs up a branch, stops, aims for a second branch, and shoots a line out into space. She waits for it to take hold, and when held fast at the far end, she pulls the line taut, and the first bridge is formed (A).

Now she walks down to a lower point on the left branch and attaches a new line. Holding it carefully in two of her legs to prevent it from tangling on the bark, she spins as she moves back to the bridge and then across and down the right side, where she again reels in the slack and completes a second bridge roughly parallel to the first (B).

Next, left and right sides are added, forming a rough trapezoid.

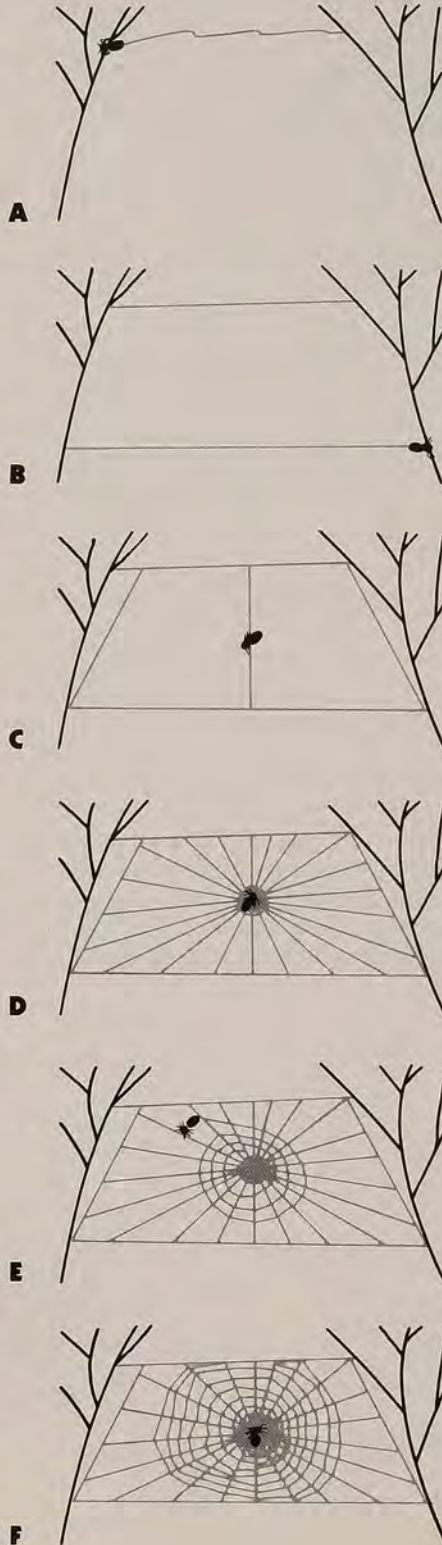
She walks back to the center of bridge one, jumps down to the second bridge, trailing silk behind her, then bobs on a plumb line. Once it's secure, she walks halfway back along that vertical, and, choosing a spot close to the center, marks the hub of the web (C).

Now it's time to form the radii or spikes that stretch to the outside frame. Working first one side, then the other, always keeping the lines in balance, she lays some 20 of them by dragging silk from the hub to the frame over existing lines, neater than a student sectioning a circle in geometry class (though some spiders, for no obvious reasons, will do a careless job). When finished, she moves back to the center and spins extra webbing to thicken and strengthen the hub (D).

Walking in a counter-clockwise direction, she lays a wide spiral of silk across the center half of the web, a scaffold to hold the foundation lines in position as she completes the spinning (E).

Until now the lines have all been dry, not sticky, but work now begins in earnest. Starting at the outside of the frame, she lays a new line speckled with glue, each turn taking her closer to the hub. When she reaches the scaffold, she deftly removes it, putting a sticky line in its place.

The "parlor" is now complete (F).



### THE HARVESTMEN

Harvestmen, or daddy longlegs, are not true spiders. They lack a separate head (or cephalothorax) and abdomen but instead have both in one body segment. They have only two eyes and have no spinning glands at all. Still, they are close relatives of the spiders, and because of their eight legs they are often thought of as spiders.

These daddy longlegs sometimes kill tiny insects for food but usually feed on the dead and ingest juices from overripe fruits and vegetables. Although they are found in abundance from late spring to the first killing frosts, most people remember seeing them at harvest time; hence the common name.

Adults die in the fall, although a few might overwinter in the southern regions. Their eggs, buried in the ground, will hatch with the warming days of spring. At first the baby harvestmen are very small and take to hiding under rocks and leaves. They are also nocturnal and wander about at twilight looking for food, slowly growing larger. Then in the early days of fall, as the days shorten, we become more aware of their existence.



# Sources

Although their legs are long, they usually walk with them bent in such a way that the body hovers just above the ground.

You will often see tiny red spots cluster at the joints of the legs of many harvestmen. These are tiny parasitic mites, which are also closely related to the spiders. Their relationship is akin to that described in the popular poem:

*Little fleas have lesser fleas  
Upon their backs to bite them;  
Lesser fleas have smaller fleas,  
And so ad infinitum.*

## BALLOONING

On one of those golden days in late spring or fall, a day when skies are crisp and blue and morning dew still sparkles on the fields, newly hatched spiderlings take wing on fresh breezes to see the world. Although it's claimed to be just instinct (and reason tells us so), the spider's search for new territory appears as thrilling as any journey with an unknown destination.

Leaving the protective shell of the family cocoon, which is packed with hundreds of still-opening eggs, the almost weightless hatchlings walk upward toward the sun, climbing branches and blades of grass or flower stems and garden fences, always toward the light. Then, at the summit, they point their abdomens toward the sky in what could be termed a foolish posture, but one with great rewards. Shooting out a filmy gossamer balloon, they are caught on rising tides of air and fly away toward new horizons.

Their journey may be short or long. Some sail far out to sea, 200 miles or more, before their tiny rope is caught in the rigging of a ship. Others, once aloft, fly over mountains and across plains, and a few, like boomerangs, return to where the ride began after minutes in the air. Most never soar higher than 300 feet, but sometimes a hardy few reach two miles, holding fast to their shining thread, waiting to land in a new field or garden.

Occasionally an older spider, still not too large or fat, can be accidentally caught in a rising wind and be blown far away from the home web. Others, seemingly tired of familiar fields, back into the wind and sail away. ☉

Peter Loewer is a botanical artist and scientific illustrator who writes and illustrates his own books. He is the author of *Peter Loewer's Month-By-Month Garden Almanac*.

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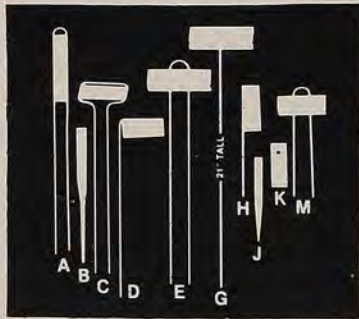
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# Pronunciation Guide

The accent, or emphasis, falls on the syllable that appears in capital letters. The vowels that you see standing alone are pronounced as follows:  
 i—short sound; sounds like i in “hit”  
 o—long sound; sounds like o in “snow”  
 a—long sound; sounds like a in “hay”

*Alchemilla* al-che-MILL-ah

*Aleurites cordata*

al-your-RY-tees cor-DAY-tah

*A. fordii* a. FOUR-dee-eye

*A. moluccana* a. mol-luck-KAY-na

*A. montana* a. mon-TAN-ah

*Amelanchier* am-el-ANK-ee-er

*Clematis macropetala*

CLEM-ah-tiss/clem-AT-iss macro-PET-ah-la

*Codiaeum* co-DI-ee-um

*Croton eluteria* CROW-ton el-you-TER-ee-ah

*C. lacciferus* c. lac-SIFF-er-us

*C. linearis* c. lin-ee-AY-riss

*C. monanthogynus* c. mo-nan-tho-JY-nus

*C. tiglium* c. TY-gee-um

*Diascia* dy-ASS-cee-ah

*Euphorbia antisiphilitica*

yew-FOR-bee-ah an-ti-syph-ill-IT-i-cah

*E. intisy* e. INN-ti-sy

*E. tirucalli* e. ty-ru-CALL-eye

*Fothergilla gardenii*

foth-er-JILL-ah gar-DEN-ee-eye

*Hamamelis* ham-ah-ME-lis

*Hevea brasiliensis*

HEEV-ee-ah brass-ill-ee-EN-sis

*Hydrangea quercifolia*

hy-DRAN-gee-ah kwer-si-FO-lee-ah

*Jatropha curcas* ja-TROPH-ah CUR-cass

*J. multifida* j. mul-TIFF-i-da

*Kalmia latifolia*

CALM-ee-ah lat-i-FOL-ee-ah

*Lamium galeobdolon*

lam-ee-AS-trum galley-OB-do-lon

*Lamium galeobdolon*

LAY-me-um galley-OB-do-lon

*Lobelia cardinalis*

lo-BEEL-ee-ah/lo-BEEL-ya card-in-AY-liss

*Malus* MAL-us

*Manibot dulcis* MAN-i-hot DULL-sis

*M. esculenta* m. ess-kew-LENT-ah

*Monarda didyma* mo-NARD-ah DID-i-ma

*M. fistulosa* m. fist-you-LO-sa

*Nepeta mussinii*

ne-PEE-ta moose-IN-ee-eye

*Nerine* ne-RY-nee

*Rhododendron* ro-do-DEN-dron

*Ricinus communis*

ry-SIN-us com-MUN-iss

*Rosa foetida* RO-sa FEE-tid-ah

*R. laxa* r. LACKS-ah

*R. moyesii* r. MOYES-ee-eye

*R. rugosa* r. rew-GO-sa

*R. sweginzowii* r. swedge-ins-OW-ee-eye

*Sapium biloculare*

SAP-ee-um bi-low-cue-LAR-ee

*S. sebiferum* s. see-BIFF-er-um

*Schizostylis* skiz-o-STY-liss

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## THE BICKELHAUPT ARBORETUM

*Continued from page 29*

is the Nature Awareness Program conducted in the elementary schools. Each January, February and March the staff goes, at the Arboretum's expense, into all of the area schools to instruct the children. Later, there is a spring tour of the garden for first- and fifth-grade students selected by the staff, a science teachers' committee and the Clinton Community School Curriculum Director.

"God has given us nature, and we are gratified to help teach the children how to care for it, respect it and love it," Fran said. In 1977, 32,000 Iowa teachers voted to honor the Bickelhaupt with the Iowa State Friends of Education Award in recognition of their extensive outreach program.

A Plant Information Service, which Bob and Fran call their "hot line," has furthered their educational goals by providing the opportunity for person-to-person contact with the public. According to Bob, in order to be effective, the hot line must be operated on a regular schedule. Bob usually assumes this duty from 1:00 to 3:00 p.m., seven days a week the year round. While waiting for calls, he uses the time to read up on the latest in the plant world. The number of calls has increased from 100 in the Service's first year of operation to more than 800 in the past year. Each question, the caller's name, the date and the information provided are recorded in a card file.

The many classes and meetings held at the Arboretum are well attended, and classes are frequently repeated to accommodate the large number of registrants. In addition to the landscaping and pruning classes held every spring and fall, courses are offered in conjunction with the State and County Extension Services. Indoor houseplant workshops, sponsored jointly by the Arboretum and the Clinton Community College, are held in the potting room and conservatory.

In addition to these educational activities, the staff aids researchers by testing a wide variety of horticultural products. The staff has also collected information for entomological studies conducted at Iowa State University.

Every new concept or project undertaken at the Arboretum is carefully researched before it is begun. For example, during the planning stages for the construction of the cistern and potting room, at least eight sources were investigated,

and work did not proceed until all questions were satisfactorily answered. Bob was particularly concerned that the types of shingles that had been used on the roof of his original dwelling might influence the quality of water in the cistern.

"From our 2,500-square-foot roof, an inch of rain brings us 1,977 gallons of clear, soft water for indoor and outdoor use—water which has not been chemically treated, which depletes no local supply, which goes through no meter. Good ecology, good economy," Bob explained.

After more than a decade of experience in running an arboretum, both Bob and Fran believe that a person with a business background is best equipped to make an arboretum run on a sound financial basis. "Coming into arboretum work from years in the business field, we were sure of one thing," Bob said. "Keeping maintenance costs down in every way consistent with good management is a matter of basic economics. Money wasted on haphazardly planned maintenance is money misdirected from the main goal."

Bob looks for the right tool or motorized equipment to get the job done right while saving as much expensive time, labor, fuel and human energy as possible. If a piece of equipment proves to be inefficient or unsafe, it is either adapted or replaced. All tractors have hour meters, double seats, tool boxes and holders for rakes and shovels; no man hours are wasted running back to the shop for a forgotten tool. Nor is any time wasted pampering trees or shrubs that cannot survive Iowa winters.

"From 1965 to date, we have studied at more than 200 arboreta and botanical gardens and have acquired a first-hand knowledge of the financial problems facing non-profit institutions of this type. We have also observed the need to keep within the physical bounds which our funds will always support," Bob explained.

Consequently, when they were offered an opportunity to acquire additional grounds adjoining their 13 acres, Bob and Fran declined, preferring a well-maintained small garden to a larger one that might suffer from inadequate care.

The Bickelhaupt got their early horticultural education in classes they attended at Morton Arboretum in the 1960s. Now, to keep current, they study, visit other arboreta, attend educational meetings and consult with professionals in the horticultural and botanical fields. They never miss a meeting of the American Association of

Botanical Gardens and Arboreta or the International Society of Arboriculture.

While at the Morton Arboretum, the Bickelhaupt had become acquainted with head propagator Roy Nordine, whom they later commissioned as their consultant. Now, 14 years after the founding of the Arboretum, at least 90 percent of the woody plants that Nordine planned and laid out are established and prospering. According to Nordine, the Bickelhaupt have built in a few years one of the finest arboreta of any size in the country.

Periodically, the Bickelhaupt critically evaluate all procedures and record-keeping methods in an effort to make improvements and to determine the best methods for maintaining and preserving the Arboretum. Last winter they spent 253 hours transferring original data to clear, easy-to-use, permanent accession ledger forms. Also, the subject files were cleared of duplicate and outdated material.

The Bickelhaupt have made many provisions to ensure a bright future for the Arboretum, which has been organized as a private operating foundation by a ruling of the International Revenue Service. Bob and Fran have endowed their Arboretum in perpetuity; they know that their daughters, both members of the Arboretum's board of directors, will act in the interests of the Arboretum. If, for any reason, the Arboretum must be closed down, provisions have been made for funds to go toward the establishment of a chair in Environmental Horticulture at Iowa State University in Ames, Iowa.

A map of Bob and Fran's early walks through the city hangs in the Education Center, a reminder of their achievements since the founding of the Arboretum in 1970. What started out as a desire to help the immediate community has developed into a project whose effects are felt nationwide. Consultations with institutions, communities, churches, civic groups, arboreta and individuals have filled the Bickelhaupt's lives with the rewards of running an arboretum.

Bob and Fran admit that, like children, they find each day exciting because they know they will learn something new. Such enthusiasm and exuberance make a visit to the Bickelhaupt Arboretum memorable.

Mary Coakley Smith is a garden columnist and free-lance writer whose articles have appeared in *Family Food Garden and Flower and Garden*. She gardens in Bellevue, Iowa.



# Color

In our search for year-round garden color, many of us inevitably turn to garden books for advice. Just as inevitable are the alphabetical listings of plants found in these books. Broken down by flower color, month of bloom or simply species, seldom do these guides offer help in arranging plant choices.

Color, per se, is easy enough to achieve in a garden. With personal preferences and a knowledge of such basics as the mood and tone created by cool or warm colors, creating color combinations might seem as simple as selecting groups of plants to flower each month. But contrary to popular belief, not all colors go together; the profanity of orange marigolds and red salvia lining countless American driveways is only one example.

No color ever stands alone in a garden; each interacts with those around it, creating harmonies or contrasts. Only in combination or juxtaposition do colors become vibrant, subtle, even poetic.

To go beyond ordinary color combinations or "safe" contrasts, such as red and white or blue with white and yellow, awareness of color hues (where each color stands in relation to the other colors in the spectrum), tone or brightness (how much pigment is present) and color saturation (purity) is necessary. Rarely, for example, is color—even a primary color such as blue—pure. Blues can contain green, pink, yellow or red, all of which have an influence on placement in a color scheme.

Some knowledge of the color wheel is particularly helpful for the more ambitious garden colorist. Neighboring colors on the color wheel normally harmonize, while colors that are opposite, such as red and green, are complementary and provide maximum contrast. Shades serve a bridging role between colors of the wheel, for example, orange shades between red and yellow, and violet shades between blue and red. An awareness of these facts can help you create fluid color transitions in flower borders.

Background colors, whether provided by house or garage, nearby shrubs or perennials, all need to be taken into account.

For example, certain shades of blue or purple, in proximity to *Alchemilla*, make that plant appear even more chartreuse. Visualize deep violet against blue-gray, then that same violet against a deep golden yellow, and you gain some sense of how colors affect one another.

Even the briefest discussion of garden color demands a reference to Gertrude Jekyll's *Colour Schemes for the Flower Garden*, published in 1908. Although Miss Jekyll expounds with great sensitivity on innumerable aspects of color in her extensive gardens, for many people the color scheme of her main herbaceous border is the heart of her message.

Planned for peak bloom from mid-July through October, the border, measuring about 200 feet by 14 feet, has a groundwork of gray and glaucous foliage at each end. Flowers at the western end are "pure blue, grey-blue, white, palest yellow and palest pink," then pass through stronger yellows to orange and red, reaching a crescendo in mid-border. The flowers then recede "through orange and deep yellow to pale yellow, white and palest pink," ending at the eastern end with purple and lilac instead of pure blues.

While certainly this and her other theories are well conceived and equally well illustrated, providing an invaluable aid to our understanding of the role of color in the garden, I have seen too many (and I'm sure there will be more) facile imitations of this main border scheme. Those who quote what Jekyll calls "the law of complementary color" (so lavishly illustrated in that main border) as if it were some religious dictum are cutting themselves and Miss Jekyll short, minimizing her relevance to present-day gardens. Styles and methods of gardening have changed since 1908; maintenance demands alone make it difficult for the English—never mind impossible for Americans with our vastly different climatic conditions—to copy literally what Jekyll created.

A kind of blithe cocktail cult presently threatens Jekyll with its static interpretation of her intent. Never in her work is color divorced from the overall unity of

garden composition. When she speaks of "the complete aspect of unity and beauty that to the artist's eye forms a picture," she prepares us for a theme central to her work. In each of her "garden pictures," color as well as form, texture, the relationship of one plant to the next, the feel of each plant and how to relate it to those plants around it, are all taken into account. The tendency is to remove these pictures from their context as reproductions and to divorce color from the other essential elements. Like the countless Degas ballerina prints at \$3.95, something is incalculably lost in the translation.

Gertrude Jekyll's garden compositions grew from a highly personal, artistic viewpoint, accompanied by practical trial and error. Over many years, the relationships between plants, color and composition were explored, stretched to their limit, refined and only then, crystallized in book form.

While Jekyll's complementary color law can be applied to any color combination (or not at all), certainly one of her major contributions to today's gardens and gardeners is teaching us to look, observe and ultimately see. For example, walking step by step through her gardens, we are led to observe catmint (*Nepeta mussinii*), "a midway purple between light and dark," against the "white-grey woolly patches of *Stachys* and the half-grown bushes of *Gypsophila*, and the Lavender and other plants of greyish foliage . . . against the warm yellow of the sandy path."

Through Jekyll's eyes we see the effect of plants not yet in bloom and observe their progress through the seasons. The relationships of plants—their textures, heights and colors strengthening and complementing one another—are dynamic, and Jekyll helps us see them in ways we never have before. ●

—Margaret Hensel

At Old Westbury Gardens in Old Westbury, Long Island, the repetition of bright red tulips along either side of the walk carries the eye along the walk and past the fountain.

Margaret Hensel is a landscape designer and garden writer living in Massachusetts.









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