



American
Horticulturist

Volume 54 Number 3 Summer 1975

PARADISE FOUND

The 30th Congress of the American Horticultural Society, Sept. 8-13, 1975,

This year America's largest gathering of amateur and professional gardeners will assemble in exotic Hawaii for six days of educational forums and horticultural programs. The American Society for Horticultural Science is meeting concurrently. This will afford an opportunity for educational exchange sessions. The 30th Congress is the most meticulously planned and executed meeting that the Society has ever hosted.

CONGRESS HIGHLIGHTS

Headquarters, The Royal Hawaiian Hotel, Honolulu, Hawaii.

Mon. Sept. 8th

Official Travel Day.

Tues. Sept. 9th

Diplomat Passport Tour—A visit to the Heritage Theater, including an exciting Hawaiian performance in memorabilia.

A visit to the Bishop Museum, with its outstanding Polynesian exhibits—the most informative in the world.

A planetarium show on the grounds of the Bishop Museum, titled—"The South Pacific Skies."

A walk through the "Falls of Clyde," one of the last Scottish-built four-masted schooners.



Wed. Sept. 10th

AHS General Session—President, Henry M. Cathey presiding.

Hawaiian program "In Polynesia, Plants Have Priority."

Tours of selected private gardens. An event sponsored by the Garden Club of Honolulu. Three homes will be featured: Ocean Front, Valley and Mountain Side. All three locations will be beautifully decorated by professional floral designers.

Additional afternoon options sponsored in cooperation with ASHS include a pomology research scientific tour and the presentation of gardening and horticultural research papers.

Evening Program—includes a film festival and plant distribution by the Hawaiian Association of Nurserymen.

Thurs. Sept. 11th

Joint Session AHS—ASHS—discussion and lecture, "The World Food Situation," featuring S. H. Wittwer, Chairman, American Academy of Sciences, Special Food Committee.

Ethnic Foods Presentation—Polynesian Gourmets will acquaint Society visitors with the gastronomic and culinary arts of the Islands.

Afternoon Options—include private home and garden tours, a scientific floraculture, landscape Horticulture and turf field trip as well as a presentation of scientific gardening papers.

Evening program—features a Hospitality Reception at the Royal Hawaiian Hotel Outdoor Ocean Terrace. Watch the sun set over the Ocean from one of the most picturesque areas on Waikiki Beach.

Presidents Banquet in the open-air Monarch Room featuring a full course oriental banquet. Later in the evening, AHS President Cathey will present the Liberty Hyde Bailey Medal and visitors will be treated to a Royal Hawaiian dinner show, featuring John Rowles, one of the most popular entertainers on the island.

Fri. Sept. 12th

The morning program includes a Hawaiian Horticultural Experience featuring three discussion groups:

1. Plant propagation
2. Tropical Plant Cultivation and Acclimatization
3. Tropical Plant materials

Visitors will also be treated to a unique Hawaiian cultural experience featuring weaving, hat making, the construction of leis, and the use of native decorative plants.

Afternoon tour options include a visit to the Lyon Arboretum, Foster Gardens and the Alice Spalding home. Visitors will be afforded an opportunity to view an

Honolulu, Hawaii.

exquisite Oriental art collection while enjoying some of the most beautiful gardens on Oahu.

Other afternoon tour options include A Hawaiian vegetable crops research presentation.

Sat. Sept. 13th

AHS-ASHS joint session—"Tropical Discovery" Educational forums will be held on:

1. Tropical vegetables
2. Tropical fruits
3. Tropical ornamentals, including special emphasis on the use of container plant materials and cut flowers.

Visitors will also be offered two exciting post Congress tour options. One tour will visit the island of Maui and Hawaii and a second will visit Maui, Kauai, and Hawaii.

Cost per person sharing

Double: \$275.00 Single occupancy: \$365.00
Deluxe: \$315.00 Single occupancy: \$430.00

Registration Package includes:

Arrival flower lei greeting; arrival and departure transfers between airport and hotel with baggage handling and gratuities to porters and bellmen; six nights accommodations at the Royal Hawaiian Hotel, maid service gratuities, Horticultural Exchange Program with the American Society for Horticultural Science, AHS Film Festival, open-air sunset cocktail reception, awards program, and President's Hawaiian Banquet, exclusive nightclub performance in the moonlit Monarch Room, Diplomat's tour, Hawaiian Ethnic Foods Presentation, Hawaiian cultural experience (native art craft and plant material demonstration); all horticultural lectures, educational programs including lecture/discussion, "The World Food Situation," and much more. For a complete descriptive brochure, write AHS Congress Committee, Mount Vernon, Virginia 22121.

Examples of Air Travel Costs

	Normal Economy Class Fare:	AHS ITBF Economy Class Excursion Fare:
Atlanta	\$500.48	\$415.15
Boston	573.23	459.04
Washington, D. C.	545.03	448.77
New York	563.33	458.67
Chicago	471.80	394.69
Pittsburgh	523.43	442.32
Cleveland	508.49	432.18
St. Louis	557.41	388.23

The Society's 1975 Horticultural Explorations

The travel adventures offered by the Society have been organized for the discriminating horticulturist or naturalist desirous of sharing experiences with other persons with similar interests.

The itineraries are extremely diversified with accents on horticultural subjects that are distinctive in the areas visited. These exposures are dependent upon the development of the country and the availability of gardens, large or small, public or private.

The accommodations are the very best available and selected on the basis of past experience. The daily programs are complete with some time available for resting or shopping. Based upon previous explorations, groups may be fully subscribed long before departure. If you are sincerely interested in any of these fascinating travel experiences, please communicate with the A.H.S. office for detailed brochures or advance reservation.

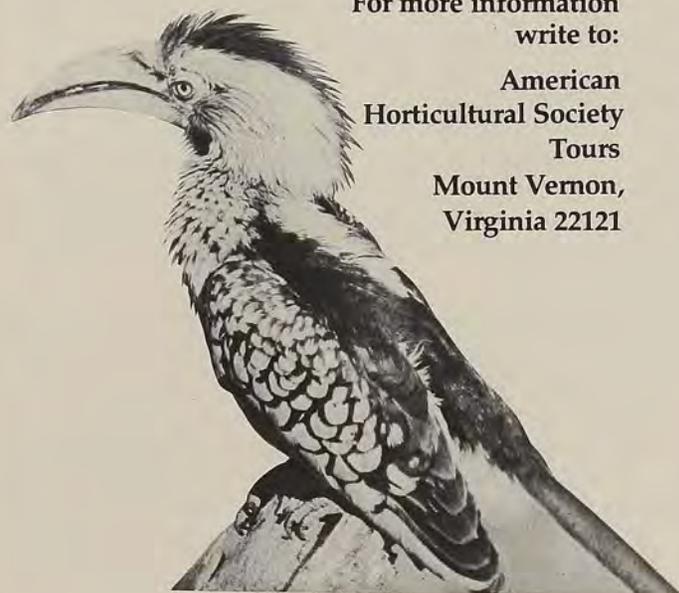
An Exploration of Flora and Fauna of South Africa, Sept. 6-28, 1975.

An Exploration of Exotic Southeast Asia, Sept. 12 to Oct. 12, 1975 (A Post-Congress Event)

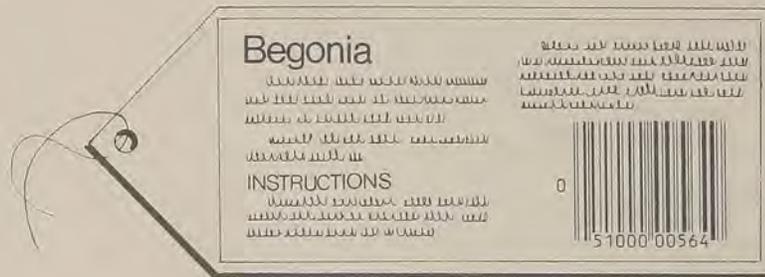
An Autumn Exploration of the Orient—October 19 to November 13, 1975.

**For more information
write to:**

**American
Horticultural Society
Tours
Mount Vernon,
Virginia 22121**



Legal Disclosure of the Needs of the Living Landscape



If certain individuals and groups have their way, all container plants sold in this country will legally be required to bear a label explaining the environmental requirements and needs for optimum growth and development.

This could cause a bit of controversy if you assemble more than one gardener in the room and begin discussing the care, feeding and sunlight requirements of any species of plant. You'll soon find an argument in the brewing. Even the environmental requirements of a simple plant like a Coleus may start a raging controversy. Although most gardeners will agree that filtered sun is best, very few individuals can come to an agreement about the proper fertilizer and moisture levels for these relatively hardy plants.

Check any gardening book to examine our current state of knowledge. Read and compare the suggested frequency of the watering of a Norfolk Island Pine or a Boston Fern. Now check another source. You will note that one suggests that you water almost daily; others encourage you to train the plant and water it only once a week. Now, mix and stir these views with other monographs written by noted garden authorities, you will find hundreds of opinions on syringing, the proper fertilizer, the correct sun exposure, the best way to control insects, proper pruning methods, propagation techniques . . . etc. The opinions are endless and oddly enough, to a degree, may be correct.

If we draw a conclusion from all these noted authorities, we discover that plants are extremely tolerant of a wide range of abuse from the cultural procedures to which we subject them . . . plants adjust their growth characteristics and survive often under the most difficult conditions. Yet many plants will die abruptly if too much abuse is given them. Others just slowly "do the strip"—as one leaf after another just falls from the plant.

Most gardeners take their failures in stride. They simply try again . . . and again . . . and again, often reading every monograph they can find on the subject. Eventually they profit from their previous mistakes of not enough light, moisture or nutrients. Eternal optimism rules the mind of the good gardener.

Eventually it may conclude that the plant he fought so hard to save was already infected with an incurable disease or that the plant is simply not environmentally adapted to his region.

This is what horticulture is all about. It has been that way

from the very beginning. Gardeners seek out a particular plant and try to master the cultural procedures to insure that it will survive in a new and often hostile location. They select only healthy and vigorous plants and try to propagate them in an environment that will insure their successful development. A good gardener won't buy inferior products. He uses his eyes and his knowledge to determine if a plant is really worth the price.

New plant people often buy what appeals to them, without knowing if it will succeed . . . without knowing if the plant is really healthy and vigorous. In this age of mass consumerism, many novice gardeners are beginning to ask if all the seeds and plants that are on the market are really what they are reported to be.

A recent study by the Federal Trade Commission suggests that 40% of the 2 billion dollars worth of plants sold by nurseries, die before the first year is out. They suggested a solution to this staggering mortality rate, may be the attaching of a care and feeding label to every plant. (The FTC, sometime ago required the clothing industry sew care tags in garments.)

On the other hand, one of the three FTC Commissioners noted that "such tags would have as much usefulness to the American public as a pair of socks on a rooster." Labelling just may not be the answer.

I believe that most people would agree that proper labelling, identifying the correct Latin and common name would be a help in the education of all gardeners. But how much correct information regarding the proper environmental requirements can be attached to a 59¢ cutting of *H. helix* "Jubilee"? Who would be the ultimate authority to supply this information? Plants don't need a legal disclosure of their wants attached to them. Conditions where they eventually may be planted are too diverse to justify printed instructions. What plants do need are more knowledgeable gardeners. The responsibility for providing this knowledge lies within our gardening books, periodicals, such as the *American Horticulturist*, our garden shows, and other educational programs.

We must also communicate that ultimately all plants must be replaced. No living thing is designed to be around forever. One tightly worded label for each species will never meet the gardening information needed to cope with planting problems in any specific community.—HMC

For United Horticulture . . . the particular objects and business of The American Horticultural Society are to promote and encourage national interest in scientific research and education in horticulture in all of its branches.

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Murray Keene
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O. KEISTER EVANS, Executive Director

MURRAY KEENE, Editor
JANE STEFFEY, Editorial Assistant
ALEX BERRY, Art Director

The American Horticultural Society, Publisher
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703/768-5700

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OUR COVER PHOTO—Coneflowers and yarrow (*Achillea Millefolium*), Burgess country garden, Lake George, Colorado. Photo: Guy Burgess



IVY-VARIED AND

My favorite plant? I cannot answer that, I have so many favorites, but ivy comes high on the list. William Robinson, writing in "The English Flower Garden" published in 1883, stated that there were two accepted species of ivy, the Australian and the English. There are now generally held to be five species—*Hedera helix*, the English Ivy; *H.canariensis*, the Canary Island or Algerian Ivy; *H.colchica*, Persian Ivy; *H.nepalensis* from the Himalayas and *H.rhombea* from Japan. Of these the first three are of importance as house and garden plants. So called Italian Ivy, with yellow fruits, is probably the Poet's Ivy thought to be a preventive of drunkenness and dedicated to Bacchus, formerly named *H. chrysocarpa* but currently relegated to varietal rank as *H.helix poetica*. Irish Ivy (the plant most often grown in the United States as English Ivy) has been similarly treated, switched from *H.hibernica* to *H.helix* 'Hibernica.' What Robinson meant by Australian Ivy I do not know. Does anyone?

Just to keep the record straight, several "ivies" aren't ivy at all. Poison Ivy is *Rhus radicans*; Ground Ivy (*Nepeta hederacea*) is a pretty deciduous ground cover with bugle flowers if you want it, a nuisance weed if you don't; Boston Ivy (*Parthenocissus tricuspidata*) is a deciduous wall covering "Virginia Creeper" type climber; Grape Ivy (*Cissus rhombifolia*; *Rhoicissus*

rhomboides) and Parlor Ivy (*Senecio mikanioides*) are popular houseplants, while Kenilworth Ivy (*Cymbalaria muralis*) is a dainty trailer with small kidney shaped leaves and wee lavender toadflax flowers, for rock gardens, wall crevices or hanging baskets.

All ivies are evergreen, though they may lose their leaves some winters in areas where they are marginally cold hardy. Most are self clinging climbers by choice, ground coverers only when they lack something to climb.

Although the Japanese and Himalayan ivies are rarely to be found, they are by no means without charm. *H.rhombea* is a dainty plant, the young stems slender and threadlike, strung with leaves which vary quite a bit in shape, a trait common to ivies. In the main they are triangular with two round based lower lobes, but some lack lobes and some are pointed hearts. My young plant of Himalayan ivy came labelled *H.nepalensis sinensis*. The leaves are dark green with circular mottlings of grey, triangular in shape with wavy edges. This species is said to have yellow berries, even occasionally red, which sounds more fetching than the drab navy blue of most kinds.

The plain green Canary Island ivy is a popular ground cover in the warmer parts of the country. Elsewhere the form called 'Variegata' or 'Gloire de Marengo' is



VERSATILE

Pamela Harper
219 Robanna Drive
Seaford, VA. 23696

more often seen, a favorite house plant but hardy outside from Virginia south. It grows fast once settled in and prefers high shady walls. Leaves average four to five inches across, beautifully patterned and centrally blotched in grey and dark green on a milky base, nearly triangular in shape but usually with two shallow basal lobes. Leaf stems are dark red—one way of distinguishing it from the somewhat similar, considerably hardier, *H.colchica* 'Dentata Variegata,' which is larger leaved and with the variegation tending more towards yellow than cream. A north wall is a good place for this, but I have yet to come across it in America. Challenging it now for supremacy in England is a comparative newcomer, 'Paddy's Pride,' an impressive form with a leaf dark green round the edge, paling within and centered with a jagged splash of bright yellow. *H.colchica* itself is a wall climber of character; the broadly egg shaped leaves pointed at the tips, very dark green, thick and leathery. Supposedly the leaves smell of celery when crushed and it is sometimes called Spice Ivy. To me they have the same, not particularly desirable, smell as other ivies.

By far the greatest number of ivies are forms of *H.helix*. The specific name means twining but ivy does not twine, it runs along the ground rooting at every node until it finds something to climb. The roots then change to aerial

holdfasts which adhere to wall, tree—even a sheet of glass. Such roots are solely supportive and provide no sustenance. If the stem of climbing ivy is cut through at any point the upper part will die. Only when ivy can climb does it flower and set the blue black berries which early herbalists warned might cause sterility or "taken in too great quantitie do trouble the mind." Being mildly poisonous and strongly emetic, chances are they would trouble the stomach before the mind. Ivy goes on climbing until it reaches a horizontal support (top of a wall, branch of a tree, etc). Lacking such support (grown up a pole, for example) it may spread out branches horizontally into space when it reaches the top. The leaves then change from the typical lobed leaves depicted on Wedgewood china to a rounded triangle with rippled margins.

Ivy reached a peak of popularity a century ago. Shirley Hibberd, whose book "The Ivy" was published in 1893, collected 200 kinds. Fashions in plants, as in clothes, come and go, and interest in ivy then waned. Now it is reviving and once again ivies are becoming collector's items.

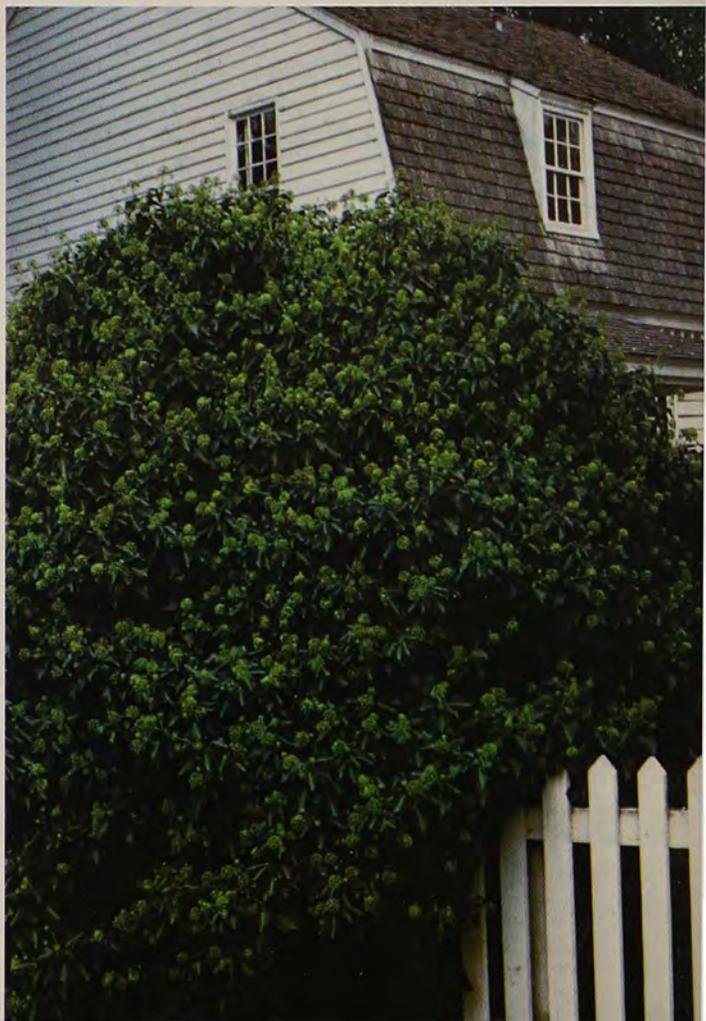
Ivy serves many purposes. Various kinds will quickly conceal an ugly wall, whilst daintier kinds enhance a handsome one. They do no harm and may help to keep brickwork dry or hold together old crumbling walls, but



Hedera canariensis variegata



Above— *Hedera Manda's Crested*
Below— *Hedera arborescens*— Tree ivy



be careful with ivy on your home because it tries to get in out of the cold and will creep through any nook or cranny around window frames. *H.helix* 'Hibernica' makes tough ground cover in shady places where grass will not grow, but water it well and keep it free from weeds until established. *H.helix* 'Baltica' is hardier in America's northern states, and *H.helix* 'Bulgarica' was selected for hot, dry climates such as those of St. Louis, Missouri. Several ivies grow well in sun; among them, varieties both rampant and restrained. Ivy planted at the base of a wire mesh fence will transform it from the merely functional into an esthetically pleasing narrow "fedge." If you have a tree cut down and the stump remains, why struggle to get it out when ivy can transform it into a decorative feature? There are slow growing ivies for beds and borders, little oddities for rock gardens and tinies like 'Minima' for terrariums or sinks, but be sure you get the true one with leaves a third of an inch across, a bigger kind masquerades under the same name.

Many ivies are ideal for hanging baskets. If the tendrils get too long just curl them around and peg them down with hairpins to thicken the top growth. Then pinch out the tips to make them branch if they do not naturally do so. Ivy can be used for bonsai or grown as a formal round-headed patio tree. This can be accomplished slowly by staking the main stem and removing side growth until the desired height is reached, then pinching out tips to encourage branching.

At least a hundred distinctly different kinds of ivy can be found by diligent search. Of the forty or so I have grown 'Manda's Crested' is outstanding. Use it for ground cover in partial shade, for walls, for trees, or in the house. Mature leaves are bright green, four inches across, with prominent white veins which become rosy tinted in winter. Young leaves are pea green. The five lobes are reflexed and crimped at the edges. This curly ivy foams out like a surfy sea, mounding to six inches in the center with long trails rippling out. Quite different, but an equally desirable all-purpose ivy, is the slower 'Ivalace,' with dainty one inch leaves polished dark green.

For high walls, I like *H.canariensis* 'Variegata' wherever it is hardy, otherwise *H. colchica* 'Dentata Variegata' or the silvery patterned *H.helix* 'Glacier.' All make good ground cover too, in sun or partial shade. *H.h.* 'Goldheart' needs sun to maintain the brightness

of the daffodil yellow central splotch to the one-and-a-half inch dark green triangular leaf. The long trails are not self-branching so 'Goldheart' makes a delicate tracery on a wall. It is not dense enough for ground cover and does not retain its good looks indoors. Nor, incidentally, does the overrated and outclassed 'buttercup,' 'Goldheart' is sometimes sold as 'Jubilee' but another ivy of this name is small and dense, the leaves overlapping like louvred slats on either side of pinkish stems. Young leaves are a mere half inch across and soft apple green. Older ones barely an inch across and are mottled in light and dark greyish green with a creamy rim. It has pleased me as a house plant, on a terrace wall, and as a tight little patch of weed-suppressing beauty at the base of a high branched pine. The cold-hardest of the variegated ivies is the one called 'Gold Dust.' This is gold freckled in similar fashion to variegated *Aucuba* and if you like the one you will like the other.

For house or garden I like the delicate slenderly lobed bird's foot varieties such as 'Sagittaeifolia,' but this isn't dense enough for ground cover. Different again are 'Fan' and 'Californian Fan,' the names self-descriptive, the color a somewhat olive green. Curly ones slightly less vigorous than 'Manda's Crested' include 'Telecurl' and 'Carolina Crinkle.' 'Fleur-de-Lis' is well named, the three main lobes rounded and so deeply cut that they often appear to be three separate leaflets, with a three dimensional effect. 'Meagheri' is a miniature imitation of this for pots or terrariums. For bonsai or rock garden try 'Conglomerata,' an old variety with thick stems and dark green undulating leaves.

Most ivies root very easily in water. If the only cuttings available are old and woody, I have had more success by putting them flat on a tray of moist peat and sand, pegged down with hairpins. This is covered with plastic and left in the shade.

I predict that ivy is about to become the "in" collector's plant, with varieties proliferating to rival roses in number and with nurseries devoted to raising and selling ivy alone. At present some of those mentioned are hard to find, but worth the search. Best chance of success is to join The American Ivy Society, 128 West 58th St., N.Y., N.Y. 10019. Exchange cuttings with other enthusiasts. Their numbers are growing steadily as ivy once again comes into its own.

The Fun, and Art of Ivy Topiary

*Suzanne Warner Pierot
Founder and President Emeritus
The American Ivy Society*

It used to be that only very rich people had topiaries. This art of training and cutting plant material into living sculptures has been practiced by the gardeners of wealthy landowners all over the world for centuries, perhaps since the Middle Ages.

One drawback to these masterpieces is the length of time they take to complete—some 5 to 10 years, others much longer.

Then someone came up with the brilliant idea of using ivy, and now we have almost instant topiary. You can fashion a completed topiary in a day or in just a few weeks or a few months depending upon the design. By the “cutting” method, which I will describe later, you can make a topiary in 30 minutes if you have a large ivy plant with many vines.

The topiary forms you can buy are mostly portable and come in a variety of forms—animals, birds, cones, umbrellas, pyramids, baskets. The selection is almost unlimited. They are not inexpensive, although I have found some 20 inch high animal forms for as little as \$9. The big spectacular forms run as high as \$160, and you can get everything from a turtle to a nine foot tall grazing giraffe. But for a fraction of the cost you can make your own forms and it is not only fun, but a test of your imagination, ingenuity and dexterity.

HOW TO MAKE

There are two ways to make a topiary. You can start with a large pot of ivy with many vines and train it up the frame which is anchored in the pot. Or you can make a hollow frame stuffed with moss and soil and plant the ivy in the moss.

In both cases the frame must be sturdy. Use the heaviest gauge of galvanized or aluminum wire you can handle. Anything lighter than number 8 wire will lack rigidity. I prefer aluminum because it is more flexible and lighter to handle than galvanized and will not rust.

IVY RING: For a beginner, the ivy ring is probably the easiest. Simply cut a length of wire and anchor each end into a pot of soil. Put two plants at opposite ends of the ring and train the vines to grow up around the ring. Or if you have one plant with a great many vines, push the ring down into the middle of the plant and merely train the vines around it. As the vines grow, fasten them with cotton-covered wire (or loosely tied nylon fishing line) and soon you'll have a thick lush green ring of ivy. This makes a wonderful centerpiece. You can hang ornaments, ribbons, all kinds of small seasonal decorations around the ring to make holiday parties gayer than ever.

IVY SPIRAL: (See Illustration 1) This is a beauty and not very difficult to make. Get a strong stake (the kind you use for tomato plants). Cut it to the length you want your finished topiary, keeping in mind that part of it must go to the bottom of your pot or container. Put the stake into the soil so that it stands firmly.

Hammer a nail into the top of the stake to use as an anchor for your wire. Fasten the end of the wire around the base of the wooden stake and shape spiral, making it widest at the bottom. Leave enough space between spirals to show a clear definition when the ivy has grown up and around it. Hook the top end of wire around the nail. Train the ivy to grow up the spiral to the top, fastening whenever needed with cotton-covered wire.



Topiary rooster

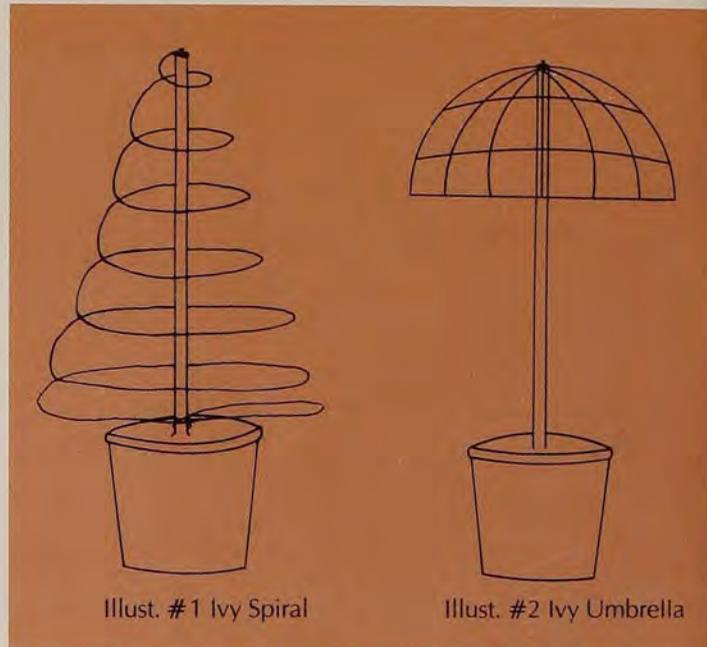
IVY UMBRELLA: (See Illustration 2) Another inexpensive and very effective instant topiary is one that resembles an umbrella. For this you need a tomato stake and a wire hanging-basket, which you can buy inexpensively at any garden center. Wrap wires of basket with wet, coarse sphagnum moss, tying it in place with flexible wire (wet sphagnum is easier to handle). Anchor the stake firmly in the soil in the middle of the pot and nail the basket, inverted, to the top. Train your ivy to grow up and around the stake and around the sphagnum-covered wires of the basket. When it gets to the top, be sure to keep the leaves well sprayed with water.

IVY BALL: (See Illustration 3 and 4) You will need two wire-hanging baskets and at least six plants with long vines for each basket, or as many rooted cuttings as required. The more you use, the fuller your ball. (All plants must be of the same ivy variety.)

Put ivy upside down in the empty basket so that all leaves and vines protrude through wire of basket. Then line basket completely with wet sphagnum moss. Pack good potting soil around roots of plant and up to rim of basket. Do the same thing with the other basket.

Place the two baskets together so their rims fit flush. In order to prevent soil from spilling out when placing the two basket rims together, put a large brown paper bag flat over the top of the basket before turning it upside

Bare wire stuck into pot of ivy ready for making into a topiary wreath. Made of *H. helix* 'Needlepoint.'



down, then pull bag out when the two rims are together.

Fasten both rims with wire to hold them together. Now anchor the ivy vines to the ball with hairpins and presto—a topiary. Hang from top with a long piece of wire with a hook on the end.

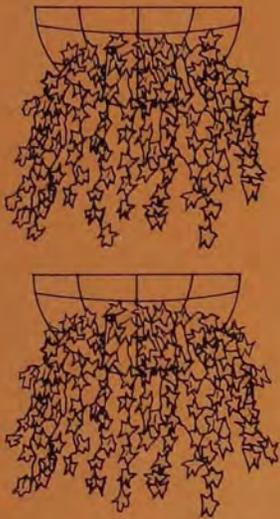
TOPIARY CARE: Each day spray forms thoroughly with a fine mist. Water the entire topiary at least 3 times a week so that the sphagnum is kept constantly moist. Feed with a water-soluble fertilizer once a month, using the fertilizer solution to spray the leaves as well as pouring it on to the roots. As the ivy fills in, clip it to conform with the design you had in mind.

When choosing a topiary, remember that the larger forms look the most exciting, but because of their size are not as easily sprayed and watered indoors.

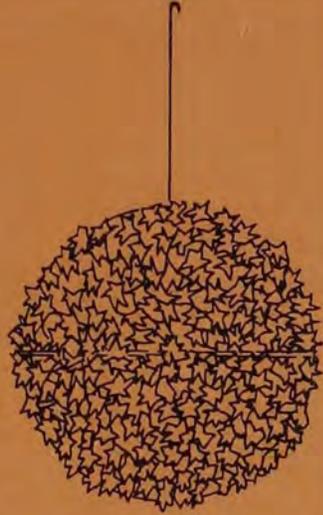
A smart thing to do with indoor topiaries is to keep a sprayer nearby. Everytime you pass, it's easy to give them a spray. Human nature being what it is, the chore of spraying regularly may often be forgotten. With a sprayer near a topiary, you'll use it more regularly. Topiaries are prima donnas and won't take procrastination with the watering. You don't have to spend a lot of money on sprayers. Just save the empty spray bottles that many household cleaning fluids come in.

INSECTS: Ivy doesn't usually tell you it is sick. So, if you don't give it a checkup once in a while, you'll never know until it is too late. Worst of all is the *Mite* and the *Spider Mite*. Unfortunately, these insects are so common on ivy, they are sometimes referred to as "Ivy Mites."

Regular spraying with a strong spray of water is the best preventive medicine, but if the damage has gone too far for that, pick off all leaves that have any speckling



Illust. #3 Ivy Ball



Illust. #4 Ivy Ball

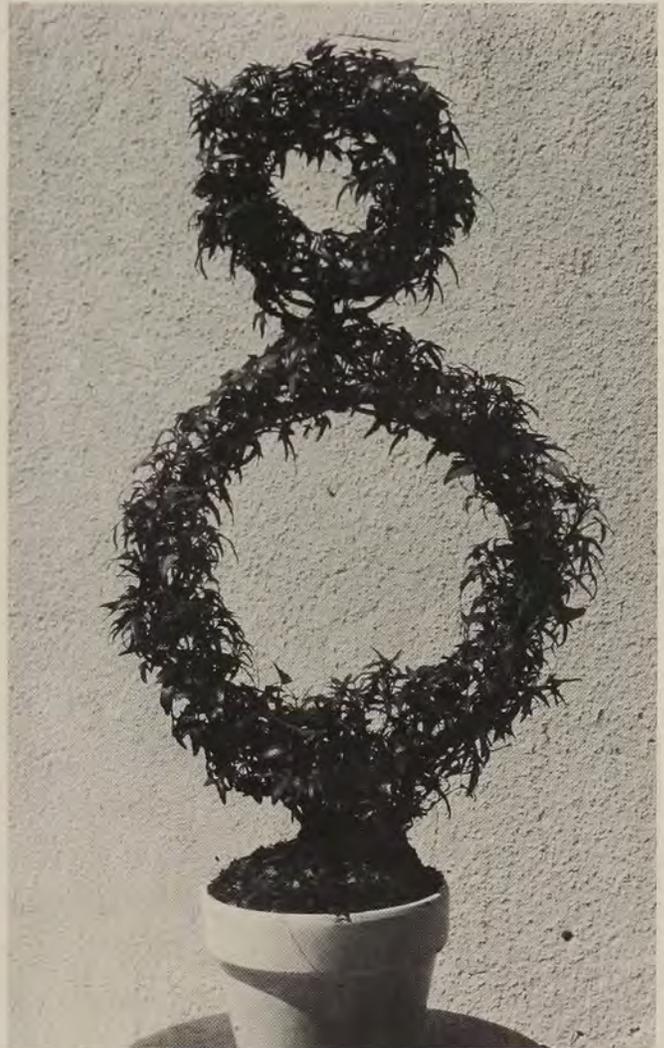
or show any damage (don't worry, they'll grow back) and spray with Malathion or Kelthane.

SOME IVIES TO USE FOR TOPIARIES: For small topiaries select ivies with small leaves closely spaced. *H. helix* 'Shamrock' is my favorite for an all green topiary. It is a rapid grower, has a profusion of leaves which overlap each other, and is a deep rich color. *H. helix* 'Jubilee' is a variegated miniature with leaves not more than 1/2 inch in length and width. It's my favorite miniature. Tiny, colorful—some leaves are all white, some variegated with more white than green, and still others with more green than white. It is self-branching with profusion of leaves. There is one drawback to this beautiful cultivar—it is a very slow grower, but if you are patient you will have a gorgeous topiary. Give it plenty of humidity, not too much food (so you won't lose the variegation), sun, or at least good strong light. *H. helix* 'Needlepoint' is a dainty birds-foot shaped ivy with leaves about 1 inch long and wide.

For larger topiaries you can use ivies with larger leaves, but select those with a good self-branching habit. *H. helix* 'Glacier' is a good grower with variegated leaves about 1 inch in width and length. *H. helix* 'Manda's Crested' is beautiful used on the topiary ball. Its curly, fluffy leaves are about 2 inches in width and length.

There are over 100 different cultivars to choose from. If you are having difficulty locating the unusual ivies write to "The American Ivy Society"—128 W. 58th St., New York City, New York 10019. [Ms. Pierot is author of "The Ivy Book—the growing and care of Ivy and Ivy Topiary" (Macmillan).]

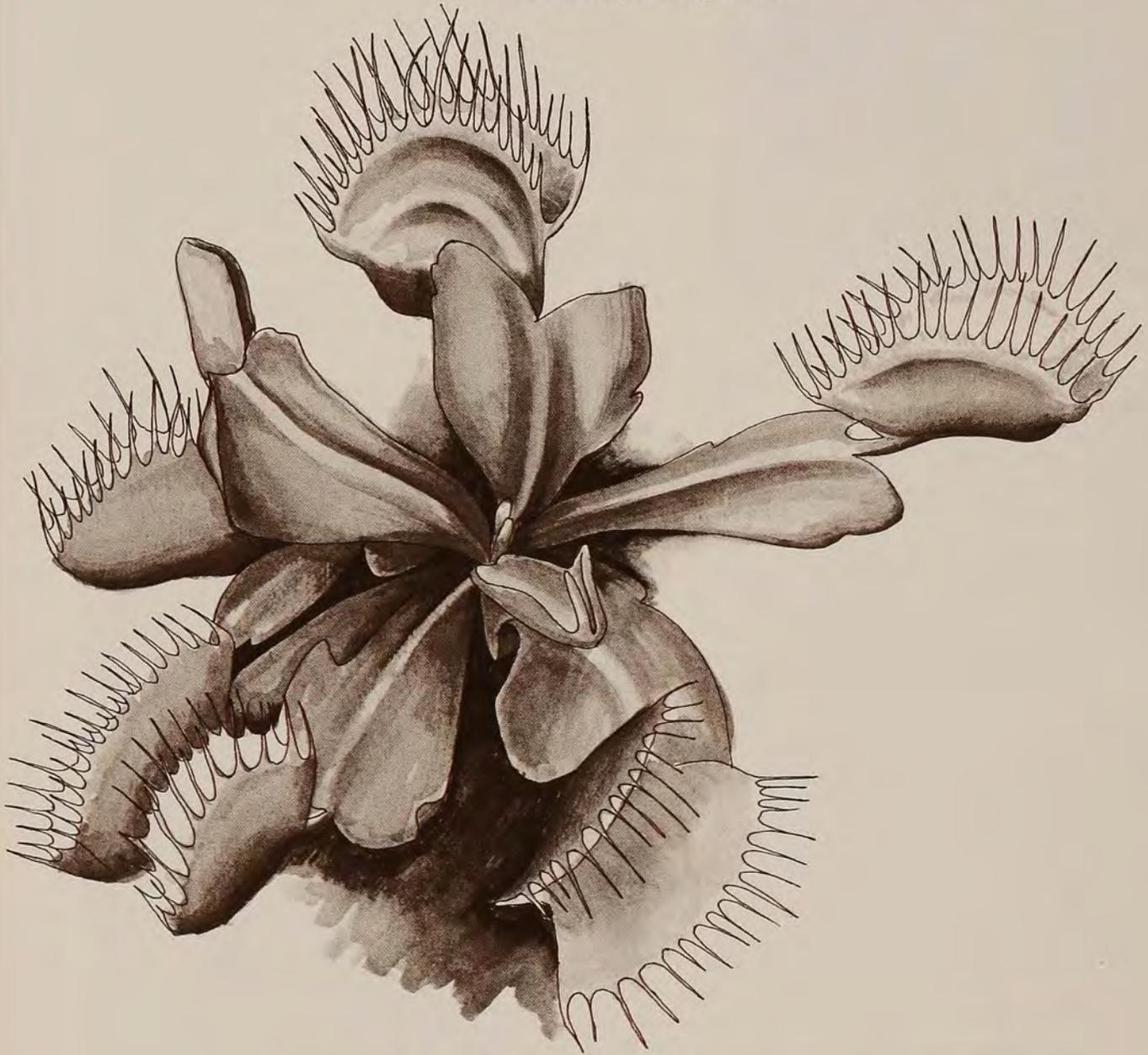
Topiary double wreath made of *H. helix* 'Sagittaeifolia.'



Venus Flytrap

by Guy Ottewell

*Mr. Ottewell is a freelance writer, painter, world traveler
and accomplished gardener.*



The plant which Darwin called "the most wonderful plant in the world." Near the center of each blade or leaf are three triggers. When they are touched by an insect, the trap is sprung, thereby catching and holding the insect until the soft part is digested. The leaves then open and wait for another victim.

Down on the coast of the Carolinas—and nowhere else—is found a rare little monster which Charles Darwin called “one of the most wonderful plants in the world.” You might easily tread on it without noticing it. What is so wonderful about it? Well, let’s begin at what may seem the more pedantic end of the explanation, and work up to the sensational part.

The typical plant, such as an oak or daisy, has a broad leaf-blade with netted veins, on a leaf-stalk or petiole. In the highest plants, however, which are called the monocotyledons and include the grasses, lilies and orchids, the blade has parallel veins. The explanation of this is thought to be that the original blade disappeared, and the stalk itself grew out to become a new blade.

Whether or not this interesting theory is true, Venus’ flytrap shows us what might be an intermediate stage. This plant appears to have a leaf-blade, on the end of which is a curious hinged and bristled structure. However, the apparent blade is actually the stalk, broadened by wings, provided with veins, and even with a suggestion of marginal teeth. It has taken over the usual leaf-work of manufacturing food with chlorophyll and sunlight. And it has had to do this because the leaf blade (which is the hinged and bristled structure) has specialized in a way like no other leaf, and is doing other work, or at least waiting to do it.

Stalk and blade start in the shape of a tight little hook. The stalk expands and its edges unroll; meanwhile the blade is still a tight little hook. The stalk becomes large (relatively—it is only an inch long) and assumes a shape like a cobra’s hood; meanwhile the blade enlarges and uncurls only a little, so that, standing upright at the end of the stalk, it looks like a flat pea-pod. At last

it tilts back and opens. It is two lobes on a midvein which has become a natural hinge. With yet another turning motion, two comb-like or eyelash-like sets of bristles come into view usually seventeen to nineteen bristles in each comb.

Within are glistening surfaces which sometimes at maturity become reddish. The color is said to act like that of a flower, attracting flies to the nectar which is in fact there; but many leaves remain green and still attract flies. On each surface there are three short hairs. These hairs are triggers. If one of them is touched twice, or two of them are touched with a slight time lag, the leaf shuts on its hinge, often in less than a second.

Sometimes a tiny fruitfly crawls safely within this maw, because he happens not to touch the hairs. Sometimes rainfall seems to make the leaves close. Of course by tickling the leaf with a stick you can make it close, but this is not a kind thing to do because each leaf can perform its closing action only about three times. At any rate, the leaf continues its closing action only if it finds it has caught something solid, and begins to release its digestive juices only if the solid thing contains protein.

I observed a plant in the act of catching a fly. Its body could be seen through the semi-translucent leaf.

At first the bristles interfingered neatly, so as to prevent the fly from escaping. Then the leaf shut tighter and tighter till the fly was dead. The squeezing of the center caused the rims and bristles to open out a bit. The leaf surfaces secreted enzymes and absorbed the fly’s juices.

A few days after the fly had been caught, a brownish-black stain appeared on the leaf, over the fly’s body and from there to the rim and

four of the bristles. Whether or not it has eaten a fly, each leaf ultimately blackens and withers. This was only a young plant, but already it was standing in a pad of rich looking mulch composed of its own blackened leaves.

You will notice that the whole rosette of leaves has a pentagonal look, like the petals of a rose. In fact the Venus’ flytrap is one of the many plants (oaks, willows, poplars, and evening primroses are some others) that exhibit a $\frac{2}{5}$ spiral. That is, each leaf springs out in a direction $\frac{2}{5}$ of the circle around from the previous leaf, with the result that the leaves overlies each other in five ranks.

When the trap opened again, after about ten days, only the fly’s indigestible hard parts were left, and these would be cleared out by wind or rain. In this way the Venus’ flytrap is more efficient than other carnivorous plants: animal remains accumulate in the bottom of the pitcher-plant’s pitcher, or in the bladder-wort’s bladder, till these modified leaves die. One other plant, the aldrovanda, has traps of the Venus kind, although smaller.

Aldrovanda is found floating freely in fresh waters over a vast area—nearly half of the Old World. Venus’ flytrap, however, is found nowhere but in the coastal plain of the Carolinas, from Charleston Harbor to Pamlico Sound. Living in the acidity of ditches and bog edges, it presumably needs insects for the nitrogen. Yet some investigators say that “unfed” Venus’ flytraps live longer.

We do not yet understand many things we would most like to understand about this plant-with-a-stomach (or, rather, with many stomachs). How exactly does its sensitive device work? How exactly does it close—and open again? And, by the way, what has it got to do with the Goddess of Love?

NEPENTHES: ORNAMENTAL ASIATIC PITCHER PLANTS

Katsuhiko Kondo, Tokuyoshi Kondo, and Josef Bogner
Department of Botany
The University of North Carolina

Nepenthes is the Asiatic or tropical pitcher plant. It is composed of approximately seventy species and many interspecific hybrids. Its distribution is scattered throughout the tropics of the Old World from the Philippines and Southern China as far south as northern Australia and New Caledonia; westward to Madagascar and the Seychelles. The scientific name *Nepenthes* is a compound word in Greek of "ne" (no) and "penthos" (grief).

The pitcher plant is carnivorous with a highly specialized trapping mechanism. The 'pitfalls' or traps produce nectar from glands located around their colorful, slippery mouths. Insects or small animals taking nectar produced by the glands moving around the traps sometimes lose their balance and slip into the pitchers. The liquid in the pitcher is sticky with a high specific gravity, making it doubly difficult for the victims to free themselves. Usually within minutes after their careless mistake, they are dead. With the aid of enzymes, the plant digests its prey and absorbs the nutrients through glands on the inside-wall of the pitcher. The plant is thus able to use organic nitrogen from the victim as a direct nutrient.

Nepenthes has been a common ornamental plant for more than 100 years. In the late 1800's it was popular in England and continental Europe. The Veitch family of Great Britain were great *Nepenthes* collectors and sponsored several collecting efforts to the tropics of the New

World in search of exotic plants. Pitcher plants were introduced to the United States in the early 1900's. The present boom in pitcher plant cultivation has been aided by the development of relatively inexpensive family greenhouses, and the popularity of terrarium gardening.

The *Nepenthes* Family

Members of *Nepenthes* briefly comprise three groups according to habitat: (1) tropical lowland savannah; (2) tropical rain forest; and, (3) tropical highland moss-forest. The grouping of these habitats is very important in understanding pitcher plant cultivation.

Lowland Pitcher Plants

Nepenthes madagascariensis and *N. pervillei* are examples of species grown in habitats of tropical lowland savannah. *Nepenthes madagascariensis* is found in Madagascar and *N. pervillei* is found in the Seychelles. The tropical lowland savannah is subjected to a yearly rainy and dry season. In the wet season, soil and air moisture reach nearly 100% saturation. During the dry period, ground water level and humidity is low. In the early morning during dry season, however, geographical conditions produce fog which brings enough moisture to allow the plants to survive. The tap roots of these *Nepenthes* are well developed much like the carrot. In dry periods, they sometimes lose their stems and leaves and become dormant. During periods of rain, the

tap roots produce new shoots. In cultivation, these tropical lowland plants may be grown in an orchid type greenhouse. Since *Nepenthes* grow natively in grassy savannah, they love sunshine and should be hang-potted close to the roof.

Tropical Rain Forest Pitcher Plants

The majority of the old stock of cultivated species and hybrids of pitcher plants originally came from tropical rain forest habitats. *Nepenthes bicalcalata* found in Borneo, is a gigantic plant, fifteen feet or more in height, and is two inches or more in diameter on climbing stems at its mature stage. *Nepenthes merrilliana* was recently introduced to cultivation from Surigao, Mindanao Is., Philippines, by the senior author and Kurata and Toyoshima in 1967-1968. This species produces the world's largest pitcher (formerly *Nepenthes rajah* was thought to have this distinction). Stems of this species climb trees and reach ten feet or more at the mature stage. *Nepenthes stenophylla* is found in Borneo. It is a handsome, middle-sized plant which is suited to small greenhouses. All of these plants require some shade, high air and soil moisture.

The best pitcher plant greenhouse maintains a temperature of 68-77°F, and 90-100% humidity. If you remodel your greenhouse to *Nepen-*

Opposite-*Nepenthes burbidgei*
Left-*Nepenthes madagascariensis*
Center-*Nepenthes bicalata*
Right-*Nepenthes stenophylla*



thes requirements, the easiest way is to use rotary-type humidifiers. The best greenhouse has a floor and foundation four to six feet below the ground level to help keep high humidity and stable temperature. The floor should be covered with sand. This type of construction also saves on heating and electricity costs. Potted *Nepenthes* may be set on a plant shelf, with some hung from the roof to utilize air space.

Highland Pitcher Plants

The last group of *Nepenthes* is from the highland moss-forests habitat. This area is geographically very foggy and cool, averaging 50-68° F in the full season. *Nepenthes rajah*, *N. lowii* and *N. burbidgei* are its example species. *Nepenthes lowii* and *N. burbidgei* are found in Borneo, while *Nepenthes rajah*, the king of *Nepenthes*, is found only in Mt. Kina Balu, Borneo.

If your area is very hot during the summer, your greenhouse will need an air-conditioner to successfully grow these plants. Air-conditioners tend to absorb moisture, thus the additional aid of a humidifier is recommended. You do not have to keep the entire greenhouse cool, however. Physically, cool air sinks and stays toward the bottom surface of the plant shelf; it will produce a cool microenvironment even though the air close to the roof may be much warmer.

Terrarium—Aquarium Greenhouses

Some hybrids of the old stock of *Nepenthes* can be easily grown in covered containers. Use a large terrarium or aquarium with a water level two to three inches deep. Set several empty pots upside down as stands for the potted *Nepenthes*. A thermostatic heater for a tropical fish aquarium may be used to provide correct water temperature. The



Left and opposite page—Pitcher plants at Longwood Gardens, Kennett Square, PA. Longwoods' *Nepenthes* House contains one of the best collections of these insectivorous plants in the country.

heater will warm and evaporate the water producing the required humidity. The terrarium should be placed in a sunny room or window. This type of home container is used by hobbyists in Japan, and has helped increase the popularity of pitcher plant culture.

Nepenthes can seldom be killed by too much watering. Water a minimum of once every day until the soil in the pot is saturated. Moisten the surface of the leaves and pitchers often.

Soil and Propagation Requirements

Soil may be made from sphagnum moss, osmunda roots, and stems of tree-ferns. Sphagnum moss is good material for keeping high soil moisture and high acidity. If only sphagnum mosses are used for soil consumption, repotting may be necessary once a year. Two portions of sphagnum mosses and one portion of osmunda roots produce the best

growing medium. Osmunda roots may be obtained from any orchid supply house.

Propagation of *Nepenthes* is dependent upon stem cuttings, and is best accomplished during the hot summer season. However, if your greenhouse is warm enough (68-86° F or more) cuttings can be taken at any time. Each stem cutting should have at least one bud and leaf. About one inch above the bud is a good position to cut. The best compost for planting is a mixture of two parts sphagnum moss and one part osmunda roots. The cut end should be covered by a small amount of osmunda roots, instead of attaching wet compost. This produces high moisture around the cut and aids the callus formation. Place the potted cutting stems in a shaded area of the greenhouse.

Pitcher plants are dioecious, and pollination of the female flower is easy. It is necessary for the breeder to have both male and female plants



in the same greenhouse or in greenhouses in close proximity. Interspecific hybridization and crossing are rather easy, but must follow random crossing, because, at present, controlling the flowering season of *Nepenthes* in cultivation has never been successful. Pollen storage may solve this problem, but is technically and financially difficult.

The seeds of the pitcher plant are very small, 1-5mm long, some with wings and some without. They are light in weight and have very hard seed coats. In nature they are dispersed by wind. Two to three months after crossing, seeds disperse easily in the greenhouse and may be lost. Watch the fruits closely approximately two months after pollination and collect the ripe seeds.

Planting

Planting seeds of *Nepenthes* is a little different from other plants; the best compost is sphagnum moss powder or peat mosses. The medium

is placed in a petri dish about one half inch deep to make the seed bed. Water it until the water level reaches to the soil level. Seeds of *Nepenthes* are planted on the surface of the soil. The seed bed is then covered or the entire dish is put in a plastic bag and sealed. Air and soil moisture should be close to 100%. Place the dishes in a greenhouse or terrarium cabinet to keep relatively high temperature and moisture. The seeds will start to germinate about one month after planting. The germination rate is about 40 to 50%. After germination, when temperature is too high, the top of the petri dish can be opened to allow fresh air and controlling moisture in. Ten to twenty days after germination, the first leaf with a pitcher appears on each seedling. As soon as the majority of the seedlings get their first leaves, transplanting may be done. The seedling bed is made out of sphagnum moss and sphagnum moss powder in a flat pot. Put the sphag-

num moss down first. If you press sphagnum moss even a little, water drainage will be impaired and molds and algae may appear on the surface of the bed. Thus, gently place the sphagnum moss in the pot and cover with sphagnum moss powder, about one half to one inch thick. Water gently from the top and leave the bed for a couple of days until the surface flattens. Then, transplant seedlings one inch apart, using tweezers. Water gently and well. Cover with glass or a plastic top. On hot days, the cover may be removed to adapt seedlings to the greenhouse environment. Frequent transplanting may stimulate faster plant growth. The seedlings take two years or more to become mature. Do not give fertilizer for the purpose of inducing faster growth. Fertilizer changes the soil pH. Coupled with high moisture, fertilizer may cause the formation of molds and algae.

Pitcher plants often have morphological and color variability. Do not give any of the seedlings away at first. Watch them carefully until they become mature. Then select the ones you want. Some of your plants may be notably valuable cultivars.

Pitcher plants are one of the most interesting greenhouse ornamentals. Many plant experts predict that they will become much more popular with amateur plant growers in the near future.

If you are seriously interested in carnivorous plants, join the Carnivorous Plant Society
c/o Don Schnel
Rt. 4, Box 275B
Statesville, North Carolina 28677
Membership \$2.00 per year/Quarterly Newsletter

Mutation Breeding of Rieger's Elatior Begonias

J. C. Mikkelsen, J. Ryan, and M. J. Constantin

Cooperative research involving Mikkelsens Inc., Ashtabula, Ohio, and UT-AEC Comparative Animal Research Laboratory, Oak Ridge, Tennessee

The term "mutation" has almost become a household word. Historically, the term was first used during the late nineteenth century to refer to striking changes in plant appearance observed in a population of the evening primrose. Now the term "mutation" is used in the broad sense to refer to any and all changes in traits of an organism that are inherited by the offspring of the affected individual.

Today you commonly hear references made to either mutations or the results of mutations. For example,



Figure 1—Mutation 8173 rose as an adventitious bud mutation from a leaf cutting of Schwabenland Red. Note the improvement in general characteristics over the parent variety.

your doctor talks to you about different strains of the flu—he means different symptoms caused by different forms of the flu virus that probably developed by mutations. Your county agent talks to you about insect pests that no longer can be

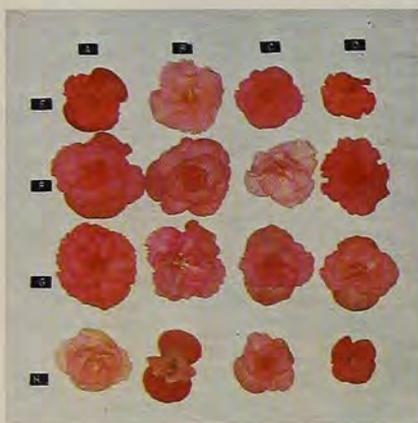


Figure 2—Examples of mutated flower changes in Aphrodite Rose.

controlled by the commonly used insecticide—he means that the insect has probably mutated that resulted in a population of offspring tolerant to the chemical. Garden centers advertise new cultivars of plants that have been developed from mutations of older cultivars.

Mutations occur spontaneously at relatively low frequencies in plant populations. Plantsmen often refer to these mutations as "sports," and train themselves to identify and isolate mutations that can be used to improve their varieties of plants. When man applies agents such as radiation and chemicals to increase the frequency of mutations in a population of plants, this is referred to as mutation breeding.

Soon after the second World War, there was an exploitation of the knowledge that the exposure of plants to x-rays and gamma rays could increase the mutation fre-

quency. Plant breeders and the public were led to believe by overzealous individuals that mutations useful to mankind beyond the realm of the imagination could be obtained with relative ease. Most of these ventures ultimately failed, because the knowledge and expertise in the use of mutation breeding techniques were undeveloped.

Aside from the exploitation efforts of a few individuals, others continued to experiment with mutation induction and accumulated statistical evidence with which to compare the



Figure 3—Mutation 8291 found in Schwabenland Red, is a dwarf measuring only six inches in height.

effectiveness of different mutation inducing agents. Today geneticists and breeders rely on mutation breeding as a tool to help solve specific problems.

Many breeders of asexually (vegetatively) propagated commercial plants are inducing mutations in cultivars destined for production



Figure 4 – Original Schwabenland Red parent.

before releasing them to the trade. This allows for an early selection of flower color, leaf form or plant size, for example. Schwabenland Red and Aphrodite Rose, two prominent cultivars of Rieger's Elatior Begonias, were used primarily in this mutation breeding study.

Background

The late Mr. Otto Rieger of Nürtingen, Germany, selected strains of the tetraploid *Begonia bertini compacti* as seed parents for some of his Elatior Begonias. Personal knowledge of the variability of the *B. bertini compacti* family allowed him to make specific selections from seedling populations for growth habits; foliage form, color and retentions; mildew resistance; and flower size, color, and keeping qualities. The *B. bertini compacti* are often referred to as the "Sunshine Begonias." The three important *B. bertini compacti* are: Lechteuer (red), Sonneschein (yellow), and Christrose (white). Yellow and white are produced by recessive genes.

The pollen parent was the diploid species *B. socotrana*, well known for profuse flowering under short day conditions of winter. Until recently *B. socotrana* was considered to be quite stable mainly because it was propagated by bulbils. Research has shown, however, that when *B. socotrana* is propagated by seed there is considerable variability.

Mr. Rieger's combinations of *B. bertini compacti* x *B. socotrana* produced a considerable number of seedlings that were commercially utilized beginning in the mid nineteen fifties. In the late sixties, Rieger's Schwabenland Red and Rieger's Aphrodite Rose emerged as the leaders in the Elatior Begonia trade.

Plants of Schwabenland Red had thick dark green foliage having sharp serrated edges and deep sinuses, large flowers with four bright red

petals offset with distinctive yellow stamens forming an eye, heavy stems with close internodes adding an appearance of strength, increased resistance to powdery mildew, and tremendous keeping qualities.

Propagation of Schwabenland Red by leaf cuttings was an important quality selected by Mr. Rieger that permits the propagators to produce young plants year round. As a result, commercial growers have been able to supply the markets with flowering begonias on a weekly basis. Of great importance in propagation by leaf cuttings is the development of numerous adventitious buds at the base of the leaf petiole. Young plants with several vegetative adventitious shoots will develop into fully, bushy self-supporting plants much more rapidly than those plants produced from a single stem cutting.

The original Rieger cultivar, Aphrodite Rose, had double azalea-type flowers. Additional qualities of Aphrodite Rose, not available previously, include dark green foliage that is considered immune to powdery mildew; resistant to foliar nematodes; vivid, rose red, multiple petals slightly serrated on the edges; very floriferous, and above all, continuously flowering often beyond six to eight months. The popularity of this cultivar has been greater in the U.S.A. than in Europe because it is useful in hanging baskets. Aphrodite Rose is propagated by vegetative stem cuttings; leaf cuttings do not consistently produce adventitious buds at the base of the leaf petiole. Three additional color selections have been made from spontaneous mutations; namely, Aphrodite Cherry Red, Aphrodite Pink, and Aphrodite Red.

Schwabenland Red and Aphrodite Rose each have 42 chromosomes indicating triploidy. These cultivars thus are sterile. Schwabenland Red

flowers are mostly males, whereas Aphrodite Rose flowers very rarely show either stamens or pistils. The possibility of obtaining additional desirable characteristics in these cultivars was a perplexing problem for the plant breeder. Spontaneous mutation was not a satisfactory answer, because of relatively low frequency of occurrence.

Tuberous begonias, a parent of Elatior Begonias, had been hybridized by plantsmen for years which suggested that genetic heterozygosity had been isolated.

Procedures

Fifty leaf cuttings per treatment of Schwabenland Red and stem cuttings of Aphrodite Rose were exposed to gamma rays and fast neutrons at Oak Ridge, Tennessee. After irradiation, the plant material was returned to our greenhouses in Ashtabula, Ohio, where all further aspects of the study were conducted. A pedigree breeding scheme was used to identify the source of mutants in terms of individuals within treatments.

Vegetatively propagated progenies were scored for any visual change such as rate of growth, plant structure, foliage appearance, flower color, flower size, and flower form. Specifically, the following new characteristics were sought:

Flowers—emphasis was placed on white and yellow colors which are recessive; flower size, conformation, and keeping quality; number and size of petals; and abundance of flowers.

Foliage—particularly to a smaller, more efficient leaf with short petioles; and improved foliage form and color.

Stems—particularly to a more compact plant (dwarf and semi-dwarf types), self-branching habit, and upright growth in the Aphro-



Figure 5—Changes in leaf characteristics in Schwabenland Red. (Original leaf is at upper left corner.)

dite Rose cultivar.

Characteristics related to management—particularly earlier flowering in relation to photoperiod, leaf petiole propagation in the Aphrodite Rose cultivar and improved uniformity of leaf petiole propagation in Schwabenland Red; and improved disease resistance.

A priority had to be established as to the most important characteristics to be selected. The mutations would in all probability remain sterile; any good qualities of lesser importance, therefore, could not be passed on by conventional breeding.

Results

There were 133 recorded mutated plants from Schwabenland Red and 115 from Aphrodite Rose.

During the screening process, mutations were evaluated that very closely resembled the commercially utilized cultivars that previously occurred as spontaneous mutations. There were many characteristics that would have been most useful in a cross pollinating program had not the selected plants been sterile. On the other hand, a few specific selections were saved for a second exposure because of greatly improved plant form and ease of propagation, even though they had inferior flowers compared to the parent.

An example of the changes in flower color, form and size, can be observed in Aphrodite Rose (Figure 2). Changes in leaf characteristics of Schwabenland Red can be seen in Figure 5; the leaf of the original is located in the upper left hand corner.

Within approximately two years from the date of the initial irradiation of the two cultivars, the following mutations of Schwabenland Red clearly show many dramatic and significant changes of economic importance when compared to the parent cultivar. Schwabenland Red is shown in Figure 4.

Mutation number 8173 (Figure 1) arose as an adventitious bud mutation from a leaf cutting exposed to gamma rays. General plant characteristics of foliage, growth, and stem quality were improved over the parent variety. Propagation qualities were considerably improved especially in the greatly increased number of adventitious shoots that initiate and develop consistently in all seasons. The most apparent difference is presented in the clustered flowering well illustrated in Figure 1.

Mutation 8291 (Figure 3) arose as an adventitious bud mutation from a leaf cutting exposed to gamma radiation. This is the most dramatic and divergent mutation found in the irradiated Schwabenland Red to date. The mutation has very small leaves. As many as 15 adventitious shoots have been counted eight weeks after beginning of propagation of leaves one inch in diameter! The mutation is dwarf measuring approximately six inches in height at flowering. Flowering is profuse with small two-tone red double flowers.

Of particular interest from irradiated Schwabenland Red was another mutation, which was originally selected because of its orange colored petals. When later propagations were flowered, it was found that upwards of 40% of the terminal blossoms were pistillate and thus female. Crosses are now being made with pollen of species with various chromosome numbers to determine if seed can be produced from this particular clone.

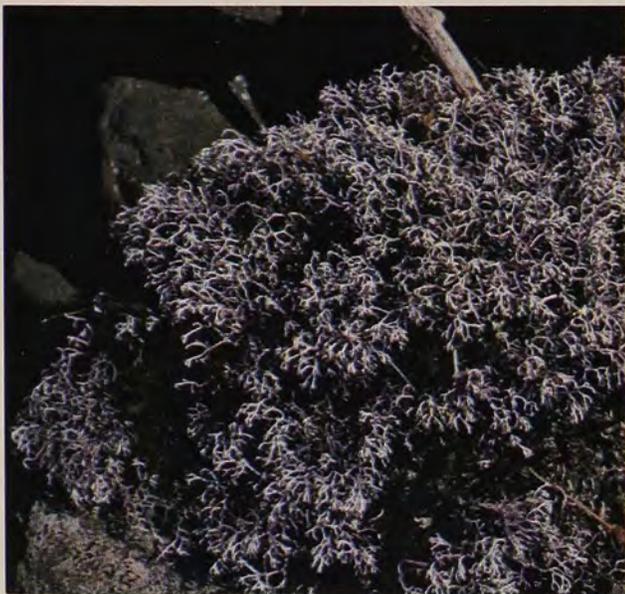
THE WORLD OF LICHENS

By Judy M. Price

Ms. Price is a freelance writer and frequent contributor to Virginia Wildlife Magazine.

*Top Left—Rock tripe and crustose lichen
Top Right—Ladder lichen
Lower Left—Reindeer moss*

*Lower Center—British soldier
Lower Right—Cup lichen*



Through the woodlands and the clearings, the pines and hemlocks tower above. These and the forest's show of flower and frond catch both the eye and the interest. Yet beyond the obvious, a world of mystery and beauty lies hidden: the world of lichens.

Lichens are the wavy-edged plants that mottle the stony cliffs above with ebony and shaded greys. They are the specks of color that flare from the tombstones in which they are embedded. They are the tiny red- and brown-capped plants that crumble beneath the feet. And they are the ones that fasten themselves to the bark of trees and stud the forest's wood with pale greens and golds. Sometimes the woodland appears richly jeweled and bright for their effect, and sometimes it seems ghostly and strange.

Lichens exist in every part of the world from the arctic to the tropic. They remain through the heat of summer and the cold of winter, and are able to survive extremes in temperature and geography because of their hardy composition.

Each lichen plant is made up of a fungus and an algae. These two originally came together so that they could withstand the poor growing conditions that existed. The algae became the provider and the fungus the protector. The fungus shelters the algae by enveloping it. Being both bulky and absorbent, it also collects and stores water for the two partners. The algae, as a green organism, then uses photosynthesis to manufacture food for the fungus as well as itself, and so the pair continues in harmony, each contributing to the plant's survival.

Lichens are varied in shape, size, and color. Some appear as hard, thin crusts of color on rocks and other bases. These, fittingly called crustose lichens, become so much a part of their substratum that they sometimes become indistinct, and are difficult, if not impossible, to separate from the surface that they have grown in to.

Another type is the foliose, or leaf-like, lichens. These reach around tree trunks and across rocks displaying delicate patterns of golds, greys, and greens. Their attachment is made by tiny threads on the lower surface of the lobed rosettes. All but the rock tripes of this group are attached in several places. Rock tripes have only one central connecting point and for this reason they are called the umbilicate lichens.

The leathery rock tripes prefer large naked boulders that are lighted and warmed by the sun. They are both ornamental and edible. Though unsavory, they can be gathered and eaten raw, fried in fat, or boiled into a thick gelatinous soup. Unfortunately, preparation does not greatly improve the taste and so rock tripe dishes should be reserved for times of need.

Upright and hanging lichens, those that are shrubby or hair-like, are fruticose lichens. They are sometimes connected to their substratum at their base, and sometimes not connected at all. They can be found rising from soil and decaying wood chips or hanging from the

branches of aging oak trees. Most of the better known lichens are of this type.

In the miniature forest of the lichen kingdom, the hollow fruticose lichens are the giant sequoias and branching fruit trees. These are of the genus *Cladonia* and many have been given common names because they are more likened to the plants better known, and are more easily identified. There are British soldiers with red fruiting tips, and ladder lichens that ascend upon themselves. There are cup lichens and beard lichens, each resembling its name.

There also is the reindeer moss, which is not a true moss at all, but another of the fruticose lichens. One type, *Cladonia rangiferina*, grows profusely across the tundras of the Canadian subarctic and through the birch forests of Scandinavia supplying the caribou and reindeer with winter grazing. Another type, *Cladonia subtenuis*, is commonly found throughout the southeastern United States, carpeting sections of the forest floor with pale green and grey. All are slender, matted, and branching; all can be used as survival foods. Taste of the dry lichen is bland; texture, grainy. When boiled, the reindeer mosses soften into a nutritious but bitter soup.

Lichens have many uses other than as forage and survival food. An extract of a northern European lichen is used as an antibiotic. Though this is perhaps the lichens' greatest importance economically, they are most commonly known as dyes. Once they were used as dye-stuff in the making of litmus paper. At present they are employed in the dyeing of the Harris tweeds of Scotland. The common lichens of any area may be gathered and boiled in water to yield rich, soft tones of brown, red, and purple to white wool. The color and its depth depends on the length of time the lichens are boiled and the varieties collected.

Lichens have been and are today employed throughout the world. At present they are being used in the research of air pollution. Though they are resistant to nature's forces of destruction, they are extremely sensitive to man's. Poisons in the air, particularly sulfur dioxide, are lichens' worst enemy. By measuring and recording the growth and development of lichens in a certain area, the extent of air pollution can be estimated. The disappearance of lichens from the leading cities should serve as a warning that not only are lichens in danger, but man himself.

Lichens abound and yet are unknown. They are strange and mysterious plants belonging not to the dark corners of science, but to the bright paths of the woodland wanderer. They once pioneered plant life and paved the way for the higher forms. Even now they are breaking down stone and building up soil in preparation for the mighty oak and the mosses about its feet. They are constant and certain in their place. They have come from the time before man and they may remain beyond.

More and more Colorado gardeners are undertaking the home care of their state's native wildings. The movement demonstrates a remarkable shift in emphasis from the protection and preservation of wildings in their natural habitat to the personal cultivation and propagation of native plant species in the home garden. Leaders of the domestication concept believe that in this era of accelerated commercial development of the mountains with vacation and ski resorts, massive highway programs, and new strip mining projects, mere protection of the fragile native plants is not enough.

Wild shrubs and trees are being gathered in advance of commercial depredation by nursery specialists, and shrubs and herbaceous perennials are being collected by wilding fanciers. Always the necessary permission is obtained in advance from ranch owners, Forest Service officials, and highway and damsite engineers. In each case the fundamentals of conservation are observed. Collectors dig only where there is an adequate supply of the plant remaining and only when they are reasonably sure they will be successful in growing the plant they collect.

Ruth Nelson, Colorado wilding authority, advises new collectors to be judicious, to give the wildings plenty of sand and peat moss when transplanting. Collect them in small plastic bags during the cool of the day, and get them into the new ground as soon as possible. Then keep them moist and shaded until they show signs of new life. In her own foraging Mrs. Nelson tries to find small individual plants for transplanting because with small root systems the plants will suffer

Domesticating Wildflowers for the Home Garden

Author: Lorraine Burgess
Photos: Guy Burgess
202 Old Broadmoor Road
Colorado Springs, Colorado



Western Red Columbine, *Aquilegia elegantula*, tiny sister of the well-known Eastern red columbine. Burgess garden, Colorado Springs, Colorado.

less damage in moving and will stand a better chance of survival.

The art of domesticating wild flowers is not a short cut or an economy move for the city gardener. Wildings take more time and more care than do commercially-grown stock, but they extend the scope of an in-town garden, introducing to high plains Coloradoans the beauties of thimbleberry shrubs, bush cinquefoil, white fir, and pinon pine. The home gardener can enjoy all manner of figwort from the tall pink-red penstemon, which the hummingbirds love, to the azure blue mountain beardtongue, and the vivid scarlet Indian paintbrush. Such a garden becomes a living museum for students of montane, sub-alpine, and alpine native plants.

The pasqueflower is one of the most beautiful and conspicuous of spring flowers, appearing each year in early March, well-protected against late snows and cold winds by a coat of silky hairs. The delicate pink shooting star follows soon after, and then the dancing blue columbine. The intensity of the blue petals depends upon the shade and moisture of the situation.

The proud gardener boasts the cultivation of the Western Red Columbine, *Aquilegia elegantula*, tiny sister to the better-known eastern species.

Four to five foot mountain larkspur in full bloom beside a stand of moist aspen can impress the most

sophisticated of home gardeners. The slender, vivid blue spikes seem far more exciting than the modern hybrid delphiniums many modern gardeners have graduated to. Too many of us forget that most of the hybrid beauties of today's show gardens are the children of yesterday's wildings. A visit to a wilding collector's garden is a kind of refresher course for the forgetful.

Colorado wildflowers to be conserved include the blue, red, and alpine columbine, the mountain clematis, the tulip and fringed gentian, all paint brush, the fairy and the yellow lady's slipper orchids,





the coral root, the Parry primrose, the pipsissewa, dwarf laurel, and wood nymph heaths, the glacier and the woodlily, and the birdfoot violet. In addition to the above, the list includes all ferns, all ball cacti, and all alpines.

Alpine flowers should not be collected; they have survived by adaptation to withstand the severe conditions of their area. They survive by cushion and mat formation. Some cushions are known to be several hundred years old. In addition to the harsh weather, they are subject to the inroads of four wheel vehicles, snowmobiles, and mountain climbers. But most of the alpines have extensive tap roots enabling them to live where top soils shift constantly. Big-rooted spring beauty may have a root six feet long and 1 to 3 inches in diameter. That is hardly a plant for transplanting. Collect a few seeds if you must.

One word of caution, avoid wildings that spread invasively. This includes most members of the pea family (golden banner and the locos), bracken fern, *Geranium fremonti*, and the star-flowered Solomon's seal. A good clue to the spreaders is generally evident where they are found. Those plants that take over an entire area, crowding out other



Top Opposite—Purple-pink sand verbena cover the Pacific coastal dunes with rich flowers in early June.

Lower Left Opposite—The Skyrocket gilia, also known as Fairy Trumpet, grows best in mountain fields. A member of the phlox family, the flowers grow in a long slender tubes, flaring abruptly at the apex.

Middle Opposite—Pasque flower anemone, Lawrence Foster garden El Paso County, Colorado

Bottom Opposite—Milkweed blossoms Ralph Giddings garden, Colorado Springs.

Right—Indian Paintbrush—best transplanted with the roots of sagebrush, which can add a silvery tone to the town garden.



plants, will be a nuisance in a home garden.

Shrubs worth growing include the birches and maple, the squaw-apple sumac, Apache plume, mountain mahogany, thimbleberry, red-twigged dogwood, serviceberry, chokecherry, golden currant, and shrubby cinquefoil. Ground covers of value include mahonia or creeping holly grape, pussy toes (*Antennaria*), creeping phlox, kinnikinnik, low-growing erigerons (fleabanes), and stonecrop sedums.

Of the tall perennials, look for monarda, penstemon, asters, and the rudbeckia black-eyed susan. In a dry, near-desert location try yucca, the liatris gayfeather, rabbitbrush, prickly pear, and the ball, and green-flowered cacti.

Wilding fanciers never show their treasures in flower show competitions. However they encourage and promote educational exhibits of native plants in labeled specimens in water, potted in containers, dried specimens, or in color slides, as a way of fostering the preservation of these endangered species.

Massachusetts wildflower authority, Katherine Taylor, has long advocated the positive approach to wildflower conservation. For years she has maintained a large private

wildflower sanctuary. She has said that a naturalistic garden is ideal for busy persons. A degree of shade is important, and high shade is generally ideal. To the eager new converts she has cautioned that wildflowers are not established until they are capable of reproducing themselves; otherwise they are merely visitors.

Good places to view alpine flowers in Colorado:

TRAIL out from the top of Hoosier Pass on State Highway 9 between Fairplay and Breckenridge.

TRAILS off Mt. Evans scenic highway, off I-70 above Georgetown. (M. Walter Pesman Trail on Mt. Goliath.)

TRAILS off Pikes Peak scenic highway, off US 24 at Cascade.

TRAILS off Independence Pass on State Highway 82 between Twin Lakes and Aspen.

OFF TRAIL RIDGE Road in Rocky Mountain National Park on US 34, northwest of Denver.

Flowers are in peak bloom from July 15th to August 8th in most locations. However some plants, like the alpine forget-me-not, sometimes bloom earlier than the 15th. No al-pines should be picked or dug up.

Some that are supported on mat or tundra cushions are more than 300 years old.

Because flower buds are formed the previous season on these perennial plants, they are able to burst into bloom as soon as the weather allows. All plants are fragile and susceptible to destruction by trampling, therefore visitors are urged to stay on established paths. Take along warm clothing against sudden storms.

Alpine flowers to look for include the forget-me-not, rydbergia, wall-flower, mt. harebell, wild candy tuft, fairy primrose, moss campion, alpine clover, sandwort, phlox, stonecrop, least lewisia, rosecrown, marsh marigold, snowlily, snow buttercup, snowlover, mt. sorrel, columbine, and big-rooted spring beauty.

The best place for a wilding beginner to start is with books. Recommended reading:

Handbook of Wildflower Cultivation—
Taylor and Hamblin
Handbook of Rocky Mountain Plants—
Ruth Nelson
Guide to Woody Plants of Colorado—
George Kelly
Pioneering with Wildflowers—George
Aiken

Thinning seedlings

If you have maintained moisture during the germination process, you will soon have thin strips of green seedlings appearing in your garden or seed flat. Do you have the recommended spacing between the plants? You must remove the extra seedlings to permit maximum development. Some plants, listed in Part I, can be transplanted to other spots in the garden or given to friends. Others, such as carrot and radish, cannot be transplanted successfully and must be thinned to the desired spacing. Gardeners usually use a hoe, chopping out the extra plants as they move down the row. For the novice gardener, hand thinning of a small plot is faster, safer and easier to do. I use kitchen scissors to cut off the seedlings just above the soil line. The remaining root systems of the other plants are not injured. The soil is not disturbed which could uncover additional weed seeds to germinate. Thinning can be done at several stages of plant development. The harvested plants can be used in salads or as a garnish on the main dish of the meal. Avoid crowding of plants at all times since the individual plants will compete for the available water and nutrients.

Weed Control

The aluminum foil mulch should control the growth of most annual weed crops. Most weed seed require sunlight for germination which the foil mulch screens out. Your only problem with weeds will be in the narrow strip of soil which is exposed along with the plants you are growing. Large growers often use selective herbicides to control their weed problems. This technology is too complex for a novice gardener to consider. It is best to learn to identify the seedlings you wish to save and remove all other seedlings by hand. The plants will grow and eventually block the growth of additional weeds. The edge of the plot should be covered with rocks to help hold the aluminum foil in place and demarcate the edge of the plot.

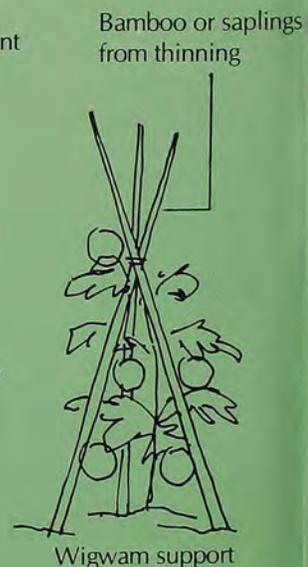
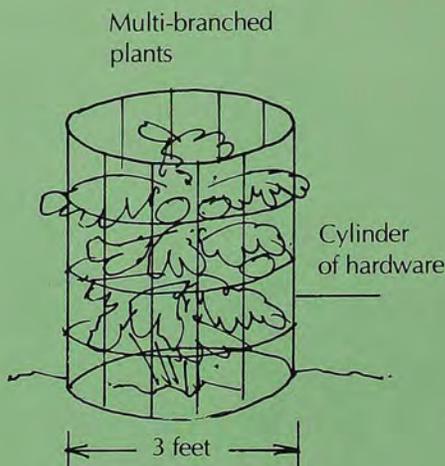
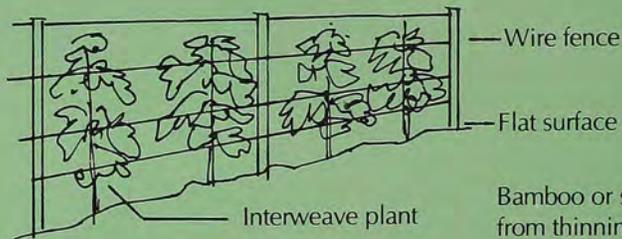
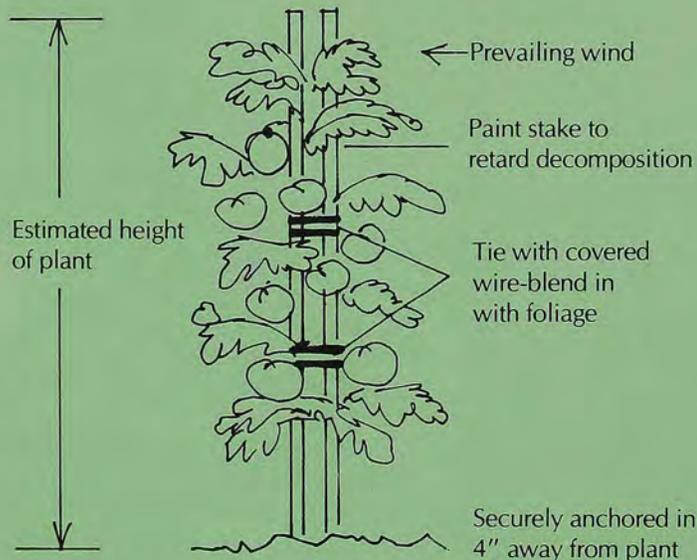
Gardens mulched with organic residue will support the growth of weeds. You will have to labor through the growing season to keep up with them.

Staking

Most plants, other than roots such as carrot and radish or rosette type such as cabbage and lettuce, benefit

FOOL-PROOF

STAKING



from being staked properly at the beginning of the growing season. Do not wait to install your stakes when the root system is completely established. A stake could rupture a section of the root system and cut down the water and nutrient adsorptive capacity of the plant. Stakes may be made out of metal, wood, or plastic; they can be decorative or utilitarian, and last only one growing season or be virtually indestructible. It all depends on cost and availability. I use bamboo canes which have been dyed a deep hunter green. They are thin, lightweight and strong.

You may use concrete reinforcing wiremesh and make 3 foot cylinders for placing around tomato plants. (See Drawing). The multi-branched plant is permitted to grow in all directions without additional staking. You may wish to make the concrete reinforcing wiremesh into a fence, training the branches along the sides. You may also use prepared stakes, branches, or bamboo shoots to form a screen or a wigwam.

Regardless of the type of staking, you should insert the stake at least 4 inches away from the plant. Estimate at the beginning of the season the height that the plant will

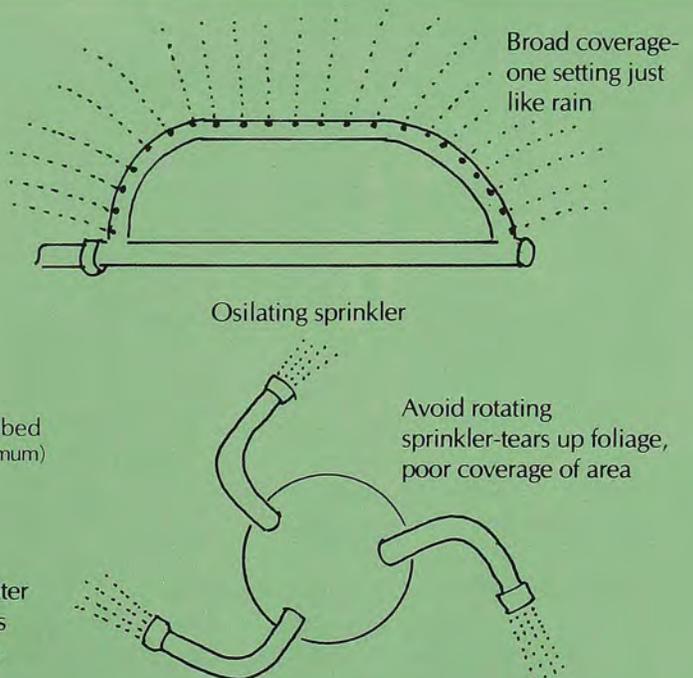
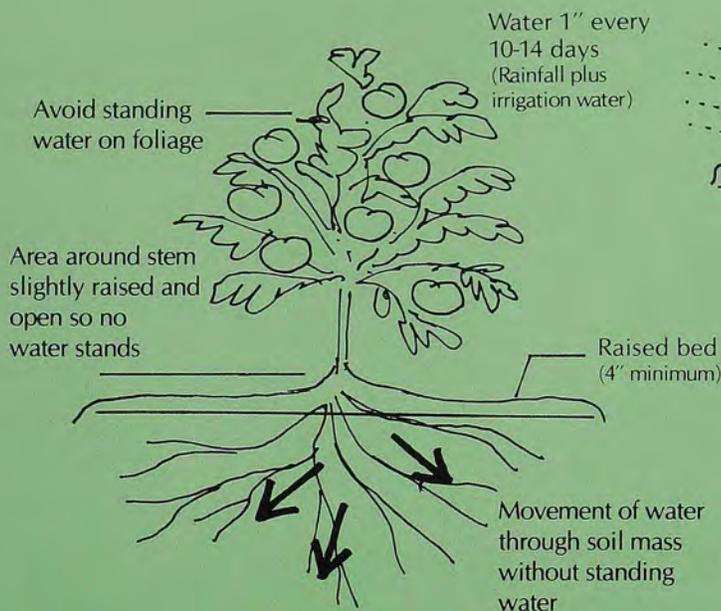
grow. Most stakes taller than 6 feet are difficult to anchor. I limit the growth of the tomato to 6 feet. When binding the plant to the stake, remember that the young trunk of the plant will grow in diameter as the season progresses. Thus allow room for expansion. I use paper or plastic coated wire, such as is sold as a tie for polybags for freezing foods. The coated ties should be cut in 12 inch lengths. Center the tie on the stem. Make a loop around the stem, leaving enough room for the full expansion of the trunk. Twist the wires several times and then pull the tie tightly to the stake. Twist the tie securely to the stake. This way the stem of your plant is loosely held while the loop is tied directly to the stake. Add new ties as the plants grow, usually at 6-9 inch intervals. As the season progresses, check the ties to make adjustments in the tension on the stem.

Fertilizing

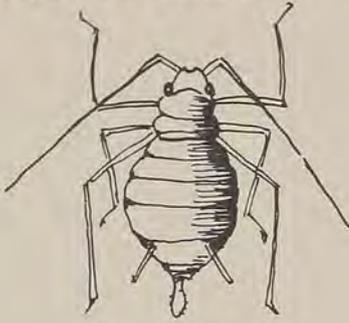
The fertilizer rates suggested for application during planting will be only sufficient for growth of the plants for three or four weeks. You must plan to supplement the fertilizers throughout the life of the plants. This is

VEGETABLES

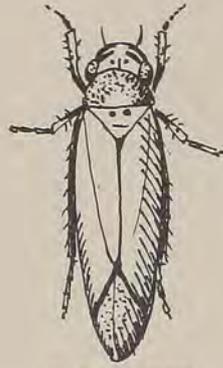
WATERING



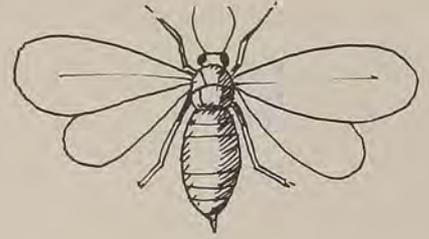
KNOW YOUR PEST



APHID



LEAF HOPPER



WHITE FLY

one aspect that is so easy to forget when the plants are green and growing. Fertilization can be done many ways, using many sources. There is nothing better than a garden soil built up over years with decomposing manure and organic matter. The soil can sustain growth with little benefit from the addition of commercial fertilizers. Most newly dug garden plots are devoid of a high component of slowly decomposing organic matter. I suggested that you add a 3 inch layer of organic material to your soil during preparation. This will be only a beginning of creating a fertile and easy-to-manage garden soil. You should start a compost pit (as discussed in *American Horticulturist*, Vol. 53, No. 5) and create your own organic matter from leaves, clippings, paper, wood chips, and kitchen rubbish. There is no substitute for the recycling of organic matter in your garden. Meanwhile, to cope with the immediate problem of maintaining an adequate supply of all of the elements essential for growth, I select a granular, agricultural type fertilizer available in 80 pound bags with an analysis of 10-6-4 (percent nitrogen, phosphorus, and potassium). The emphasis is on the nitrogen content, a water-soluble, quick-green element, which is readily leached out of the soil. I make several light applications, every other weekend, rather than one or two massive applications. The amount you apply depends on the stage of growth. I sprinkle the granules in a small circle around each large plant, such as tomato, squash, pepper, giving each the equivalent of a teaspoon of fertilizer. I give an equivalent amount to 2 feet of plants growing in rows, such as carrots and spinach. This may appear to you as a very small amount, but it is possible to maintain good growth without wasting fertilizer. Shake the plants lightly to ensure that all of the granules fall to the ground. Any fertilizer lodged on the leaves may cause burning when moistened with dew. I immediately water the entire area to soak the fertilizer elements into the soil. Fertilization should be timed to coincide with watering.

Continue to apply the fertilizer every other week throughout the growing period of the plants. Never apply fertilizers and hope that rainfall will dissolve them. The most effective way with maximum conservation of

the amount of fertilizer applied is low dosages applied frequently.

Watering

Rainfall, uniformly spread over the entire growing season, seldom occurs. You should plan to water at regular intervals to ensure rapid and continuous growth. I find that 1 inch of water is required every 10 days throughout the growing season. Check the newspaper to determine the amount of rain which falls each day. If during each 10 day period you are running a deficit amount of rain, turn the sprinklers on to make up the deficit. Most novice gardeners turn on the sprinkler and let it run. You will waste a great deal of water from surface drainage and may soak the soil. The proper procedure is to determine how much water your sprinkler delivers per hour when turned on full force with the maximum distribution pattern. Put several empty tin cans in an open area of the yard, turn on the sprinklers and determine how much water is delivered following 1, 2, . . . 4 hours of sprinkling. Measure the amount of water which accumulates. I find with my sprinkler that it takes about 4 hours to apply 1 inch of water over the sprinkled area. I turn on the sprinkler every 4-5 days to make up the deficit of rain. Following this method, you will never let the plants get into a period of water stress.

The method of applying the water comes down to a personal preference. I use an oscillating sprinkler which covers a large area with raindrop-size particles. I avoid using a rotary sprinkler because it covers the area with varying amounts of water. The force of the water often pushes plants over, and a great deal of the water drains out of the garden plot area. One can also use soaker hoses (canvas hoses which permit the water to ooze into the soil). They also may be placed underneath the aluminum foil mulch. I have also made troughs between the rows where I inject water with the hose. This system is similar to the irrigation systems used in the Southwest. One must grow the plants on ridges above the natural soil line to avoid water stagnating in the troughs. Under all circumstances, I never stand with the hose in my hand and sprinkle the plants individually. It is a waste of your



BEETLE



CABBAGE WORM



CATERPILLAR



RED SPIDER MITE

time and seldom provides for the optimum application of water to the plants.

Timing of the watering is critical. I find that it is safer to water with sufficient time prior to darkness so that the plant leaves dry before sundown. The incidence of many of our leaf diseases is favored by high relative humidity. Moist foliage during periods of temperatures of 85-90°F also set up a favorable environment for disease organisms to develop. Dry foliage with sufficient air space around the plants helps control diseases.

The aluminum foil mulch will tend to block the easy entry of water. If not applied at too rapid a rate, the water will ooze into the soil. There will not be loss of water, however, from the soil. The total amount of water required to grow the plants will be significantly reduced when compared with plants grown in open ground.

Pest Control

Gardeners have many views on the best way to control garden pests. They may plant companion plants which will discourage the development of various insects. They may make extracts from plants and apply them to the foliage. Most of the plants that I have suggested can usually be grown without the use of pesticides. But I keep on the alert for any problem and immediately remove the pest-ridden tissues. The aluminum foil mulch will help deflect day flying insects. If pests become a problem, I use a clip-on spray bottle attached to my garden hose to apply insecticides. A foliar spray gives complete coverage of all surfaces, upper and underside the leaf. Dusts and granular formations of insecticides are also available, but they are less convenient to use than foliar sprays.

Insecticides:

Rotonone or Pyrethrum—beetles, caterpillars.

Carbaryl—aphids, beetles, slugs, sow bug, leafhopper, millipeds, squash bug, mealybug.

Nicotine Sulfate—aphids.

Malathion—red spider, whitefly, mealybug, aphid, scale, leaf rollers, thrips, fungus gnats.

Read the label of your pesticide and follow directions carefully. I use insecticides only when all other methods

are not giving adequate protection. Most garden stores have large picture displays of how various pests injure plants. Seek advice if you cannot identify your specific garden pest.

When you are on vacation

During the growing season, many gardeners find that a business or vacation trip will take them away from the garden. All of the previous efforts may be lost while you are away. I usually arrange with someone in the family or a neighbor child to monitor. I give specific instructions on:

—Watering—How much, how often to maintain good growth. Tell them what you are doing.

—Staking—Check on the plants following a rain or strong wind to straighten up the plants. If this operation is delayed, the plants may be permanently injured.

—Insects—Give a simple how-to-do-it when caterpillars (remove by hand), aphids (strong blast of water to wash them off), and leafhoppers (put cheese cloth over plants to prevent feeding).

—Harvest Produce—Ask them to remove fruit, roots, and leaves at the proper stage of development. If they are allowed to continue to develop, all future growth will be delayed.

Whoever you leave responsible for your garden plot will be happy to welcome you back!

Next Issue:

—Replanting your 10' x 10' plot for Fall.

—Harvesting—Fresh.

Storage—Frozen, Dried, Canned.

When to harvest—tests of maturity.

—Prolonging productivity of plants.

—Sharing vegetables with friends.

—Summer garden projects with youth—with your plot as the model.

—Finishing the gardening season.

—Preparing for Winter.



Carnation Vs. *Dianthus calycinis crenatis*

Plant Nomenclature: A CAPSULAR CONSIDERATION

Michael A. Dirr

Assistant Professor of Ornamental Horticulture
University of Illinois at Urbana-Champaign

Recently I read a column by a noted garden writer who attempted to define the makeup of a plant's scientific name. His ideas and those of the taxonomic world were miles asunder. A name is a handle by which we get to know certain people, places and plants. We learn to recognize specific characters, for example, an individual's facial expressions, voice, or walk, which make him or her different from another. Plants are not unlike people in this respect for they possess characteristics which set them apart. Sugar maple, *Acer saccharum* Marsh., possesses opposite, simple, 5-lobed, medium to dark green leaves, sharp-pointed, imbricate, scaly, gray-brown to brown winter buds, upright-oval growth habit and brilliant yellow to burnt orange to red fall color. These features bring to this species an identity of its own which permits identification and separation from other types.

But what is this thing called a species? What do the latinized terms signify? How did the present system

for naming plants evolve? Actually a historical sojourn would uncover several interesting facts concerning plant nomenclature. Before the Linnean (binomial) system was accepted as a standard for naming plants, nomenclature was literally a disaster. Plants were named *Descriptively*. Latinized adjectives were added until sufficient verbiage was present to allow differentiation among plants. These latinized terms usually described morphological features of the plant. For example, the common carnation which is now *Dianthus caryophyllus* L. was, before 1753, "*Dianthus floribus solitariis, squamis calycinis subovatis brevissimus, corollis crenatis.*" The Japanese maple, *Acer palmatum* Thunb., was "*Acer orientalis, hederæ folio*" which, figuratively translated, means oriental ivy-leaved maple. Obviously, students of plant materials were at a distinct disadvantage in the embryonic stages of nomenclature. If this latinization approach seems cumbersome or confusing consider for a moment the *Common Name* syn-

drome. The common name of a specific plant in one part of the state, country or world often is not the same in another. *Carpinus caroliniana* Walt., American hornbeam, has been called the water beech, blue beech, ironwood and musclewood. *Nymphaea alba* L., the European white waterlily, has 15 English common names, 44 French, 105 German, and 81 Dutch for a total of 245 common names. The term Mayflower means different things to different people. In the Middle West it refers to *Podophyllum* (mayapple), in New England to *Epigaea repens* (trailing arbutus), in England to *Caltha palustris* (marsh marigold), and in the West Indies to a member of the pea family.

The question which arises is how was this chaos made orderly? It is credited to Carl von Linne more commonly known by his pen name of Linnaeus. His book, *Species Plantarum* (1753), signaled the beginning of the binomial system of nomenclature. Essentially it means that plants acquire two Latinized names, one representing the *genus* and the other termed the *specific epithet*, which in combination with the generic name constitute the *species* by means of which all plants or animals are known by all people in all countries who speak or write of them with precision. Take, for example, the European white waterlily. It is known to everyone as *Nymphaea alba*, however, it becomes a different entity when spoken of in common name terminology.

floribus solitariis, squamis subovatis brevissimus, corollis

Those who work with and read about plants are continually exposed to the concepts of genus, species, variety, and cultivar. These terms appear in every nursery catalog, gardening article or publication concerning plants. However, what do they signify? Is there any practical significance to them and will understanding their meaning enhance one's appreciation for plants?

The genus is weakly defined as a more or less closely related and definable group of plants comprising one or more species. The genus is a category whose components (i.e. species) have more characters in common with each other than they do with components of other genera within the same family. Similarity of flowers and fruits is the most widely used feature although roots, stems, buds, and leaves are used. There may be a single species comprising a genus such as in the case of *Ginkgo* where the species *Ginkgo biloba* L. is the only member. *Cercidiphyllum* possesses only one species, *Cercidiphyllum japonicum* Sieb. and Zucc. (katsura-tree), a beautiful tree of Japanese origin. At the other end of the spectrum the genus *Rosa* (rose) contains between 100 and 200 species. The generic name is written with a capital letter and underlined [*Quercus* (oak)]. The plural of genus is genera and not the often used genuses.

Possibly the most important unit of classification is the species; however, the term is more a concept than an absolute entity. Lawrence noted that

botanists of every generation have attempted to define the term species for which there may be no single definition. L. H. Bailey defined a species as a kind of plant or animal distinct from other kinds in marked or essential features that has good characters of identification, and may be assumed to represent a continuing succession of individuals from generation to generation. He then went on to say that the term is incapable of exact definition for nature is not laid out in formal lines. Actually, the species term is a concept, the product of each individual's judgment. My concept of a species is borne out in Figure 1. In any population of trees, shrubs or people there are those which fit under the common characteristic portion of the curve. These individuals adhere to the marked or essential identification features. Certain individuals do not fit the stereotype and appear to belong at the fringes of the curve. Intergrading between the normal types and the extremely divergent types are those of moderate adherence to the essential features but exhibiting some variance perhaps in degree of pubescence (hairiness) or some other salient feature. A casual stroll through the woods, meadow or any area where native stands of trees, shrubs, wild flowers and grasses co-exist will elucidate the great variation that exists within a species. All sugar maples within a given geographic area are not similar. They are members of the species, *Acer saccharum* Marsh., but exhibit discernible dif-

ferences. A species name is composed of the following components and written as follows.

<i>Acer saccharum</i> Marsh.		
genus	specific epithet	The authority or individual who first and correctly names the tree, in this case, Humphrey Marshall.
species		

Note that the species name is in italics and the specific epithet is lower case. The plural of species is species and the authority name does not have to be included in normal writing.

The term variety as used in the botanical sense constitutes a group or class of plants subordinate to a species (subspecies) and is usually applied to individuals displaying rather marked differences in nature. The crux is that these differences are inheritable and should show in succeeding generations. The difference between the thornless common honeylocust (*Gleditsia triacanthos* L. *inermis* Willd.), a true variety, and the species, common honeylocust (*Gleditsia triacanthos*), is the absence of thorns on the former. Seed collected from the variety will yield predominantly thornless seedlings, although a small percentage of the population will exhibit the thorny character. The redleaf Japanese barberry (*Berberis thunbergii* DC. *atropurpurea* Chenault.), a true variety, yields 90 percent or greater red-leaf progeny when grown from seed. Un-



The flowering dogwood exhibits white bracts (species), while the cultivar 'Pluribracteata' is a double flowering type.

fortunately, variety is often confused, and used interchangeably, with the term *cultivar* (a term coined by L. H. Bailey). The variety term is always written with the species, in lower case, and underlined or with the abbreviation "var." placed before the variety term and the underlining omitted. The plural of variety is varieties. For example the pink flowering variety of the white flowering dogwood (*Cornus florida* L.) may be written as follows.

Cornus florida rubra
or
Cornus florida var. *rubra*

A relatively new term and one which has important implications in horticultural circles is that of cultivar. A cultivar is an assemblage of cultivated plants which is clearly distinguished by any characters (morphological, physiological, cytological or chemical) and which when reproduced asexually, or sometimes sexually, retains its distinguishing characteristics. The difference between Norway maple (*Acer platanoides* L.) and the cultivar Crimson

King') is the purplish-maroon foliage color of the cultivar. This cultivar cannot be reproduced from seed (hence does not fit the definition of variety) and must be reproduced vegetatively (grafting) to maintain the foliage characteristic. Essentially all other characters of identification between this species and the cultivar are similar. *Cedrus deodara* Loud. 'Kashmir,' the Kashmir Deodar cedar, is similar to the species in leaf, stem, bud and other morphological characters except it is much hardier. Kashmir was the only plant of 200 set in nursery rows in Concordville, Pennsylvania, which survived a rapid temperature drop to 25° F below zero. Obviously this difference is not apparent to the eye, as in the previous example, but the selection of this cultivar permits the use of this beautiful specimen much further north than could be accomplished with the species. This difference between the cultivar and species is of a cytological nature possibly related to protoplasmic resistance to low temperature stresses. Sexually reproduced cultivars include those plants (annuals such as petunias, marigolds, and asters) which are propagated

from seed derived from the repetitive crossing of two or more parental breeding stocks maintained either as lines or clones. A line consists of a group of plants that are largely homozygous (similar in genetic makeup). *Clone* is a group of plants which originated from a single individual and, therefore, is genetically homogenous.

Cultivar names are written with single quotes and the first letter of each word comprising the term is capitalized or the insertion of cv. before the term and the deletion of the single quotes.

Example: *Acer platanoides*
'Crimson King'
or
Acer platanoides cv.
Crimson King

It is possible to have a cultivar of a variety. *Cornus florida* var. *rubra* is the pink flowering form of the flowering dogwood. A cultivar of this variety is Cherokee Chief which possesses deeper red flowers. The term would read *Cornus florida* var. *rubra* 'Cherokee Chief.'

The basics of plant nomenclature are relatively simple to comprehend. A fuller, deeper appreciation of the great diversity which nature offers can be developed through an understanding of the previous discussion. A knowledge of the systematic naming of plants also has practical implications. Consider the great variation in the red maple, *Acer rubrum* L. The purchase of a seedling-grown tree does not guarantee red flowers in Spring nor brilliant red fall color, for trees may range from yellow to red in flower and fall color. The purchase of *Acer rubrum* 'October Glory,' 'Autumn Flame' or 'Red Sunset' cultivars guarantee a tree with outstanding red to scarlet fall color for these trees were selected for their consistent ability to color.

A distillation of the preceding discussion should lead to the conclusion that an appreciation for plant nomenclature guarantees a deeper involvement with plants and their intricacies.

Tree Wounds & Decay

By Tom Stevenson
Garden Editor, *The Washington Post*

A wind storm hit Washington, D.C., the Nation's Capital, Thursday, April 3. Hundreds of trees came crashing down. Most had cavities. The U.S. Weather Bureau said the winds were part of an overall east-bound storm from the Midwest that battered the east from Maine to Florida.

A young girl visiting the National Zoo was killed by a falling limb. Large areas were without electricity and telephone service for hours. There was a tremendous amount of property damage.

The loss of a big tree itself in any city is usually a heavy loss. Trees may enhance the value of property as much as 20 percent. There is the loss of shade and other amenities the tree provides. It takes a long time to fully replace such a tree.

The wind is a powerful force, with more energy than the rising and falling tides and earthquakes combined. The wind blows constantly throughout the world. A lot of study has gone into weather control, but chances are the wind will continue to blow and blow, and weakened trees in poor health will be toppled over by it.

A. L. Shigo dissects a root of red oak to trace decay from roots upward into the trunk.

But there are ways to considerably reduce the losses caused by strong winds and falling trees. One is to help keep trees strong and sturdy and able to withstand the force of the wind. Another is the development of a meter that detects flaws within the tree which may cause it to give way under pressure.

The technology is available, due largely to research by Dr. Alex L. Shigo, Forest Service plant pathologist.

The problem, says Dr. Shigo, is infection and decay that develop from wounds that trees receive. The trees are weakened to the point that they become vulnerable.

"Decay leads to a weakening of branches, trunks and roots," he says. "As decay develops, strong and beautiful trees are reduced slowly but surely to unsightly hazardous trees."

Dr. Shigo heads a pioneer research project on discoloration and decay of trees at the Forest Service's laboratory at Durham, New Hampshire. In a recent research project, he cut into 3,000 trees throughout Northern New England with a chain saw.

By dissecting living trees and studying organisms that infect them, he learned that discoloration and decay of wood develop in certain predictable patterns.

"I know home owners are very interested in cavities and wounds in their trees," says he. "I get these questions asked of me every time I lecture to a general audience. I try to point out that there must be a beginning



to these cavities. They begin when the bark is broken and wood is exposed to the atmosphere."

"City trees are especially vulnerable to many types of wounds. They seem to always be in collision courses with moving people, pets, and vehicles of all types. City trees are wounded by lawn mowers, snow plows, by nails for posters, and by construction equipment during street repairs."

"Yet the most common and most serious wounds on city trees usually go unrecognized most of the time: branch stubs. The stub or opening into the tree that remains after a branch dies, or is broken, or is pruned improperly, is indeed a serious wound. All trees lose some branches during their life."

"If a tree is vigorous, and if the branch is pruned properly, the wound will heal rapidly. But if the tree is not vigorous, and if the branch is not pruned properly, the wound heals slowly. Then the wood-inhabiting microorganisms (that cause decay) have an easy access into the tree."

The wound problem on city trees is serious now, and it will get worse unless something is done, Dr. Shigo says.

"One thing we can do is to develop tree-maintenance programs using new information and new tools that have come from recent research on wounds and decay."

"I feel we now have information that can indeed help minimize decay associated with wounds."

"First, we must use every opportunity to tell people that wounds start the processes that can lead to decay. By preventing wounds, we can prevent decay."

"Second, we must tell the public that proper treatment of wounds can stall the decay process. Branches should be pruned properly, and wounds should be treated so they will heal in the shortest possible time."

"Third, we have developed electrical equipment that will detect decay in living trees and utility poles. It is called the Shigometer, and is now being manufactured by Northeast Electronics, Concord, New Hampshire. It is inexpensive, durable, portable, accurate and easy to operate."

The meter measures the electrical resistance of wood to a pulsed current. It works this way: first a minute hole is drilled into the tree with a battery-powered drill. A long thin twisted-wire probe, attached to the meter by a thin cable, is inserted into the hole. A pulsed current, passed through one wire on the probe, passes through the wood from the probe tip and returns to the meter through the other wire on the probe. The resistance is measured in K (thousand) ohms on the meter. As the tip of the probe passes through sound tissues, the electrical resistance remains approximately the same. But as the probe tip passes from sound to unsound wood, the electrical resistance displayed on the meter drops abruptly.

"The Shigometer will tell you what the internal condition actually is. On the basis of this information, an action plan can be started: remove the hazard tree or do

everything possible to increase its vigor.

"What do we do for the tree after we know we have some time to help it?"

"One thing we should not do is cover the fresh wound with some wound dressing and forget it, thinking we have done all that is possible to help the injured tree.

"After a tree is wounded, the injured bark and wood should be removed with a sharp knife. The wound should be shaped to form an ellipse when possible. This often means that the wound must be enlarged. The important point is that all the injured bark must be removed so that vigorous bark is in contact with sound wood at the margins of the wound."

"Then do everything possible to increase the vigor of the tree."

"Properly prune dead and dying branches; fertilize and water the tree; and, thin out less valuable competing trees when possible."

"After all of these steps are taken, some wound dressing may be applied—only to indicate that someone has treated the tree. Wound dressings alone do not stop decay. To apply wound dressing without doing all the other things for the wounded tree is foolish." (Tests by Dr. Shigo and Dr. Charles L. Wilson, plant pathologist, USDA Shade Tree and Ornamental Plants Laboratory, Delaware, Ohio, have shown that wound dressings do not prevent invasion of wounds by decay fungi: International Shade Tree Conference Proceedings 47: 97a-98a, 1971).

A new concept about how decay begins and develops in wood has emerged in recent years, Dr. Shigo says. The decay process is no longer seen as a simple relationship between wood and fungi, but as a complex succession of events that involve chemical reactions, bacteria, different kinds of fungi, and discoloration as well as decay.

"Research on this new concept has revealed the unique ways in which a tree reacts to its wounds by sealing off the affected tissues. Even though a tree may be rotten at the core, it may still live on to produce healthy new wood for a long time."

"A wound that looks serious, may not be; while one that looks minor may be associated with advanced decay.

"When a tree is wounded, some living cells may be killed, and others may be injured. The injured cells are exposed to the air. Chemical changes quickly take place in the wood. Slight discoloration of the wood results, due to the dark materials formed in the living wood cells by the chemical changes. Sometimes the early discoloration is a bleaching of the wood rather than a darkening."

"At this early stage in the process, microorganisms are usually not involved in the discoloration process. These early discolorations of cell contents do not weaken the strength of the wood. The process initiated by the wound may stop right here when the wound heals. Whether it heals or not depends on the severity of the wound, the



Experimental wound on Red Maple. Four wounds of this type were cut on each tree. Fifty trees were wounded and ten trees "Harvested" every year.

1 wound = Control 1 wound = Asphalt dressing
1 wound = Poly varnish 1 wound = Shellac

No difference between wound treatments after 4 years. Wound dressing did not stop decay.

time of year of wounding, and the vigor of the tree. "

"When the wound does not heal rapidly, discoloration continues to develop. Then in time the cambium—that thin layer of tissue under the bark that produces new wood and bark each year—responds to the wound. "

"When the wound occurs during the dormant period, the cambium responds to the wound as soon as growth begins again in the spring. When the wound occurs during the growing season, the cambium responds immediately. "

"The first cells produced by the cambium after a wounding are different from the cells that are normally produced. They have thicker walls, smaller vessels, more cells with protoplasm, and different orientation. "

"These new and different cells act as a barrier to the discoloration process. They wall off the discolored wood; they compartmentalize the defect. The discoloration can spread up and down inside the tree, within the core sealed off by the barrier cells. But it does not spread outward into the new wood being formed. "

"The extent and intensity of discoloration depend on the vigor of the tree, the severity of the wound and time. Discoloration continues to advance as long as the wound is open. If the wound heals, the entire cylinder of wood present when the tree was wounded may not become discolored. Meanwhile, the cambium continues to form new growth rings that are free of discoloration. "

"The first microorganisms to invade the tree (through the wound) usually but not always are bacteria and non-decay fungi. In some cases, decay fungi are the pioneers. These pioneers first infect the cells that have been altered by chemical changes in response to the wound. The new tissues formed after the injury still remain free of infection. The tree begins to compartmentalize the pioneer

microorganisms. "

"The infected cells are further altered by the pioneer microorganisms. The discoloration may intensify; the cells may become more moist; the mineral content of the cells may increase; and parts of the cell walls may be slightly eroded. "

"The wound/disease process could still stop at this stage if the tree is vigorous and the wound heals. "

"In some cases the wood tissues are killed and decay microorganisms begin to move in. The succession of microorganisms continues. The decay microorganisms affect those tissues that first were altered by chemical changes and then by the pioneer microorganisms. "

"But still the new growth of wood that continues to form remains free of discoloration and decay. "

"The wound/disease process continues as long as the wound remains open. Many species of microorganisms may interact among themselves until the dead wood is decomposed. The succession of organisms does not stop when the first decay organisms enter. It stops only when the tissues have been completely digested. "

"The decaying wood is often separated, walled off, from the new white wood by a band of discolored wood. The pioneer microorganisms may remain in this band. As decay continues, the decay microorganisms slowly digest this discolored band; and only a hard, black rim then separates the by-then hollow core from the healthy white wood. "

"Up to this point the process may take 40 or 50 years or even longer. Healthy white blemish-free new wood will surround the hollow core, unless other wounds are inflicted later. "

"An important point is that the process need not go through to completion. Healing of wounds, antagonism among organisms, unfavorable environments, and other forces may cause the processes to abate in any stage. "

When removing decay from a tree in preparation for filling cavities, take care not to break the inner compartment wall that separates the decay from the healthy wood, Dr. Shigo warns. If this wall is broken, decay will spread into the healthy wood that surrounds the decay.

Do not bore holes in a tree to let water out of a column, he says. It is only because the hollow is separated from the healthy wood by the tough compartment wall that water remains trapped.

The Shigometer can be used to determine the actual condition of the wood behind the wounds and to detect the compartment wall that surrounds a decay column.

Three of the best things that can be done for mature trees—and particularly trees that are not making normal growth—is to fertilize them regularly, water them during periods of drought and prune dead and dying branches.

Two things other than pollution that weaken and shorten the life of many trees are misapplied weed-killing chemicals and rock salt applications for ice and snow control.

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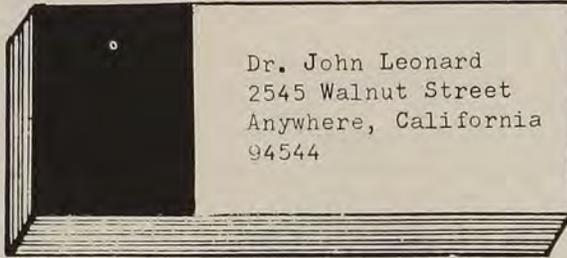
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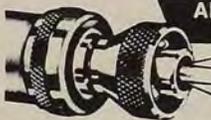
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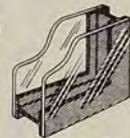
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A GUIDE TO THE MEDICINAL PLANTS OF THE UNITED STATES

by
Arnold and Connie Krochmal
Quadrangle/The New York Times
Book Company
New York—1973
\$12.50

A Guide To The Medicinal Plants Of The United States, provides brief descriptions of the plants, their habitats, and their use for more than 250 species currently growing in the U.S. The introduction indicates that the authors wish to call attention to plants having potential commercial value, but the uses given all read like bits of folklore and no reference is made either to a current commercial or pharmaceutical product. The references made to the plant lore of the American Indian are particularly vague since no specific tribe or regional group is mentioned. The inclusion of such introduced species as *Ginkgo biloba*, *Melaleuca leucadendra*, *Eucalyptus globulus*, *Cinnamomum camphora*, and *Ailanthus altissima*, makes one wonder about the authors' intent even more. Certainly these plants were not used by the American Indians, which is the general intimation given by the introductory portion of the book. Since the authors specifically warn "against using these plant drugs for purposes of self-medication," the book seems to be without any real purpose; not recommended except for browsing.

G.S.D.

Poisonous Plants:

HUMAN POISONING FROM NATIVE AND CULTIVATED PLANTS, 2nd Edition

by
James W. Hardin and Jay M. Arena
Duke University Press
Durham, North Carolina—1974
\$6.75

KNOW YOUR POISONOUS PLANTS

by
Wilma Roberts James
Naturegraf Publishers
Fieldsburg, California—1973
\$5.50 cloth; \$2.50 paper

The joint effort of a botanist and a physician, *Human Poisoning From Native and Cultivated Plants* is intended to familiarize the layman with the commoner poisonous plants. Brief but clear descriptions, together with a

reasonable number of illustrations, as well as a description of the symptoms of poisoning in each case, recommend this book as background reading for those individuals responsible for children in an activity where poisoning is potentially possible. The book is presumably meant to be read in its entirety, for it cannot be used as a means of identification for the unknown plant poison. For familiarization with the subject, however, it probably ought to be required reading for scoutmasters and camp counselors.

Mrs. James' book, *Know Your Poisonous Plants*, is similar in intent and approach. It is illustrated with rather good line drawings and has more of a western accent for the plant material described, which is not surprising since Mrs. James is a native and resident of California.

Both books are equally recommended for increasing reader awareness of the more common sources of plant poisoning. The eastern reader should choose the Hardin and Arena book, whereas the western reader would do better with the James book.

G.S.D.

THE TERRACE GARDENER'S HANDBOOK Raising Plants on a Balcony, Terrace, Rooftop, Penthouse or Patio

by
Linda Yang
Doubleday & Co.
304 pages. \$8.95

For the gardener dwelling in a city highrise, a suburban garden apartment, or a vacation condominium, this modest-sized book abounds in practical help and author-tested practices.

For both amateur and advanced gardener, conditions of light, wind, space arrangement, height limits, storage—even the practical matter of how to get water to the terrace if an outside faucet was not provided in construction—are examined in such a way that the book becomes a step-by-step workbook and proceeds to the vital day to day tasks. At the appropriate point within the text sources of equipment and supplies are named. Marginal side-headings for paragraphs are a useful device for relocating some particular bit of information applicable when a question arises. Plants are listed in tabulated form according to conditions for which they are suited. Black and white photographs illustrate practices and useful devices to achieve space and scenic results; the color photographs will

encourage you to go ahead on your own.

A glossary of gardening terms, a bibliography of additional recommended reading, and a list of helpful horticultural organizations comprise the useful appendices.

TREES OF PUERTO RICO AND THE VIRGIN ISLANDS, Second Volume

by
Elbert L. Little, Jr., Roy O. Woodbury,
and Frank H. Wadsworth
U. S. Department of Agriculture
Agricultural Handbook No. 449
Washington, D. C.—1974
\$13.45

COMMON TREES OF PUERTO RICO AND THE VIRGIN ISLANDS

by
Elbert L. Little, Jr. and Frank H. Wadsworth
U. S. Department of Agriculture
Agricultural Handbook No. 249
Washington, D. C.—1964
\$8.50

The first volume of this work, published ten years ago, included excellent line drawings and detailed descriptions of 250 of the commoner trees of the tropical islands of the United States. Information on commercial or horticultural applications, as well as propagation, is often included. At \$8.50 (and still available from the Superintendent of Documents, Washington, D. C. 20402), the original volume was, and still is, a bargain. The second volume treats with another 500 species of arborescent plants of this same area and is even more of a bargain. For anyone interested in tropical or subtropical horticulture, these two volumes are a must.

G.S.D.

GARDEN PESTS AND DISEASES OF FLOWERS AND SHRUBS

by
Dahl, Mogens and Thyge B. Thygesen
Macmillan Publ. Co.
November 25, 1974
223 pp. Macmillan Color Series
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THE SMALL GARDEN IN THE CITY

by
Garland, Madge
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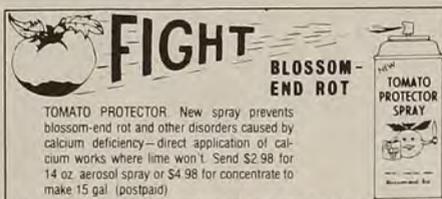
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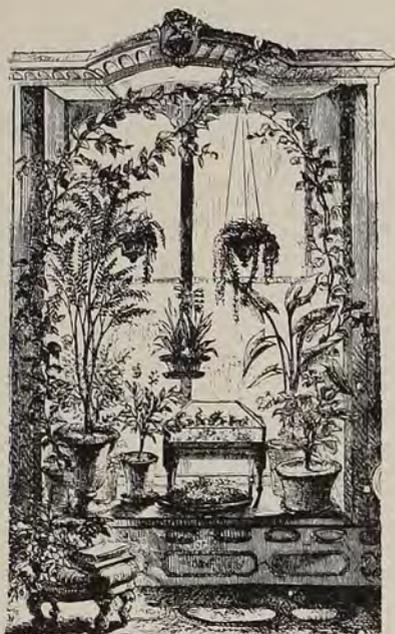
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