American Horticulturist

Volume 51 Number 4 Winter 1972

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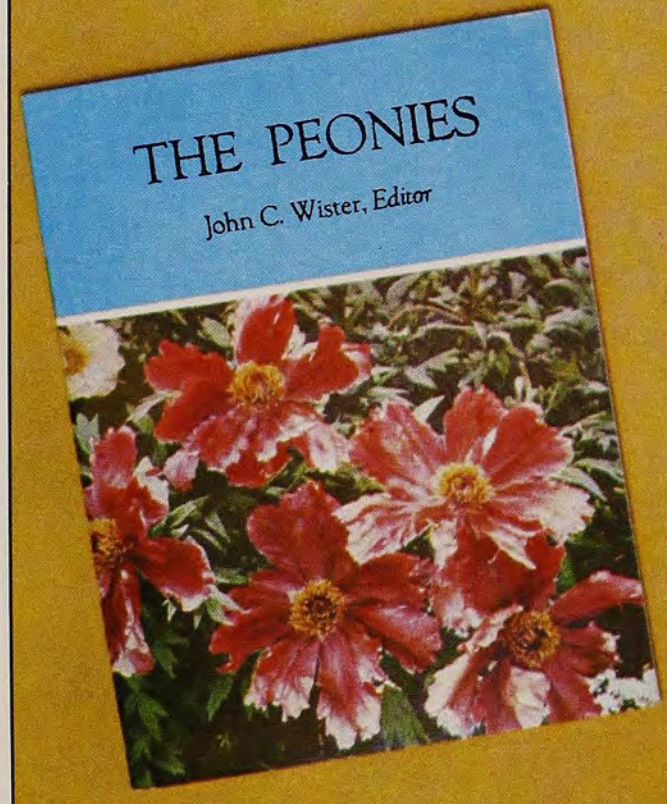

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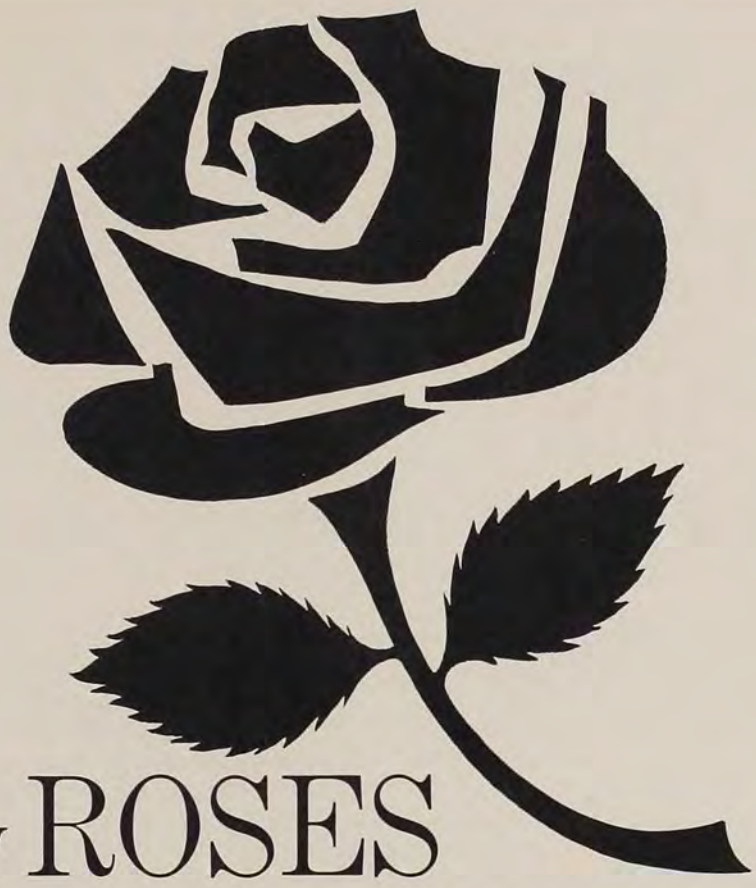

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an editorial . . . .

The A.H.S. Role in Urban Horticulture

When experts put their heads together good things come of it. The various American Horticultural Society Handbooks are examples of co-operation; A. H. S. and the Holly Society, A. H. S. and the Iris Society, and so on. The backyard gardener benefits directly from these productive get-togethers. Special grants to A. H. S. have made possible the Plant Records Center operation, the production of a retirement manual, and a very productive membership drive.

A special get-together involved our Society and various horticultural groups in the Pacific Northwest recently. The resulting event was the Twenty-seventh Congress of The American Horticultural Society. Held in a setting where weather, soil and other growing conditions blend into a nearly perfect environment for gardening, Congress participants viewed private and public gardens, parks and arboreta, and a display of plants unequalled at any previous Congress. A. H. S. is enjoying considerable success in reaching out to various horticulture-oriented groups for joint endeavors.

The Officers and Board members of A. H. S. are guiding the Society into a position of leadership in the area of Urban Horticulture. Why the caps? What is so important about Urban Horticulture? No one will dispute that a garden setting contributes immeasurably to the quality of life. But, somehow, when inner cities are redesigned, when new housing developments are on the drawing board, when an outlying shopping center is created, horticulture comes in as an after thought. Worse yet, when an essential traffic freeway has to be brought into the city, planners find it easiest (and cheapest) to direct it right down an existing parkway or, worse, through a park system. Why tear down buildings when open land is available? People are fond of saying that horticulture is like the flag and motherhood. Who could possibly be against them? But that is not enough. Somebody has got to speak out positively for horticulture.

This is where A. H. S. steps in. Horticulture is our thing. We would be the ones to protest from coast to coast if Milwaukee were to turn those handsome expanses of well planted, well maintained parklands into playgrounds, stadium sites or highway access routes. During our 1971 Congress in Milwaukee everyone marvelled at the extensive horticulture, but a change in politics could plow under the grass and trees in short order. We need to guard against the loss of any park land right across the country. But we go further. We must take the lead in demanding more park land. People and parks go together. And all too often, the parks are not where the people are. Or something that is called a "park" is architected into a concrete jungle with fountains, statuary, and construction galore, and horticulture is relegated to a few petunias in a planter.

Urban Horticulture means grass, trees, shrubberies and flowerbeds downtown, uptown, and in the public housing areas. Urban Horticulture means public greenery throughout the urban scene. But it means more. It means flower boxes on tenement windows. It means terrariums in school rooms. It means presenting the older city generation, a generation who grew up with vegetable gardens and bits of lawn, with a bench under a shade tree with grass under foot. It means creating an awareness of green, growing things, in the tiny folks who will be the next generation.

When a weed or a tree seed blows into a crack in the sidewalk of the inner city and a tough plant comes out of it, that plant often gets its picture in the paper. What a commentary on American Horticulture that a volunteer plant growing in a concrete setting would make the news! It is high time for somebody to take on Urban Horticulture. A. H. S. will do the job.

We will enjoy considerable help. Plant societies, enlightened planners and architects, and even corporations who have discovered that a green setting is good business will help out. Read Dr. Skinner's remarks on the job of categorizing all the ornamentals available to Pacific Northwest gardens that was done by a group of dedicated amateurs. Urban Horticulture has strong friends.

Where will a strong push for Urban Horticulture lead us? The ultimate goal is a city environment made, not liveable, but enjoyable, due to an atmosphere of greenery. Cities need botanic gardens and arboreta. Cities need parks and forest preserves. Cities need places where people can get their hands in the soil and garden. Look at that picture of the rare, albino sea-holly on our magazine cover. What would you give to have grown that specimen? Wouldn't it be nice if every person in the country could look out of his window and see something that beautiful? It could happen if Urban Horticulture becomes a reality.—**J. P. B.**

American
Horticulturist
Volume 51 Number 4 Winter 1972

JOHN PHILIP BAUMGARDT, *Editor*

The American Horticultural Society, *Publisher*
901 North Washington Street/Alexandria, Virginia 22314
O. KEISTER EVANS, *Executive Director*

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.

AMERICAN HORTICULTURIST is the official publication of The American Horticultural Society and is issued in March, June, September, and December of each year. This magazine is included as a benefit of membership in The American Horticultural Society. Individual dues are $15.00 a year.

Refer editorial matters to:
John Philip Baumgardt
American Horticulturist
P. O. Box 7163
Kansas City, Missouri 64113

Refer advertising matters to:
Publisher Services, Inc.
621 Duke Street
Alexandria, Virginia 22314

Address requests for reprints of articles to The American Horticultural Society, Alexandria, Virginia.

AMERICAN HORTICULTURIST is devoted to the dissemination of knowledge in the science and art of growing ornamental plants, fruits, vegetables, and related subjects. Original papers which increase knowledge of plant materials of economic and aesthetic importance are invited. For manuscript specifications please address the Executive Director, 901 North Washington Street, Alexandria, Virginia 22314.

Replacement issues of *AMERICAN HORTICULTURIST* are available at a cost of $2.50 per copy, but not beyond twelve months prior to date of current issue.

Second class postage paid at Alexandria, Virginia and at additional mailing offices.

IN THIS ISSUE

OUR COVER PHOTO—More than 100 species compose the sea-holly genus *Eryngium*. Our cover photo displays the 'Alba' cultivar of *E. alpinum*. These herbaceous, usually perennial members of the *Umbelliferae* make fine garden ornamentals, thriving in light, sandy loam in a sunny bed or border. Propagate them by seed, division, or from root cuttings. Photo by I.G.A., Vaduz, Liechtenstein.

Introductory Remarks Horticultural Preview—1972 American Horticultural Congress—Seattle, Washington*

*Henry T. Skinner***

You are about to enjoy some fascinating displays—a banner exhibit of bonsai at the Seattle Art Museum Pavilion, and a most unusual horticultural exhibit at the Pacific Science Center. The uniqueness of these exhibits centers primarily upon the fact that they could be duplicated nowhere else in this country. They relate to the plant resources of a uniquely plant-rich Coastal Northwestern region about which, and by way of a Preview Introduction, I have been invited to make a few comments.

From the Cascades to the Pacific and from Portland to Vancouver, B.C., we are within a region where potentialities for the cultivation of temperate to near-subtropical plants are most nearly approached elsewhere only within the British Isles or in parts, perhaps, of Japan. Temperatures are moderate, patterns of sunlight are relatively similar and the climates of these regions are moderated by moist air off westerly oceans. Combine climates with good growing soils, stock with gardeners, amateur and commercial, and the inevitable end result is a maxi-sized version of the Jermyns Gardens to be described by Mr. Hillier on Saturday.

The plant wealth of this region is of course only partly an acquired wealth. The native flora of itself is rich, as was jointly suspected by Thomas Jefferson and by Britain's Sir Joseph Banks in the later 18th century and as was demonstrated by Mr. Witt last night. Jefferson was initially blocked by French politics in his efforts to launch André Michaux across the Rockies, but Banks and the Royal Society had better luck in sponsorship of the two expeditions of Dr. Archibald Menzies, to Nootka Sound with Captain Colnett in 1787, and along the Washington shore line with Captain George Vancouver in 1792. Vancouver was more sea water than plant minded, to Menzies' dismay, but Menzies did return with over 300 specimens, some 25 of which still bear his name. However, President Jefferson did not remain entirely disappointed, for his Lewis and Clark expedition of 1804-06 yielded a reasonably good catch for the American Philosophical Society with duplicates, doubtless as a safety measure, for Jefferson's own garden.

These men, with their Menziesias, Lewisias, Clarkias, and the like, provided a taste of this region's flora, but it remained to David Douglas—Douglas of the fir—to sample its riches in depth during 1825 and '26. Recommended by Banks' friend, Sir William Hooker, sponsored by the Royal Horticultural Society and operating out of the Hudson Bay Company's trading post at Vancouver, Washington, Douglas and his companion, ship's doctor John Scouler, found untold treasures in vicinity of the Columbia River, north and south. The shipments to England of Douglas fir, noble fir, sugar pine, yellow pine, Sitka spruce, Brodiaea, Collinsia, Mahonia, Spiraea, Mimulus, Fritillaria, Erythronia, *Penstemon scouleri*, and hundreds of other species brought comment from J. C. Loudon that here, indeed, were "more new and beautiful plants than ever before had been introduced by an individual from any country." As a matter of interest, a preceding article of Loudon's Magazine of Natural History, 1828, provides a critique of eleven bird paintings by an unknown American of hitherto unnoted genius—by the name of Audubon. It was a great age!

There were other collectors, as Nuttall, Tolmey, Charles Wilkes, and Jeffrey and other botanists as Asa Gray, John Torrey, and England's Hookers who stayed home identifying and evaluating their imported wealth. But by the mid-19th century, the Northwest was no longer isolated. Portland and Victoria, B.C., already were thriving. Seattle was founded in 1851.

The first nurseries were established—the firms of Malmo and Tom Hopkins still exist—and importation began in earnest. Private plant collections grew and public parks and gardens were being planned and dedicated. Famed Stanley Park, of British Columbia's newer Vancouver, was established in 1887, and parks and gardens of Portland and Seattle soon followed. By around 1910, Jenny Butchart was initiating a duplication of Victoria's color displays as replacement for the unkempt appearance of her husband's disused stone quarry. Within another twenty years, Carl English started his world-unique embellishment of Seattle's Chittenden Locks.

**Dr. Skinner's remarks, presented here, introduced Congress registrants to the outstanding display of ornamentals and Bonsai specimens displayed at the Pacific Science Center.*

***Director, U.S. National Arboretum, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. Dr. Skinner was awarded the A.H.S. Liberty Hyde Bailey Medal during the Seattle Congress.*

A little later yet, alpine collector Edward Lokbrunner began tapping the mountain resources of New Zealand, Japan, Scotland, the Pyrenees, and Dolomites to the enrichment of his Victoria-based Lakeview Gardens. And so it went. Each passing year saw the native plants of new gardens being surrounded by new imports from other regions of the continent and the world.

At a central position amidst this expansion of horticultural and plant interest has been the Arboretum of Seattle and the University of Washington. Dating officially from 1935, the time of its occupation of Seattle's Washington Park, this Arboretum in actuality has much earlier origins—in the form of a University Campus Arboretum dating from 1895. These campus plantings, tied to lumbering interests and abetted by the Seattle Parks Board, were spearheaded, improbably as it may seem, by Edmond S. Meany, ex-State Legislator, Professor of History, and University Registrar. Recognition of the values of these plantings led to development of the separate Arboretum which, under Dean Winkenwerder, Dr. John Hanley, and through the twenty-five year directorship of Mr. Brian Mulligan, has registered impressive progress in marshalling the plant wealth of this favored coastal region. England's Kew Gardens has a history of upwards of 200 years. The Arnold Arboretum celebrated its centenary this spring. The National Arboretum is approaching its fiftieth year, but the University of Washington Arboretum has become an educational, recreational, and cultural resource of local, national, and international impact in the short span of thirty-seven years. The only institution of its kind between British Columbia and San Francisco, it has gained national and international prominence by virtue of its plant collections, its publications, and its exchange programs with the U.S. Department of Agriculture and with numerous sister institutions of this country and abroad. It has become noted for its research, no less than for its linkage with the names of an array of respected plantsmen and scientists. To which, I might add that many of its plants have come to the National Arboretum, with which I am associated, and several, in magnolias, maples, and so forth, have figured prominently in our breeding programs.

We may hear of a certain amount of industry in the Seattle area—aeroplanes and the like—yet the economy of the State of Washington is, and has always been, very plant oriented. You may think of forests, fruit, farming, and the rest but specialty crop horticulture has become big business, too. Among Washington's 1886 licensed nursery dealers, 250 alone have reported annual sales of stock worth in excess of ten million dollars wholesale, of which nearly fifty percent represents sales to other states. And this is but a segment of the total picture. Through demonstration, education, and research, the University of Washington Arboretum has the potentials for ever increasing service to the citizens, the University, and to all phases of the horticultural interests of the State of Washington. It is to be hoped that a wide recognition of these facts can be translatable to future budgetary support on a deservedly adequate scale.

My comments have attempted to both stress and provide reasons for the plant wealth of the Coastal Northwest as we find it today. But I have given you no inkling, as yet, of the concentration of plants to be found in this region's private gardens. The evidence is being dramatically provided this week, through the tours and by today's presentation. Under the chairmanship of Mrs. Albert Brauss and with the assistance of other accomplished members of the Friends of the University of Washington Arboretum, two major projects have been undertaken for your benefit. The first is a published compilation or listing of the current plant resources of the Coastal Northwest, and the second is a fabulous exhibit of the plants themselves. Statistics have been shifting over recent weeks, days, and hours, but you may find that the listing extends to 150 families, over 1,000 genera, and some 5,500 species—the present listing, that is. Many more will be added in a supplemental production already being worked upon. If you will now hold tightly to your seats, I will let you in on the secret that the Pacific Science Center exhibit contains living specimens of the majority of the plants of the 150 families, 1,000 genera, and 5,500 species of the listing! The ones missing, as might be expected, are confined largely to such early season species as are scarcely suited for exhibit at this season. The marshalling of a display of this magnitude represents a phenomenal accomplishment of which Mrs. Brauss and her assistants can be justly proud.

A second exhibit, at the Seattle Art Museum Pavilion, represents northwestern plant resources again but with an oriental twist. It is the exhibit of bonsai staged by Mrs. Horace Raphael with the combined assistance of Seattle's bonsai groups and the Friends of the Arboretum, including that ultra distinguished group known as the Bonsai Bums. My statistics are lacking, and I am no sort of an authority on bonsai, but as a strict amateur in this field, I have been immensely impressed by the size, diversity, and especially by the quality of this exhibit. It is also fascinating to note the number of of native plants that so successfully adapt to bonsai culture. Many of them are naturally dwarfed specimens, and some are very old—as old, perhaps, as 400 years. I am sure that you, too, will be impressed, and the more so if you allow adequate time for viewing and study.

I know that you will enjoy these exhibits and will feel honored, as I do, that such effective demonstration of the horticultural wealth of the Coastal Northwest has been undertaken—for our benefit.

Thank you for your attention. Bon voyage and rewarding viewing!

Eucalyptus camaldulensis *Photo by H. T. Reeves, Hawthorne, Vic.*

Salt Bushes and "The Red Center" of Australia

*Edwin A. Menninger**

Salt is detrimental to plants. Plants which grow in environments heavily laden with salt do so in spite of it and not because they thrive on it. Those which grow well by the seaside are armed with three or more physiological modifications which make them salt-tolerant.

Salt Spray Resistance

Some salt tolerant species have leaves put together like scales on a fish and salt cannot penetrate them. The Australian-pine *(Casuarina sp.)* is a good example. Some of them have leaves heavily coated with a vegetable wax which prevents the salt from being absorbed in the tissues. Salt crystallizes on the leaf and washes off with the next rain. Seagrape *(Coccoloba uvifera)* or the Yucca *(Y. aloifolia)* are good examples. A third kind of protective device is what is called *tomentum* or *indumentum*. This is a thick fuzz. Salt spray hits it; salt crystallizes

**Edwin A. Menninger, D. Sc., is noted internationally for his researches on tropical plants and for his books, particularly on tropical woody species and tropical vines. Dr. Menninger spends November through April at his Stuart, Florida home and resides in Cashiers, N. C., May through October, Books by Dr. Menninger include* Flowering Vines of the World, Flowering Trees of the World for Tropics and Warm Climates, *and* Seaside Plants of the World.

out on the dense hairs and drops to the ground without damage to the plant. The best example of this on Florida beaches is *Tournefortia gnaphalodes*, ordinarily called sea-sage. Leaves are so densely fuzzy they are almost white.

Plants in Saline Soils

In salt marshes and salt deserts the problem is different because plant roots grow in soils high in soluble salts. The only plants which survive are halophytes (salt-tolerant plants) because of their peculiar ability to absorb moisture from the soil without taking in any of the salt which is in solution in that water. Presumably this is a process of osmosis. This problem has been extensively studied by many scholars.[3]

Australian literature is replete with references to "salt bushes". They seem to be important in the vast open spaces of that continent but it is obvious that no particular plant is referred to, though there is some connection with salinity, as "salt bushes" grow on the beach and also in the interior.

Light is thrown on this problem by Laing and Blackwell[1]. These authors write; "Plants which have been evolved in soils containing more than a half per cent of salts in solution, are termed halophytes. Such plants are found chiefly near the seashore, by river estuaries, or in salt marshes. They sometimes occur also in desert areas, particularly in the dried-up beds of salt lakes. They often bear resemblances to xerophytes*. The water of salt-meadows is apparently not readily absorbed by plants, and consequently such situations may be physiologically dry. Probably the presence of salts in solution interferes with the passage of moisture by osmosis into the plant cells."

"Sand dunes, sea-marshes, deserts, and old lake bottoms are more or less impregnated with salts of sodium, calcium, magnesium and potassium. Plants growing in such situations are termed halophytes, and it is in these localities that most of the chenopods** are found. Wherever the ground, on drying, rapidly becomes encrusted with salt, there only halophytes can grow. Plants usually halophytic may, however, sometimes be found in soils that do not contain any specially large amount of alkaline constituents, but they often lose many of their chief characteristics."

Pursuing the question of "salt bushes" the author asked Ernest E. Lord, Melbourne botanist and author[2], to write for The American Horticultural Society an explanation of this subject, based on an expedition he made with five other scientists to the interior of Australia where names on the map are not towns, just cattle stations. His job was collecting for the herbariums in both Melbourne and Adelaide, which still lack specimens of much of the native flora of Australia, presently estimated at 15,000 flowering plants. From the last rail point Codnadatta, the expedition travelled by fully equipped truck to Everard and Musgrave mountain ranges. There these scientists spent a month. The following paragraphs are written by Mr. Lord to explain the Australian "salt bushes" and their environment.

Leaves and fruit of the sea-grape (Coccoloba uvifera) *which thrives on exposure to the sea.* Photo by Paul Root

Australian "Salt Bushes"

In Australia we have a lot of plants that are called "salt bushes". This name is applied to a good number of species of our chenopods, chiefly among the genera *Atriplex* and *Rhagodia*. They form a big family of more or less succulent and often fiercely spiny shrubs scattered through our hot and arid inland. Some of this country is subject to surprisingly low temperatures on winter nights. I am not sure who originated the term salt bush, but it probably has reference to

*Plants that grow naturally in desert conditions.

**Plants in the Chenopodiaceae such as Goosefoot, Lamb's Quarters and Spinach.

Flowers of Yucca aloifolia, *common on Florida's east coast, growing almost within reach of the surf.*
Photo by Paul Root

Hakea lorea, *"Corkwood" in Everard Range, Central Australia.* *Photo by E. E. Lord*

Atriplex cinerea, *one of the Australian "salt bushes".*
Photo by T. R. N. Lothian

Hakea intermedia, *"Corkwood" near Musgrave Ranges, Central Australia.* *Photo by E. E. Lord*

certain plants conspicuous for their thriving in the salt-pans and salt-lake areas of our strange inland.

I had the rare privilege of a trip to our 'desert' interior—amazing country! H. H. Finlayson described it in his little classic *The Red Center*. We call it 'desert' and so it is as regards surface water, for you would quickly die of thirst in a day or two anywhere, unless by a miracle you were within reaching distance of a well. There is water everywhere at thirty to fifty feet underground.

The rainfall is around three inches annually and is immediately followed by an amazing, prolific growth of numerous small flowers and grasses—composites, chenopods, succulents as *Parakeelia*, numerous species of *Hibiscus*, amarants and many more, a garden of color. Yet in a few weeks all is finished. They have attained maturity, flowered, seeded, died. The millions of seeds then await the next rain which may be six months or six years. But many shrubs and trees persist; my opinion is that their roots are in that deep moisture. Their leaves and stems are succulent to carry them for long dry periods, or their leaves have been reduced in evolution to mere vestiges (as *Casuarina*) or phyllodes (with few stomata) or thorns. Perennials and bulbs are virtually absent.

There are species of *Cassia, Eremophila*, and *Acacia* almost without number—many are still unrecorded. In lesser range are *Melaleuca, Atriplex, Rhagodia, Hakea, Grevillea, Abutilon, Frankenia, Prostanthera, Solanum, Pimelea* and *Eucalyptus*. The soil is red, the rocks brown-red or black. The predominant tree is Mulga, *Acacia aneura*, usually ten to fifteen feet high. The most striking trees are corkwoods, *Hakea lorea, H. ivoryi* and *H. intermedia* and red gums a pure-white-trunk form of *Eucalyptus camaldulensis*, better known as *E. rostrata*, now renamed.

The greatest inland 'lake' there is Lake Eyre, 150 miles long yet usually quite dry. Long rivers drain into it, at those rare times when they flow. With no outlet to sea it is salt. But much of that country is not salty at all. Soil is a reddish combination of sand and fine clay (loose stuff long since blown away) and it is stable. 'Roads' are merely wheel tracks, they do not get covered up although carrying perhaps one vehicle a week or a month.

As I have seen for myself, when that soil is watered it is amazingly fertile. Great cattle ranches cover all the area which is not reserved for rocket ranges and aboriginal reserves. At the homesteads water is pumped from perhaps fifty feet down and when applied to the soil in the compound almost anything will grow.

Big areas there are, too, where the ground is just sahara-like sand, but much of it in central and eastern-central Australia carries an extensive flora. I enclose a couple of snapshots I took of corkwoods around twelve feet high. One I induced a small aborigine boy to pose in; this shows the large white trusses of blossom. The terete foliage is richly glaucous and the trunk is heavily corked. I have never seen a corkwood in cultivation in the civilized parts of Australia. Seed was exceedingly hard to find, but I got a scrap. ⟡

Sea-sage or Sea-lavender (Tournefortia gnaphalodes) *is native to Florida's coast line, often growing down almost to the surf. Its leaves are so densely covered with tiny white hairs that they look like silver. The foliage is undamaged by salt spray.*

Photo by T. R. N. Lothian

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2. Lord, Ernest E.: Shrubs and Trees for Australian Gardens. Lothian Pub. Co., Melbourne, 5th Ed, 1963.
3. Shakovhov, A. A.: The Salt Tolerance of Plants. Moscow, 1956. In Russian with English summary. 552 p.

Floribunda No. 601 (trial ground number). ('Ophelia' × 'Park Direktor Riggers') × 'Pink Parfait'. This rose won the award for the best New Zealand raised rose in the 1970/71 trials at the International Rose Trial Ground, Palmerston North, New Zealand. Hybridized by Mr. G. Sherwood of Shannon, New Zealand.

Floribunda No. 522 on trial at the moment. 'Pink Parfait' × 'Golden Sonne'. Hybridized by Mr. G. Sherwood

Floribunda, 'Michelle Meilland' × 'Pink Parfait'. Hybridized by Mr. G. Sherwood.

Hybrid Tea seedling, unlisted parentage. Hybridized by Mr. John Simpson of Palmerston North, Vice-president of The National Rose Society.

ROSE HYBRIDIZERS IN NEW ZEALAND

*CREDIT: The New Zealand Embassy, Washington, D.C.**

Floribunda 'Vermillion', unlisted parentage. Hybridized by Mr. John Simpson.

Hybrid Tea 'Chantre' × 'Perfecta'. Seedling not yet named. Hybridized by Mr. D. Butcher of Stratford, President of The National Rose Society.

Floribunda (with Hybrid Tea characteristics) 'Dame de Coeur' × 'Independence'. Hybridized by Mr. D. Butcher.

*This article was prepared, with the accompanying illustrations, especially for American Horticulturist by the Information Officer of the New Zealand Embassy.

New Zealand, a small country in the South Pacific, has proved to be a hybridizer's paradise. The environment provides a full range from alpine to sub-tropical and New Zealand's best nurserymen and propagators are equal to any in the world. Growing conditions are ideal as far as soil and climate are concerned—so good in fact, that many plants grow better in New Zealand than in their native habitat. Visiting South African horticulturalists are surprised at the way their native plants flourish here. Visiting commercial rose hybridizers from the United States, Ireland, United Kingdom, Europe, and Japan envy a climate where rose breeding can be done out in the open, instead of in their acres of glass houses at home.

Rose Seedling Trials

It is not surprising that the largest horticultural society in New Zealand, the National Rose Society with its forty branches, should have a number of hybridists. Some excellent seedlings are being bred. Amateurs are encouraged to compete in 'The Best New Seedling Class' at provincial and national rose shows and also at the National Rose Society's International Rose Trial Ground in Palmerston North. Here new varieties from the great commercial nurseries of the world are tested together under code numbers for a limited number of awards given to the best roses at the end of a two-season trial period. Amateur raisers also submit new seedlings for this trial and some have performed very well in open competition with professionally raised roses.

The seedlings, six of each variety, have a vigorous trial with little pampering and are individually assessed six times during the trial period by an experienced panel of fifteen persons. Awards are few and keenly sought by professionals and amateurs alike, and the results widely publicized in horticultural publications throughout the world.

Rosarians from the United States, England, Ireland, Europe, South Africa and Japan, who recently visited Hamilton for the 1st World Convention of Rose Societies were impressed by the quality of the New Zealand raised seedling class on display at the Convention's National Show. The amateur raised seedlings seen in the Rose Trial Ground at Palmerston North the week following the convention at the time of the final judging gave the visitors an even better idea of their quality—some were better than many entries from professionals overseas.

National Rose Society Awards

This recently established trial ground is the only one of its kind in the Southern Hemisphere. It is administered by the National Rose Society, and maintained by the Parks and Reserves Department of the Palmerston North City Council. Its yearly awards to the new roses will show the New Zealand gardening public which varieties are particularly suited to our soil and climate as well as giving encouragement to amateurs to compete for the 'Silver Star of Palmerston North'—the award for the best New Zealand raised rose. It has recently been won by Mr. George Sherwood, a dairy farmer of Shannon. Mr. Sherwood has, for a number of years, had success with his seedlings on the show bench.

Other enthusiastic amateurs with promising varieties are Mr. D. Butcher of Stratford, President of the New Zealand Rose Society, Mr. John Simpson, Palmerston North Vice-president of the National Rose Society, Mrs. Torrens, Ohaupo, Hamilton, who won first place at the Convention, Mrs. Nola Murray, Wanganui, Mrs. Stewart, Wanganui, Miss Pat Mason, Manurewa, Mr. W. Clayworthy, Auckland and Mr. G. Fuller, Feilding.

The Horticultural potential of this small country is tremendous and hardly tapped yet. Growing quantities of flower seeds are exported all over the world. Bulbs from many countries grow and propagate exceptionally well here and exports increase yearly. Cut flowers, expecially orchids (many hybridized here), go to the Northern Hemisphere in their off season. With improved air freight services distance is no longer the barrier it used to be. There is an advantage in being seasonally opposite the Northern Hemisphere as far as cut flowers are concerned.

Plants for Export

Live plants and cuttings go from New Zealand to many countries. Chinese-gooseberries, "Kiwi Fruit," which despite its name, is a New Zealand plant, grows in popularity from year to year. Rhododendrons and camellias (many hybridized here) are exported in quantity to Japan.

Floribunda (with Hybrid Tea characteristics) introduced by Mrs. Nola Murray of Wanganui as 'Una Hawken'.

Many New Zealand native plants, like the weeping *Leptospermum* 'Wairere' and 'Pink Cascade' are very popular overseas.

Endowed as we are with such a fortunate climate for hybridizing and propagating, and with the ever increasing interest of visiting nurserymen in the side variety of plants flourishing here, a promising future for New Zealand horticulture seems assured.

The Impossible and Promising Plants for Urban Conditions —In a Cross Section of USA Cities—

Russell J. Seibert *

Inner city environments have rapidly become intolerable for the average plant—and for the human resident. Our urban resident in many cases, has lost contact with nature, except for a congestion of other humans, bedbugs, cockroaches, rats and stray pets.

How, under a host of increasing environmental stresses, do we sensibly approach the problem of choosing suitable plant materials for these severely polluted conditions?

Former tried and proven street trees as Ginkgo, Norway Maple, Pin Oak and other long-time favorites are unsatisfactory under the presence of modern adverse factors which include dangerous levels of oxidants and fluorides. Individually and synergistically, combinations of planting site, site preparation, quality of plant and its maintenance, vandalism, air and water pollution, salt damage, competition, diseases, insects, animals, chemical damage, soil compaction, erosion, drainage, wind, heat, drought, artificial light, population pressures, and so forth, all have contributed to increasing the problems of maintaining satisfactory urban plantings. In many cases, just one or two of these factors alone have made it impossible to retain the character of the planting desired.

Man, being an adaptable animal, is still reluctant to protect his environment because he has been told that his job may be threatened if pollution must stop. Ever since the industrial revolution, the town's belching smoke stack has been the prosperous community's status symbol. This combined with increasing automobile congestion has raised air pollutants to an intolerant level. Now that the environmental quality has been allowed to adversely affect both human and plant health, we have reached a point where, even with effort, it will be possible only to maintain levels of pollution at their present rate with little or no hope to improve them in the near future.

To help meet our urgent needs and to help revise the nationwide thinking about the kinds of plants which should or should not be used in the polluted population centers of this country, the American Horticultural Society's Environmental Committee has initiated a *National Survey of Plant Performance to be Compared in Response to Man's Effects on His Environment*. This survey records the plant performance of trees, shrubs and ground covers in relation to the existing environmental pressures which vary with each site and with each plant growth region. This much needed information is *not* otherwise available. It can be gained *only* by local observation and is a project which can be accomplished *only* by volunteer effort. This survey, then, can fulfill a desire on the part of many concerned individuals who, as knowledgeable amateur plantsmen, desire to serve a need for their environmental cause. This is something that you and I—each of us *can* do. All individual and organized amateur gardeners, horticulturists and plant scientists are invited to participate in this national effort. What we really need to know is which plants do best and *are* satisfactory in *each* geographical location and which ones are *not* suitable.

It is very important in the process of conducting the survey, when observing a species showing normally poor environmental resistance, to select out that occasional completely tolerant specimen. These resistant selections are to be vegetatively and seed propagated by the local park system, botanical garden, arboretum or interested individual. They should be utilized for testing, selection and breeding for further pollution resistance.

The educational value of these surveys will, we hope, create an awareness by the gardening and horticultural community of the multitude of factors necessary to consider as basic to planting plans and to help assure a higher survival of plants in our many hostile, man affected environments within population and industrial centers.

The existing planting lists are no longer serviceable. They are not usually related to plant growth regions in combination with the specific site as freeway, medial strip, park, mini-park, triangle, street side, residential, garden, or before garden, nor do they consider whether or not the site is subject to salt spray or to the host of other *modern* hostilities perpetrated by man as a means of easing his labor. Many of these

*Director, Longwood Gardens, Kennett Square, Pennsylvania.

man-made environmental changes threaten the very basis of life itself! I need only to reiterate that air pollution does adversely affect photosynthesis and frequently halts it entirely!

Preliminary test surveys have been conducted and already show some interesting results along with various practical observations.

For instance—

1) *In Philadelphia*
   Pyrus calleryana, Quercus borealis, Quercus phellos, Sophora japonica, Ailanthus altissima and *Hedera helix* are probably among the best. Even they will go out, however, if planted near the refinery center of south Philadelphia. Such historically important subjects as Lilac, Flowering Dogwood and American Linden are no longer possible to grow satisfactorily in our national shrine, Independence National Historical Park. To use them frequently means to replant them in spring only to find them virtually killed before autumn.
2) *In Miami*
   It is generally felt that there is no air pollution problem. However, if you look more closely, you will find that some of the Heliconias will show the effects of air pollution injury following those periods of inversion when car exhausts and power plant emissions combine to produce some chronic injury on the more susceptible tropicals and subtropicals so widely used there. *Calathea, Coccoloba, Dombeya* 'Rosemound', *Ficus religiosa*, and *Ipomoea spp.*, have shown the effects of ozone flecking in Bayfront Park.
3) *In Chicago*
   The use of phenomenal amounts of salt on main traffic arteries virtually eliminates the use of any species of plants for medial strip plantings, other than for certain resistant noxious weeds. A combination of climatic conditions, population pressures and air pollution in the center city and industrial center of Chicago usually restricts the use of any trees other than Honey Locusts, *Crataegus*, Crab Apples, Weeping Willow, *Ailanthus altissima*, Cottonwood and perhaps *Elaeagnus angustifolius*.
4) *In St. Louis*
   Those trees listed for Chicago also serve well, but one can add a number of others, such as *Liquidambar styraciflua Euonymous bungeanus* and *Quercus phellos*. On the busy thoroughfares and intersections, Ginkgo shows oxidant injury to a very serious extent. Even at the Missouri Botanical Garden, it has shown injury since at least 1965.
5) *In Los Angeles*
   Los Angeles is unique in our country since it has experienced serious photochemical oxidant air pollution for twenty-five years. It now probably harbors the finest collection of air pollution resistant sub-tropical and some temperate plants which man has ever brought together into one geographical location. Natural selection has had adequate time to start functioning there. If one goes to Arcadia, Pasadena, or San Marino, he will find the basis for suitable planting material to be used in many of the rapidly growing sub-tropical communities of other parts of the world now starting to suffer from this same malady. Plants bred and selected in the Los Angeles Valley are showing remarkable improvement in air pollution resistance, i.e., *Poinsettia* and *Chrysanthemum*.
6) *In Seattle*
   It would appear that location has a great deal to do with what plants may or may not be used at any specific site. Areas downtown and close to the freeway ought to avoid *Azalea mollis* hybrids, *Azalea quinquifolia, Cornus florida*, small leaved Japanese maples and even the Canadian red maple! Believe it or not, convincing symptoms of ozone injury may be seen on a number of the superb specimens of Bonsai exhibited at the Seattle Art Museum pavilion.

As indicated before, some of our best known street trees which are still listed and recommended, such as London Plane, Sycamore, Ginkgo, Norway Maple, Pin Oak, and European Linden are of very questionable value for inner city use *unless* resistant strains or cultivars have been selected. These species *are* very resistant to coal smoke and to SO_2 *but*, they do not resist the combined effects of hydrocarbons, photochemical oxidants and fluorides which plague the ambient air today. Therefore, they are prime subjects to be observed very critically in order to select out highly resistant forms from among mature seedling progenies still existent in center city plantings. They should be observed along the streets, and in the small parks and in home gardens wherever they may still remain and we ought to develop selection nurseries in the *inner cities—not* out in the country!

I am very optimistic about the future for certain *plants* in the environmentally stressed inner cities. But, we must take a fresh look and act now to provide new, highly resistant forms of ornamental plants which will better survive the local conditions we impose upon our plantings. To fail to do this now, will spell disaster to the future of new plantings in urban centers.

If we will locate and use the most resistant plants which nature is selecting out, we can avoid the complete discouragement of those responsible for these plantings. Also, we can then make it financially encouraging to utilize new resistant plants as a part of solving the urban crisis. ⟡

LOTUSES IN A JAPANESE GARDEN

*Yuji Sakamoto**

'Ohga-hasu', an ancient cultivar of N. nucifera

'American Lotus', N. lutea

**Dr. Sakamoto, a biologist of Tokyo, Japan, directed the development of the lotus display pond at Expo '70. He is noted for his plant breeding work, including crosses between American lotus and the Indian lotus.*

The mercury soared and the sun shone hot on the beautiful pavilions and gardens of Expo '70 in the rolling forest lands of the Senri Hills between Osaka and Kyoto. Over the surface of the extensive lotus pond stately blue-green leaves moved gently in the breezes and fresh lotus blossoms, some 200 hundred of them, opened each morning. The sunlit water of the pond was dappled with yellow, white and red lotus flowers. This magnificent August, 1970, display of lotuses was the culmination of more than two years' intensive work. We had produced the stock rhizomes for the pond, lifted them, transported them to the display pond, and worried over them. We had juggled schedules to cope with problems arising from construction delays. Through two years of sunny days, rainy days and even snowy days I had made the seven hour trip to Osaka to

'Maihiren' ['*Dancing Princess*'], *Dr. Sakamoto's hybrid of* N. lutea × N. nucifera *(an ancient Chinese form).*

supervise the lotus project. I know that nothing worthwhile comes easily, but in this case my efforts, and those of the many people who assisted with the lotus project, had paid off in a water garden of pure beauty. A serene garden; a placid, mirror pond gracefully adorned with the marvelous water and standing leaves of lotuses and the lotus blossoms.

I should like to share with American readers the story of the development of our lotus pond at Expo '70. Though the handsome display pavilions of the exposition have been removed, the pond remains, and the Japanese gardens surrounding it continue to develop and enlarge. Visiting horticulturists will find much of interest at the garden today; not the least interesting among the many features will be the lotus pond.

The pond, as originally designed, is an area of 6,250 square meters. Scheduled for completion by the spring of 1969, with stock rhizomes of lotus to be

planted that spring so plants could develop through that summer to be in display condition for the summer of 1970, the pond construction was scarcely underway in the first part of 1969. Accordingly, the lotus stock was planted out in other nursery ponds for later removal to the Expo '70 lotus pond. Our original plan of growing the lotuses through 1969 in their display pond, making observations on growth and blooming habit, had to be discarded.

Our alternate plan called for growing the stock plants in nearby nursery ponds, moving them toward the end of the season into the Expo '70 lotus pond. Immediately, several difficulties arose; first, that of moving lotuses at the wrong time of year (none of us were sure how they would respond); second, the task of digging, without injury, and replanting a great number of lotus rhizomes; third,

1. Lotus rhizomes packed for transport to the Lotus Pond.

2. A working view at the nursery; rhizomes being transported.

3. Checking the rhizomes while they are passing the winter.

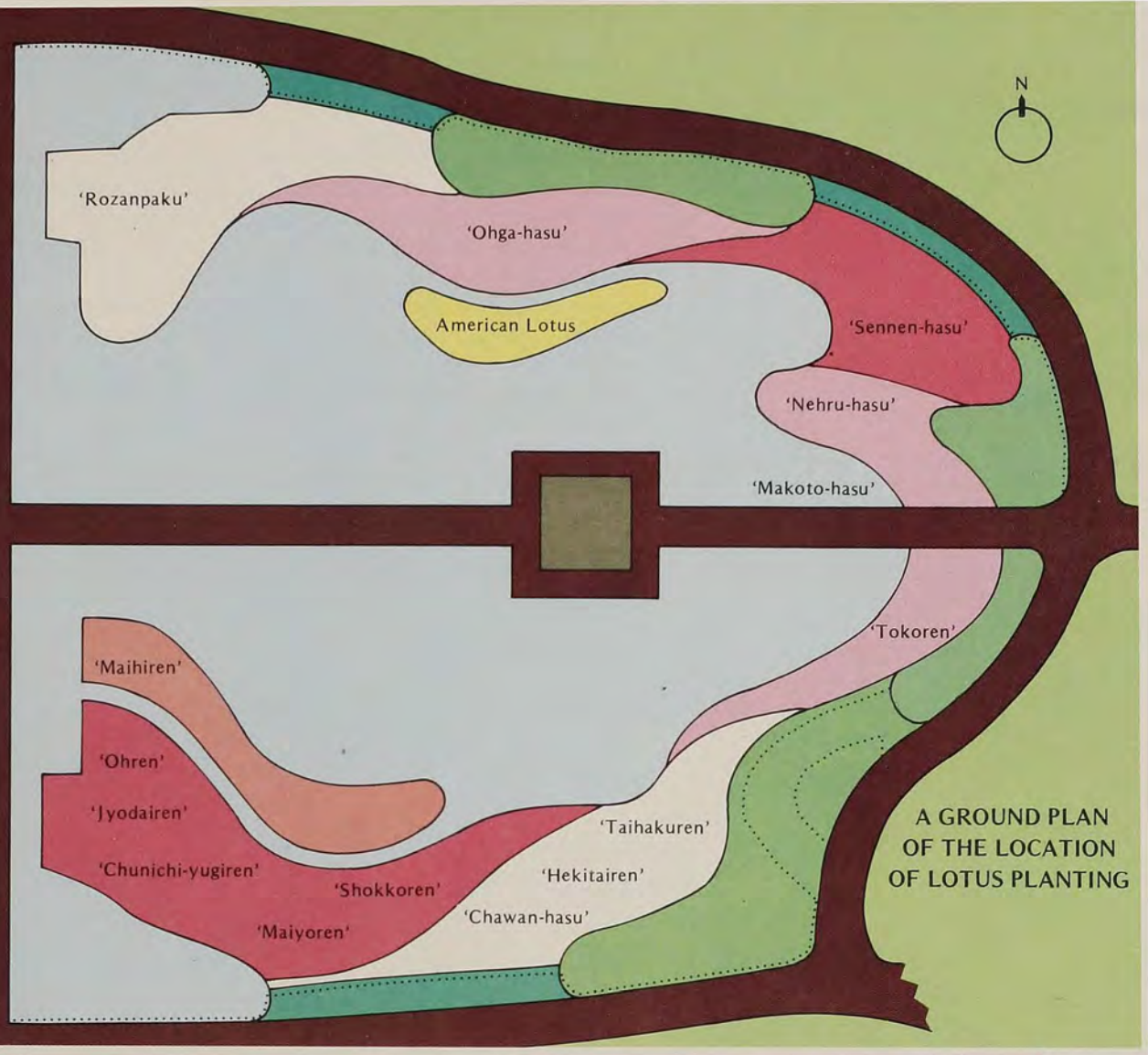
4. The Lotus Pond in early spring.

where to get the experienced people to do the job of moving the plants, and, fourth, how to bring the plants through the winter after recent transplanting.

The ideal time to move lotus plants is at cherry blossom time. As the weather warms, lotus roots and leaves begin to grow and the plants, even when disturbed, live and thrive. We made our plantings in nursery ponds at such a time. Our stock plants grew nicely through the summer, making good increase. In September we faced the problem of lifting plants not yet dormant. Were the rhizomes mature enough? No one knew the answer, but we began digging.

Lotus rhizomes are rather slender and brittle. The terminal bud must not be bruised and the rhizomes should not be injured in any way if decay is to be avoided. The digging was slow and tedious—I spent three full weeks lifting some seven hundred good stock rhizomes each consisting of three nodes with perfect lateral and terminal buds. At this point we hit a snag that we had somewhat

A panoramic diagram of the Japanese Garden.



A GROUND PLAN OF THE LOCATION OF LOTUS PLANTING

Garden Lotuses Planted, Area, and Number of Roots Needed.

Cultivar	Flower-color	Type	Area Square Meters	Number of Roots	Remarks
'Ohga-hasu'	pink	single-petaled, large-sized	271.6	85	Ancient Chinese lotus
'Sennen-hasu'	red	single-petaled, large-sized	269.1	74	
'Maihiren'	reddish yellow	single-petaled, large-sized	224.9	66	Hybrid of Ohga-hasu with Ohji-hasu, (American lotus)
'Rozanpaku'	white	double-petaled, large-sized	413.3	114	
American Lotus	yellow	single-petaled, medium-sized	107.6	38	*Nelumbo lutea*
'Tokoren'	pink	single-petaled, large-sized	318.4	36	
'Nehru-hasu'	pink	single-petaled, large-sized		52	*Nelumbo nucifera*
'Hekitairen'	white	double-petaled, medium-sized	324.1	76	
'Taihakuren'	white	single-petaled, medium-sized		14	
'Jyodairen'	red	single-petaled, medium sized	544.8	31	
'Maiyoren'	red	single-petaled, medium-sized		5	
'Shokkoren'	red	single-petaled, medium-sized		5	
'Chunichi-yugiren'	red	single-petaled, medium-sized		80	Produced by Wuhan Botanical Garden in China
'Ohren'	red	single-petaled, medium-sized		30	
'Chawan-hasu'	white	single-petaled, small-sized		5	Supplementary planting
'Makoto-hasu'	white	double-petaled, large-sized	in a box 2 square meters		Supplementary planting
		TOTAL	2473.7	711	

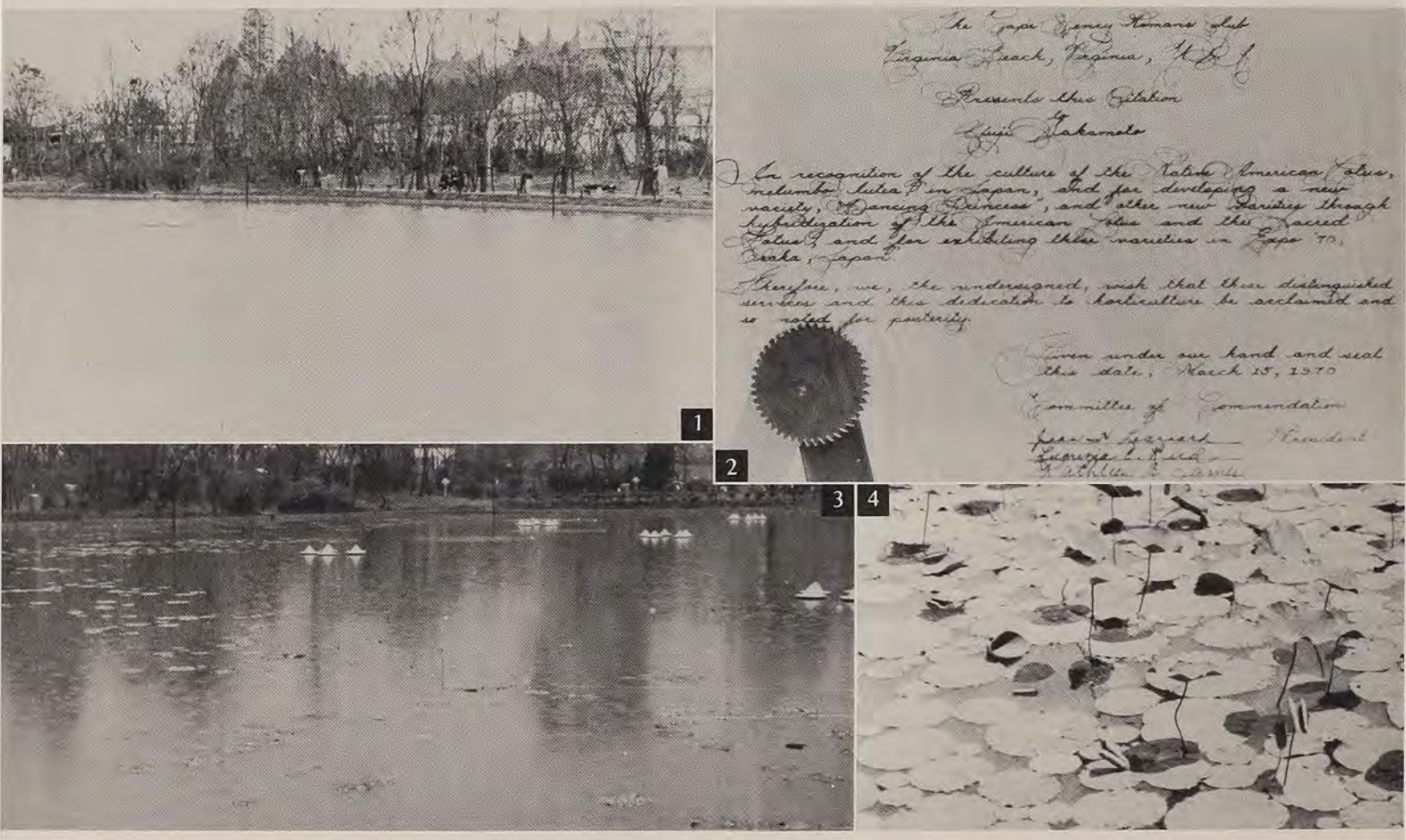
anticipated; stock of some cultivars was short. We were lacking rhizomes of 'Jyodairen', 'Tokoren', and 'Hekitairen'; to keep the original planting design in tact we substituted four cultivars, 'Chunichi-yugiren', 'Shokkoren', 'Maiyoren', and 'Ohren' for 'Jyodairen'; 'Nehru-hasu' for 'Tokoren'; and 'Taihakuren' for 'Hekitairen'.

Planting out of season had to be carried out carefully to insure maximum winter protection for the unestablished rhizomes. Taking care, again, not to injure the rhizomes or their buds, rhizomes were set deep in the muck of the pond—a messy and difficult job. The two planting dates at Osaka were September 29th and October 8th, 1969. The work was in the hands of the Osaka Gardening Cooperative Society, and was finished on October 10th.

The display pond is designed to resemble a natural pond. The bottom is

1. The Lotus Pond in early spring.

2. Letter of commendation presented to Dr. Yuji Sakamoto by the Cape Henry Women's Club.



3. The Lotus Pond during the rainy season. Water leaves appear over the planted rhizomes.

4. Lotus leaves standing above the surface are seen among water leaves.

based of hardened red clay covered over with a mixture of compost and paddy field soil. The pond was designed to maintain an average depth of 34 centimeters of water, the deepest place being 60 centimeters. To help insulate the newly planted rhizomes during the winter of '69-'70, the reservoir was kept brim-full. Beginning at the end of October, mornings and evenings were extremely chilly; by winter, the rhizomes were subjected to extreme chill, with ice on the pond and snow falling.

We made a winter examination of the rhizomes and were not encouraged; some had had their buds broken away; others were turning black and withering. We decided that the loss would run as high as fifty per cent. But some species were, apparently, quite resistant, and we depended on these to make our summer display. In any case, we could do nothing during the winter months to prevent some loss of transplanted rhizomes.

Snow continued to fall through the middle of March and the cold lingered. Even in April the pond showed no signs of life; sunshine and warmth were needed to stir the lotuses into growth, but instead the rainy season came on. On June 19th, Mr. Katsuura, project engineer, and I, examined the lotus plantings in a downpour of cold rain. Water (floating) leaves of lotus were apparent over the planted beds, but only a few leaves were standing above the water. The sight was far from the image of lofty lotuses, and we were not at all sure of a summer display. Where no water leaves appeared we presumed the plants to be dead and arranged for a supplementary transplanting of extra lotus plants. Eighty such plants, with leaves already standing, were dug out and brought to the Expo '70 pond early in the morning. On that occasion, at the shore of the 'Hekitairen' section of the pond 'Chawan-hasu' (white, single-petaled, and small-sized) was

5. The Lotus Pond is seen by many people (The Pond in summer).

6. A fine display of lotuses decorating the finale of EXPO '70. The Soviet Pavilion is in the background.

added. 'Makoto-hasu', which had been box-grown by the Osaka Gardening Cooperative Society, also was transplanted into the pond at this time.

Just as if they had broken through the black clouds of the rainy season, flowers of 'Maihiren' ('Dancing Princess') opened in early July despite the bad conditions. By mid-July the rainy season ended and burning hot summer came around. More lotuses flaired into blossom. Mr. Ichiro Ogawa, a Japanese-American who had worked diligently to introduce the American lotus, *Nelumbo lutea*, a yellow-flowering species indigenous to eastern North America, to Japan visited the lotus pond on July 21st. Mr. Ogawa was present as an emissary of the Cape Henry Women's Club of Virginia Beach, Va. This organization is dedicated to the preservation, development and extended planting of the American lotus. Fortunately, five blossoms of *N. lutea* greeted Mr. Ogawa and me when we walked to the display. This species would bloom more freely later in the sum-

7. Lotuses near the pavilion in the center of the Lotus Pond.

8. The Lotus Pond with the Symbol Zone in the background.

mer, but Mr. Ogawa could tell the Women's Club that *N. lutea* was thriving at Osaka. At the garden, Mr. Ogawa presented me with a handsome plaque of citation, recognizing both my work of culturing *N. lutea* in Japan, and my hybridization program involving crosses between *N. lutea* × *N. nucifera* (the sacred, or Asiatic lotus) which has resulted in the new cultivar 'Dancing Princess' and other hybrids exhibited at Expo '70. I greatly appreciated this generous gesture from American gardeners whose hearts respond to the beauty of the lotus as mine does.

And so the summer came on; bed after bed of lotuses in the Expo '70 lotus pond sent up their great tulip-shaped buds that opened into plate or bowl-

↓ *'Rozanpaku' a double-petaled, large white cultivar of* N. nucifera.

← *' Hekitairen ', a double-petaled cultivar of* N. nucifera.

shaped blossoms of classic beauty. Lotus fragrance wafted over the water to please visitors walking along the margins of the pond. The bitter and laborious aspects of the previous months melted away when viewed across the serene beauty of that enameled pond bearing the reflections of exquisite foliage and flowers on its surface.

Today the gorgeous pavilions have disappeared. But the extensive Japanese Garden will be enhanced by maturity through the coming years; it will see winds, snows, and summer sunshine for centuries to come. Today the Japanese Garden remaining from Expo '70 is sponsored by the Japanese Government and has become a famous park of the Prefecture of Osaka. It is a favorite resting place for the citizens of Osaka. Through summer's hot months lotus flowers and lotus leaves dapple the Garden pond, presenting a unique illusion of beauty and tranquility.

LOTUSES IN AMERICA*

The native American lotus is *Nelumbo lutea*. This species occurs in ponds, quiet streams and estuaries from the New England States and Florida westward to Minnesota, eastern Nebraska and western Missouri. The range extends southward to east Texas. Dormant in winter, buds break on the slender, rope-like rhizomes buried in bottom ooze when the water warms, and soon circular leaves to a foot or more across, usually cupped, stand high over the water. The pale yellow flowers may be as much as twelve inches across though often they are smaller.

Apparently, coastal Indians once cultivated lotus for its edible seeds and tubers. Aquatic wildlife still make good use of the seeds and fleshy creeping rootstocks. M. L. Fernald, editing the Eighth Edition of *Gray's Manual of Botany* cites common names of this plant as sacred bean, yellow nelumbo, water-chinquapin, pond-nuts, and wonkapin, but fails to include either lotus, certainly a common enough epithet today, or yonkapin (jonkapin), a common inland name.

After a history of ill-usage, American lotus is regaining popularity. Earlier, boatsmen cursed the plant and dredged it out of their channels and stockmen destroyed it because it grew profusely in watering ponds. Few native stands remain, and these are imperiled by polluted waters and by drainage systems that dry up the shallow pools in which lotus thrives. Hurricanes, sweeping up the Atlantic coast and washing salt waters far into estuaries, have destroyed other habitats. This seems unfortunate, particularly as American lotus seems to have considerable promise as an erosion-controlling plant. The network of rhizomes effectively ties bottom muck and the dense stand of leafstalks effectively stills water action, reducing bottom wash and bank erosion.

Various lotuses are finding favor in American water gardens. The home owner with a small pool may choose to feature a tub-grown lotus with blossoms of pink, white, yellow or red. Even without flowers, the leaves are highly ornamental. 'Mikado', a recently introduced cultivar with large, pale green leaves and five-inch across fragrant pink blossoms is said to grow well in a twenty-inch across jardiniere filled half with potting mixture and half with water.

Lotus rhizomes may be planted directly in a clay-muck layer on the bottom of a pool or in containers to be set in a pool. Plastic or wooden tubs or half-barrels make suitable containers. Prepare a mixture of three parts garden loam (free of sand and with a relatively high clay content) and one part composted cow manure. If manure is not available, enrich the soil with two cups of 5-10-5 fertilizer per bushel. Avoid sand, sawdust, peat or similar additives. Fill the container to within four inches of the top; make a depression in the soil and plant the rhizome, bud end in the center of the tub and above the soil, distal end toward the rim and buried to a depth of two inches or more. Place a flat stone over the buried portion of the rhizome to hold it in place until it takes root. On no account permit any damage to the terminal bud. The surface of the soil should be covered by four to eight inches of water. Container-grown lotus cultivars have survived in American garden pools through Zone 5, even when the pools froze almost solidly.

A native stand of American lotus, Nelumbo lutea, *in Tabernacle Creek, Virginia.*

**Notes on growing lotuses in America extracted from correspondence with Mrs. Cecil H. Reed, Lotus Research Chairman, Cape Henry Woman's Club, Virginia Beach, Virginia. Mrs. Reed submitted Dr. Sakamoto's manuscript to* American Horticulturist.

×Pardancanda norrisii
An Intergeneric Hybrid Between *Belamcanda chinensis* and *Pardanthopsis dichotoma (Iris dichotoma)*

Parental Generation (P_1)

Pardanthopsis dichotoma × Bellamcanda chinensis

First Filial Generation (F_1)

× Pardancanda norrisii **

*Lee W. Lenz**

In 1936, Rex D. Pearce of the Pearce Seed Co., Morristown, New Jersey, imported a number of plants from Japan, one of them being *Belamcanda flabellata* Grey which he described as "a low, compact species with flowers that were unmarked golden-yellow." According to Grey (1937) *B. flabellata* is native to Japan but the exact provenance is unknown. Through hybridization between *B. flabellata* and *B. chinensis* (L.)DC. (grown under the name B. sinensis) Pearce produced by selection from the resulting hybrids, a strain of blackberry-lily known as the Avalon Hybrids. Recent authors, (Ohwi, 1965; Chittenden, 1951) recognized *Belamcanda* as monotypic and the species *chinensis* as widespread in Asia and variable. On this basis, Pearce's Avalon Hybrids would be considered intraspecific rather than interspecific. In the early 1960's Samuel N. Norris of Owensboro, Kentucky purchased seeds and plants of the Avalon Hybrids from the George W. Park Seed Co., Greenwood, South Carolina. These he reports "showed considerable variation in height and growth form."

A plant generally known as *Iris dichotoma* Pall. has long been in cultivation but it has never been very common in gardens. Its resemblances to the common blackberry-lily *Belamcanda chinensis* have been noted by numerous authors, nevertheless recent taxonomists have not suggested that it was not an *Iris* although they have all placed it in a separate category within the genus where it stands by itself. Rodionenko (1962) considers the subgenus *Pardanthopsis* containing *I. dichotoma* to be the most primitive saying that it "retains both in structure and its biology, many ancestral traits, i.e., such as were characteristic of the ancestral species of *Iris*." A recent study (Lenz, 1972) has shown that in a number of respects *I. dichotoma* is more closely related to *Belamcanda* than it is to *Iris* and that this relationship is best expressed by according the plant generic status under the name *Pardanthopsis*. The production of fertile hybrids between the blackberry-lily and *P.*

*Director, Rancho Santa Ana Botanic Garden, Claremont, California.

**Not presently available, American Horticulturist hopes to announce a commercial source of × Pardancanda norrisii soon.

dichotoma (Pall.) Lenz bear out this close relationship. No hybrids between *P. dichotoma* and any species of *Iris* have been recorded.

Norris (pers. com.) purchased from the Zilke Brothers Nursery, Baroda, Michigan, plants sold under the name "Hansen New Everblooming Orchid *Iris*." According to them, the plants were brought to the United States by "Carl A. Hansen from one of his world-wide plant exploration expeditions."They described the plants as coming from "the wilds of Siberia near the town of Shilka." According to *The Times Atlas of the World*, Vol. 2, Shilka is located at 51° 55′ N and 116° 01′ E, placing it east of Lake Baikal and about 500 miles northeast of Ulan Bator, Mongolia. These plants were later identified as *Iris dichotoma* now properly known as *Pardanthopsis dichotoma* (Pall.) Lenz, a species of wide distribution in eastern Asia.

During the summer of 1967, Norris (pers. com.) pollinated flowers of *P. dichotoma* with pollen taken from a number of the plants of *Belamcanda* Avalon Hybrids. He obtained twelve well filled capsules with nearly 500 seeds which were planted immediately upon harvest. Within three weeks approximately half of them had germinated. Seedlings were grown throughout the winter under fluorescent lights and lined out in the garden the following April. According to Norris, blooming commenced about the middle of July and continued until frost. The F_1 generation was very uniform in bloom and growth. In the F_2 generation the plants showed great variation in both flower form and plant habit. Norris' experience has been that the hybrids will backcross to both parents but when *Belamcanda* is used as the maternal parent the seeds fail to germinate. In the spring of 1970, Norris supplied me with plants of the two parental species and the hybrid as well as seed produced by placing mixed pollen of the F_2 generation onto *P. dichotoma*. The seeds germinated readily and the plants began blooming in late July and continued well into October.

Plants of the F_2 generation showed great variation in flower form between those typical of *Belamcanda* and *Pardanthopsis* although in this population there were no yellow-flowered plants but there were some that were salmon-colored and there were none that were identical to *Belamcanda* in flower form. One of the most obvious and at the same time interesting morphological features of these hybrids was the style and the style branches which varied from those typical of *P. dichotoma* to those nearly identical to those of *Belamcanda*. If Rodionenko is correct, and *Belamcanda*, or a *Belamcanda*-like plant is the progenitor of *Iris*, then by arranging the style branches from plants of the segregating F_2 population in a sequence from those most nearly approaching *Belamcanda* to those most like *Pardanthopsis* one might gain an understanding of the evolution of the advanced petaloid style branch found in *Iris* from the simple structure present in *Belamcanda*. One of the most conspicuous features of the *Iris* style branch is the two style crests, often very long and attenuate, below which is a stigmatic flap. In *Belamcanda* the terminal segments are all alike and all three are stigmatic. In the F_2 populations of the *Belamcanda* × *Pardanthopsis* hybrid a series could be arranged showing various stages in the development of the style crests and associated stigmatic flap from the simple undifferentiated style branch characteristic of *Belamcanda* to the petaloid style branch found in *Iris*.

Plants from the population, *P. dichotoma* ♀ × (*Belamcanda* Avalon Hybrids × *P. dichotoma*) ♂, as might be expected, more nearly approached in morphological characters *Pardanthopsis* than *Belamcanda*. The flowers opened late in the afternoon or early evening and were closed by next morning, also a characteristic of *Pardanthopsis*. The flowers of *Belamcanda* normally open about mid-morning and close by late afternoon as do those of the F_1 generation of the hybrid.

×*Pardancanda norrisii* Lenz, (Aliso 7: 407. 1972) Leaves alternate, equitant, to 35 cm. long, 3 cm. wide; flowering stems to 1 m., much-branched, the peduncles often issuing in pairs of equal length at the same point; spathes many-flowered, flowers fugacious, after anthesis perianth segments spirally contorted; pedicels to 3 cm. long; perianth tube about 1 mm. long, 2.5 mm. wide; external segments obovate, 2.9 cm. long, 1.2 cm. wide without a distinct claw but outer portion distinctly reflexed, purple, claw with white markings near keel; inner segments broadly elliptical, emarginate at the apex, tapering into a claw about one-third length of the segment, 1.9 cm. long, 1.2 cm. wide; ovary elliptical, about 7 mm. long, 2.5 mm. wide; style 2.1 cm. long, divided into three segments about one-half the length of the style, style arms slightly winged, style crests about 2 cm. long, stamens six, anthers about 7 mm. long, filaments about 1.2 cm. long; stamens upright, not firmly held against style. Lee W. Lenz 24895, 21 Sept., 1971 (RSA).

It gives me great pleasure to name this hybrid in honor of the man who created it and who kindly supplied me with plants and information about the origin of this most attractive garden plant.

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Brassovola martiana.

Orchid Hunting in South America

*Jan W. Boekhuizen**

The jungles of northeastern South America are probably the largest, essentially unexplored, land area in the world. The visiting tourist, traveling by plane, ship or car, gets a false impression. Most airfields, villages, houses and roads in these parts of the world are primitive and sub-standard as compared to those of the more developed countries. Most tourists demand modern comforts and if they do not find them they are not in the mood to appreciate the majesty of tropical nature. Tourists visiting these countries are like people entering a house by the back door. One has to travel by foot or by small boat, after careful preparations, to get to know the jungles as they really are. Each jungle inhabitant, man, animal, tree or plant, is a king in its own right, a king who has won his battle for life and who, as a result of total freedom under extreme conditions, has acquired royal qualities. All animals and plants in these surroundings show a high degree of perfection, a fact proved by the orchids.

Even if one lives close to the jungle it takes time to find the right friends who think it worthwhile to spend their free time "hunting" insects or plants. There are many men who like to hunt birds or other animals but these are unfit for insect or

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plant hunting because they never "see" anything, they only "listen" and are always in a hurry. To go orchid hunting takes a small party of two or three dedicated men. Never go alone into the jungle.

According to popular belief about jungle country there are snakes, tigers, spiders and other dangerous animals lurking behind every tree and bush. In fact these creatures are only active during the night and they hide away during the day. If they happen to come in one's path they flee as fast as they can. They are usually more afraid of us than we are of them and they can hear a man cutting through the bush miles ahead. One has to observe certain rules as to where a moving person should place his feet and hands. It pays always to be very observant, especially when crawling underneath bushes, passing over or near dark holes and climbing through dead trees spread on the ground. Real dangers are frequently in unexpected places and of an unexpected nature. Once I was almost thrown over by a tigercat fleeing from its lair in a hollow tree stump because without knowing it I blocked his line of escape. Poisonous plants hook their barbs into the skin at the slightest touch. Rotting wood hides snakes, scorpions and other crawling insects. Not until these masses of wood are disturbed does one realize the abundance of life underneath. Ants, wasps and bees are everywhere as I shall discuss later.

One does not often get the chance to organize or join a real expedition equipped for long jungle trips. To maintain a group of ex-

Brassia lawrenceana.

Epidendrum fragrans.

plorers during two or more weeks takes quantities of provisions, camping materials and other necessities. The cost of these trips including the guide, the cook and other labor, runs very high.

On the other hand it costs very little to organize a one day trip for two or three men, each man carrying his own load and equipped with a machete. The leader of the group should have a compass and a light firearm. Any point on any road, river or coastal strip can serve as a starting point. From the moment we start cutting a path for ourselves it takes only a couple of minutes until we enter into the adventurous, secret worlds of the jungle, individual worlds that move with the explorer, wondrous worlds shared by nobody else than those forming the party. The tremendous wealth of tropical vegetation swallows the explorer and surrounds him on all sides.

Jungle Habitats

The jungle has many moods from grim, secretive, eternal, to gay, lovely and friendly where it hides the most beautiful and amazing forms of miniature life. On rotting wood we find orange, purple and deep golden fungi with shapes of trumpets, tulips or clusters of rocks. Every wet spot is a natural terrarium filled with small plants of unbelievable perfection. The scenes and landscapes one comes to are of endless variety, low bushes of every kind, lovely brooks, cool to walk in and different every yard of their course, wonderful savannahs of various compositions, some on low, some on high ground, with plant life adapted to the soil formations and soil substances, solemn forests of all kinds of trees, small and large swamps from shallow to deep. Where opposing conditions meet the vegetation is very special; for instance where the savannah meets the high forest, and where the swamps are either in the open, half-covered, or entirely underneath the trees. All these combinations offer habitats for different species of plants, different insects, different birds and different animals. Nature is full of wonders in these environments. Those who have learned to observe find exceptional beauty in these places. It is a rewarding experience to accept certain risks and explore unspoiled nature as it exists in the tropical parts of the world.

Jungle Creatures

The jungle is never silent; monkeys, birds, frogs, insects, dripping and running water, objects falling from trees and so on make a continuous background of noise. Honeybirds (hummingbirds) satisfy their curiosity by approaching from behind; suddenly you hear the sharp fluttering noise of their tiny wings very close to your ears. Honeybirds come in many colours and can be found everywhere. While hovering over the sunlit flowers of the savannahs they look like exquisite works of art of an infinite delicacy. One bird in the South American forests makes a sharp piercing cry like the crack and sweep of a long whip, other birds come in large groups twittering like monkeys. Even if you do not see them you hear monkeys howl or signal to each other with a low pitched sound. I remember a monkey family teaching its young to jump from tree to tree while we, underneath in our canoe, kept very quiet.

After much urging the youngest jumped, slid down a branch or two and finally held on swaying over the surface of the water. The entire family, watching from above, clapped their little hands and uttered shouts of joy to congratulate the little fellow after this daring but necessary feat. While moving through the bush it happens regularly that unseen animals, from very near by, suddenly rush off with a loud rustling of leaves and cracking of twigs. Certain birds on the savannah are so sure of their protective colouring that they usually wait till they are practically under your nose before taking off. When an entire flock plays this game it can give you a real jolt.

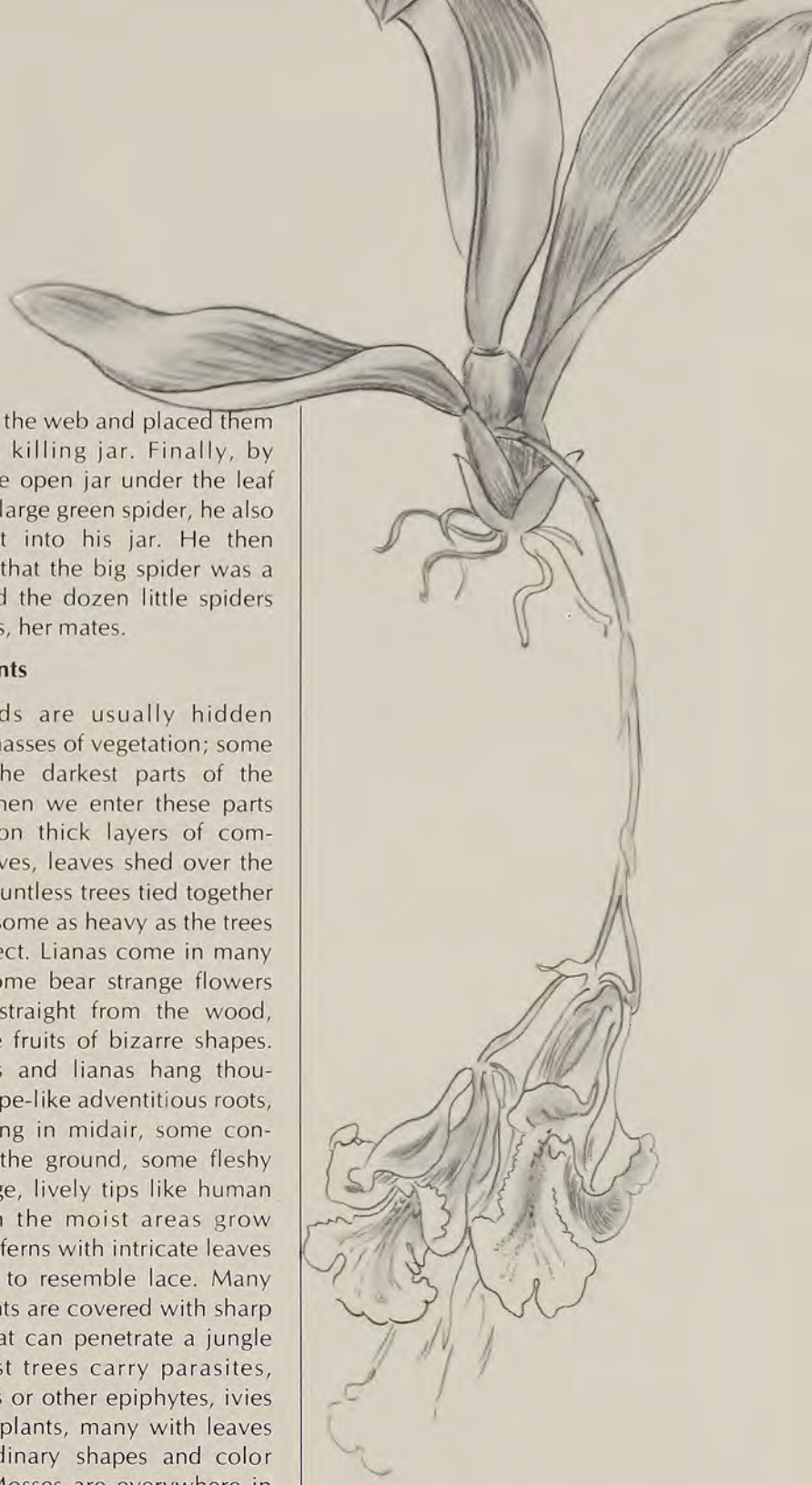
Another well known aspect of jungle life are the insects. When cutting a path through bush and fallen wood a man must not only watch out for snakes but at the same time he must be on his guard for bees, wasps and ants. Insect repellent sprays are only of use against the smaller flying insects. The nests of the wild jungle bees are large and easily detectable; jungle bees, however, are excellent scouts and once they become disturbed by a falling branch or other commotion unknown to the approaching traveller, they attack anybody in their neighbourhood in the most ferocious way. Wasps come in many types and sizes. The very large and beautiful solitary wasps live in holes in the ground. Most kinds, from quite small to over two inches long, build their nests in the shrubs. Those building small to middle size nests often attach these to the undersides of large leaves where they are protected

against drip and rain. They have taught many a man swinging a machete to take a good look before cutting. Looking is a necessity under all circumstances. In some parts of the woods the ants build enormous subterranean nests. The person who makes the mistake of venturing into such a place is in no time covered by ants. Some are very small but are called fire-ants because of their bite. Some jungle ants are over an inch long. I once saw large ants entirely covered with sharp bristles.

It would be unjust to consider all jungle insects as a nuisance or danger. In the woods and on the savannahs live some of the most beautiful butterflies. One of the larger species has deep blue wings of a metallic glittering quality; another has multicoloured wings with transparent parts like windows in a wall. Among the smaller butterflies living in the swamps I once found one that was gold colored with curled, black edged wingtips and covered with sparkling dots like diamonds. Another family of beautiful insects are the tropical dragonflies. Varying from large to very frail and delicate, in daring fluorescent colors, they can always be found in the vicinity of water. One sort is very long and thin, and flies with two pairs of wings—its body drooping—while it hangs in the air like a helicopter. When I tried to scoop it into a net it stopped in mid-air, when I tried again it moved backwards. I once accompanied an entomologist who collected bush spiders. We came to a large web with a big glittering metallic green spider in the middle. The scientist ran it out of the web and it hid under a leaf. He then picked about a dozen very tiny spiders out of the web and placed them inside his killing jar. Finally, by holding the open jar under the leaf hiding the large green spider, he also knocked it into his jar. He then explained that the big spider was a female and the dozen little spiders were males, her mates.

Jungle Plants

Orchids are usually hidden between masses of vegetation; some grow in the darkest parts of the jungle. When we enter these parts we walk on thick layers of composted leaves, leaves shed over the ages by countless trees tied together by lianas, some as heavy as the trees they connect. Lianas come in many species, some bear strange flowers sprouting straight from the wood, some have fruits of bizarre shapes. From trees and lianas hang thousands of rope-like adventitious roots, some ending in midair, some connected to the ground, some fleshy with strange, lively tips like human fingers. In the moist areas grow palms and ferns with intricate leaves sculptured to resemble lace. Many jungle plants are covered with sharp needles that can penetrate a jungle boot. Most trees carry parasites, bromeliads or other epiphytes, ivies and other plants, many with leaves in extraordinary shapes and color patterns. Mosses are everywhere in the rain forests. Orchids, from tiny miniatures to large bulbous plants, are hidden in shrubs and in the crotches of the trees. Some species always are on the lower branches, others on the upper branches. There also are orchids on the rotting tree trunks and broken branches spread on the ground. The savannah has many kinds of terrestrial orchids,



Rodriguezia candida

Stanhopea eburnea = Stanhopea grandiflora.

Aganisia pulchella.

Epidendrum ibaguense *growing on an ant-nest,* Coryanthes macrantha *imbedded in the ant-nest, its flower spike protruding below.*

Paphinia cristata.

Flowers of Coryanthes macrantha.

Ionopsis utricularioides.

Oncidium pusillum.

Gongora quinquenervis.

Catasetum longifolium

some looking so much like the surrounding wild vegetation that they can not be found unless they bloom. To describe all the orchids we have found on our trips into the bush would take too much space. Besides, to be frank, I often am uncertain about their correct names. Many species can be recognized only after they have come into blossom. Even then, as happened to the famous Lindley who tried to distinguish between the species of the *Catasetum* and *Cycnoches* orchids, one may find male and female flowers of entirely different shapes on the same plants.

Orchids of the Savannahs

Among the low vegetation of the open savannahs there are many clusters of heavy pseudobulbs belonging to at least six species of the genus *Catasetum*. The female flowers of these plants resemble rows of little bonnets complete with strings attached, their insides yellow to orange. The showier male flowers on the other hand look like flocks of speckled butterflies. The taller pseudobulbs (of about two feet length) belong to *Cyrtopodium* species. The numerous green-brown-yellow flowers of these plants blend into a mass of beautiful shades and composition. Most other terrestrial orchids, such as *Cleistos rosea* are rooted deeply into the soil (some are saprophytic or parasitic) and can not be found unless they bloom.

Many orchid species perch on various woody plants of the savannah. Best known are the Epidendrums such as *E. fragrans, E. nocturnum, E. oncidioides, E. vespa* and the colourful *E. eanosmum*, the Brassavolas with trumpet shaped white and yellow flowers emerging in all directions from the upper parts of their long pencil-like leaves. The small *Rodriguezia secunda* plants grow so close together that their flowers form a continuous patch of deep red. The rare *Aganisia pulchella* on the edge of the forest climbs vine-fashion with bunches of star-like white flowers displaying their bright yellow and red hearts. There are Maxillarias of many shapes and colors, Bifrenarias with purple speckled, salmon-colored flowers, *Rodriguezia bracteata* with bunches of white bell-like flowers showing bright yellow spots on each lip. Other savannah epiphytes include a great variety of miniature orchids of delicate beauty such as *Ornithocephalus bicornis, Pleurothallis, Octomeria lansbergii, Quekettia microscopica, Platystele*, and many others.

Forest Orchids

The larger orchids grow in the shaded parts of the forest. One of the most beautiful is the *Oncidium lanceanum*. Because it normally flowers during the short wet season at the end of the year it is popularly known as the Christmas orchid. Christmas orchids have large fleshy leaves (no pseudobulbs) and erect flower stems, up to eighteen inches in length, bearing purple-brown flowers with a lip varying from rose to white. Another exquisite orchid growing in the swamps and near forest creeks is the *Menadenium la-*

biosum with flowers two to three inches across of a delicate combination of light-brown, white and red-purple. In the heart of the forest are the *Brassia* varieties with multicolored triangular flowers arranged two by two on horizontal flower spikes, *B. lawrenceana* with short sepals, *B. caudata* with long sepals. Other forest epipytes include *Epidendrum floribundum* with compact bunches of white flowers, *Gongora quinquenervis* with long trailing flower spikes bearing flowers shaped like wasps in colors from salmon to red, *Stanhopea eburnea* with large white hanging double flowers, the base petals resembling a pair of miniature ladyslippers (whence its popular name), Bolleas, Chaubardias, Batemanias, and Aspasias. *Peristeria* with hanging clusters of cupshaped multicolored flowers hides in the jungle foliage; Sobralias flower like small Cattleyas. One sees Cuticarias with beige-colored, brown spotted flowers growing from the base of long trailing leaves shaped like chopped off lengths of green wire. *Ionopsis* blooms with great masses of small purple flowers like so many small butterflies. Vanillas stretching their thick stems and fleshy leaves like endless centipedes. *Oncidium altissimum* winds its long strings of golden flowers through the branches of the trees. There are *Epidendrum ciliare, Schomburgkia, Trigonidium, Trichocentrum,* too many to describe.

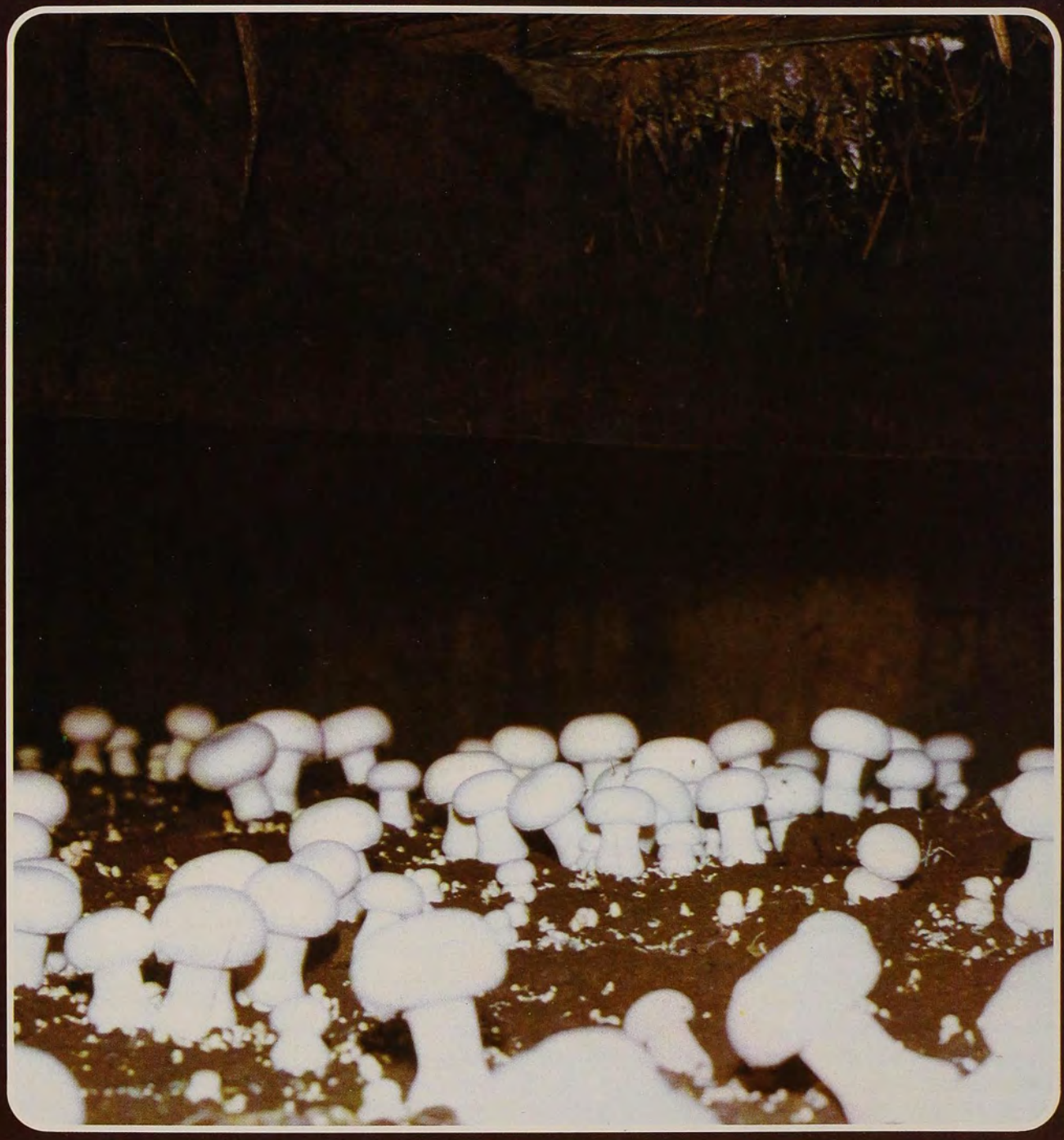
In the Garden

To close my list I should like to mention two more very special species. One dear to my heart is the *Paphinia cristata*, an orchid to be found near brooks and in the swamps. Because of its delicacy I learned to move it by sawing down the tree on which it grows. After carrying it home very carefully I placed the entire block of wood holding the plant over a pond in my garden. The flowers, sometimes three on one stem, are like large striped stars of a rust-red color with an extended lower petal (labellum) and with white whiskers protruding from the center giving a cat-like appearance.

The most peculiar of all South American orchids is the *Coryanthes macrantha*. It has at least three peculiarities which set it aside from the other orchids. First, the way it grows; its natural environment is swamp-bush where it likes to settle in the heart of ant-nests situated in the branches of trees. The plants grow inside these nests in such a way that half their tapering pseudobulbs with their crowns of leaves stick out of the top of the nest while the long trailing flower spikes hang out of the bottom. (Often one finds another orchid, *Epidendrum ibaquenese*, with crowns of red-purple flowers sitting on top of these nests.) Coryanthes' second peculiarity is the way its flowers emerge. I watched this from a plant I kept in my garden. After the newly formed flower spike has come down two to three feet it forms a small balloon-like bud on the end which starts swelling until one early morning it bursts open with a distinct popping noise. Both halves of each "balloon" turn inside out so they form a bucket-shaped flower of creamy green color spotted with purple and each fills itself with a sticky fluid. As soon as the fluid is present, green bees appear, which brings us to the third peculiarity of this plant, the highly-ingenious construction of the flowers. It is well known that orchid flowers are equipped with intricate devices to protect the plants against self-fertilization. *Coryanthes* beats all other orchids on this point in my estimation. After the green bees appear some are intoxicated by the fluid so they drop into the "bucket". They cannot get out unless they follow a fixed route which compels them to deliver the pollinia picked up from other plants before arriving at the spot where they pick up new pollinia. Every detail of the flowers seems to be designed to attain this purpose. The top parts of the flower contains glands to drip the fluid into the "bucket" and the flower brings down its sepals in such a way as to screen the exit of the "bucket". This screen not only guides the insect out, but also serves to keep other insects from entering the "bucket" on the wrong side.

The wonders of the jungle are the wonders of life itself. The jungle takes us away from the works of man and confronts us with the works of God. The orchid plant, dwelling in the age-old tree, lives on for hundreds of years by simply renewing its pseudobulbs. To the human observer it demonstrates a significant accomplishment of evolution; the combination of beauty and long life.

MUSHROOMS ARE BIOLOGICAL WONDERS



Button mushrooms (Agaricus bisporus) *ready for cutting in a commercial grower's house. Notice the strawy compost hanging from a higher tray. Photo taken at J. Krahenbuhl & Son Produce Farm in Kansas City.*

*Leo J. Wilhelm**

Mushrooms sometimes are called—correctly—great biological wonders!

They are primitive plants, but with elaborate life-cycles. Botanists usually rank them as equal to the algae in complexity. But the fungi, of which the common field, woods and market mushrooms are a subgroup, have no chlorophyll. They cannot photosynthesize and therefore obtain nutrients as saprophytes or as parasites. Mushrooms, which are the fungi's largest and lovliest members, come in a profusion of colors, shapes and varieties, and range from the fatally seductive Amanita to the savory Morel.

Mushroom culture is not new but the practice of cultivating mushrooms as a crop is surprisingly recent. And it has reached a very high standard in the United States.

History of Mushroom Culture

Since very early times, it has been known that mushrooms are edible. But Egypt's Pharaohs considered them too good for the common man and to the Romans they were "food for the gods". Pliny the Elder mentioned them nineteen centuries ago in his recommendations to the Roman farmers. His writings were mostly warnings not to eat them because they were poisonous.

One of the first books in English devoted exclusively to mushrooms was written in 1779 by John Abercrombie, of London. It was published under the lengthy, but descriptive, title *The Garden Mushroom: It's Nature and Cultivation. A Treatise, Exhibiting Full and Plain Directions, for producing this desirable Plant in Perfection and Plenty, according to the true successful Practice of the London Gardeners.*

Across the Channel in France, efforts at growing mushrooms commercially were first made during Louis XIV's reign, when enjoyment of all of life's delights was very much in vogue.

It was not until late in the nineteenth century, however, that growing mushrooms commercially was introduced into the United States. The first growing center in this country was near New York City, and extended onto Long Island.

Meanwhile, in about 1890, greenhouse operators near Kennett Square, Pennsylvania, discovered that they could grow mushrooms in the unused spaces under greenhouse benches. Mushroom growing became popular and spread rapidly in this area. Soon, Kennett Square became known as the "Mushroom Capital of the United States", a title it still holds.

Morchella esculentus

Modern Mushroom Production

Today, much of the mushroom industry is centered in Pennsylvania, Delaware, and New York; Pennsylvania supplies about two-thirds of all mushrooms commercially produced in this country. Although all States except those in the Deep South have climate and soil conditions that permit the commercial culture of mushrooms, the climate in this country is not really suitable for their production out-of-doors, since mushrooms thrive in a damp, dark and cool environment. To assure satisfactory yields, commercial producers grow them in enclosed rooms where temperature, humidity, and ventilation can be carefully controlled.

According to the U. S. Department of Agriculture, only one species of

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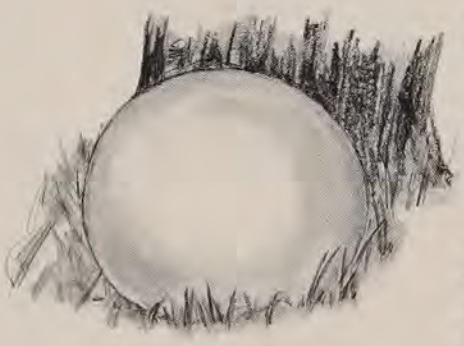
Coprinus comatus



Calvatia gigantea

mushroom is cultivated commercially in this country—a common field species which has been horticulturally adapted. This is the more surprising when we learn that there are more than fifty edible wild species common here and that over 3,000 different mushroom fungi have been identified in this hemisphere alone.

According to Lucy Kavaler, in her book *Mushrooms, Molds, and Miracles*, the mushrooms produced here are descendants of the umbrella-shaped species, *Agaricus bisporus* (A. campestris), from Europe. On a cool fall day in 1926, a farmer found a clump of pure white mushrooms of this species in a bed of cream-colored caps. And it is from that very clump that our present mushroom industry has grown, except for a brownish variety of the same species which is cultivated in the Middle West and on the West Coast, where brown-colored mushrooms are popular.

Today mushroom growing in the United States is big business. Industry representatives estimate that approximately 165 million pounds are grown each year on over ninety million square feet of bed space. The yield is usually from one and one-half to two and one-half pounds per square foot per crop, though sometimes it is considerably higher. And under today's modern methods of handling and processing, mushrooms are prepared for slicing into salads, made into soups, canned, broiled, pickled, stuffed, sauced, sautéed and creamed, for mushroom connoisseurs everywhere.

Nearly 20,000 workers engage in growing and processing mushrooms. Several million dollars a year are spent for compost and equipment used by commercial growers, and amateur growers spend many thousands more. According to the latest U. S. Department of Agriculture figures, there is a capital investment of nearly $60 million in all businesses depending on mushroom growing.

Edible Wild Mushrooms

Mushroom culture intrigues many people—growers and gourmets, professionals and amateurs. But very few Americans have had any experience with more than a couple of species of mushrooms, most with only the commercially grown species. Even only a handful of gourmets have ever tasted the highly prized Morel.

Although there are over fifty wild species of edible mushrooms, experts caution amateurs to limit themselves to the 'Foolproof Four', as they are referred to by the authority on mushrooms, Professor Clyde M. Christensen of the University of Minnesota. Besides the prized Morel, these are the Giant Puffball, the Sulphur Polypore, and the Shaggy Mane.

The delicately delicious Morel *(Morchella esculentus)* is not rare but it is elusive because it seldom appears consecutively in the same place, its fruiting season is short, and it has not been grown under cultivation so far. It grows from two to six inches tall, ranges from tan to a rich brown, and retains its flavor best when sautéed in butter.

The Giant Puffball *(Calvatia gigantea)* which gets its name from its size, up to twelve inches in diameter, grows in open fields and under rotten logs. It can be prepared into puffball steaks, breaded into cutlets, sliced into salads, or made into a creamed pureé.

The Sulphur Polypore *(Polyporus sulphureus = Lateiporus sulphureus)* grows in fan-shaped tiers for several feet along the trunk of a tree or on a dead log. It varies in color from orange to yellow, and a single colony yields up to six pounds of very tasty, meaty mushrooms the flavor of which resembles that of breast of chicken. It can be made into soup or croquettes, fried, stewed or fricasseéd.

The Shaggy Mane *(Coprinus comatus)*, which grows from four to six inches tall, and occasionally reaches eighteen inches, must be eaten almost immediately upon picking because its shako-like white cap dissolves within hours into an inky black fluid. For this reason, it is very seldom on the menu at even the

finest gourmet restaurants. It is enjoyed best when baked with a mild cheese sauce, or when steamed for about five minutes and dressed with melted butter or cream.

Because of the high risk of being poisoned, all other mushrooms should be avoided. Although some are exotically beautiful, such as the graceful *Amanita phalloides*, the death angel, and *A. muscaria*, the fly agaric, their color, flavor, shape, or scent give no clue to their poison potency. Cooking, freezing, or drying will not destroy their death-dealing poison.

Growing Mushrooms for Market

In growing mushrooms, there is much more than meets the eye. What you see above ground is the edible portion, the fruiting structure, the sexual, reproductive part of the mushroom fungus—only one per cent of the entire fungus "plant". The ninety-nine per cent you do not see is the mycelium, which is basically thread-like and grows root-fashion underground. Sometimes miles of these microscopically-small mycelial threads, which may be only 3/25,000ths of an inch in diameter, permeate the soil absorbing moisture and nutrients from partly decomposed organic matter for the spore bearing, edible structure before it forms fully and matures. It takes only a spring-like breath of fresh air and a few drops of water to awaken mushroom vitality into a magic burst of activity. All parts of the fruiting (above-ground) structure are edible. And all parts are as nearly soft and delectable as the others. The subterranean-fruiting truffles of Europe do not grow in America.

Agaricus bisporus

Mushrooms as Food

Cultivated mushrooms are definitely nutritious and have a distinct place in today's diet. While they are delicious, they are not fattening. A pound contains only ninety calories. Although mushrooms are not as rich in protein as meat and fish, they compare favorably with most fresh vegetables. They are also rich in vitamins and minerals, such as iron and copper; and they contain substantial amounts of riboflavin, nicotinic acid, pantothenic acid, thiamin, and biotin.

One of the big differences between mushrooms and green plants is that mushrooms cannot manufacture their own carbohydrates as green plants can. Therefore, mushrooms must be grown in an organic compost medium, which contains carbohydrates as well as the minerals that green plants need. Yet, mushrooms cannot be satisfactorily grown hydroponically (in a liquid medium) because the carbohydrates in the liquid stimulate the growth of other molds which contaminate the mushroom mold and overwhelm it.

Mushrooms are propagated by spores and spawn. Spores are microscopic asexual reproductive bodies that function similarly to fern spores. The edible portion of a single, mature mushroom, such as *Agaricus* from which the bulk of our cultivated mushrooms come, produces as many as 1.8 billion spores. Spawn is a preparation of the mycelium, the root-like, white cottony mold, which grows from the spores and threads its way underground reaching toward moisture and nutrients. Spawn is both the boon and the bane of the mushroom industry. While it is the key to quality, color, and nutritional value, it is also the stimulus to quantity production. This has led to the "standardizing" of cultivation of only one variety in the United States, with the consequent loss of imaginative mushroom farming and the denial of the general enjoyment of numerous other tempting species.

When the present century started, mushroom growing in this country was a precarious undertaking. Mushroom growers failed or succeeded without knowing why. However, a turning point came in 1918 with the introduction of pure-culture spawn, grown from carefully chosen spores, and the pasteurizing of the planting beds prior to innoculation with spawn. Progress has quickened during the past twenty-five years. Mushroom culture is now an advanced science.

Polyporus sulphureus = Laetiporus sulphureus

Amanita phalloides

Amanita muscaria

Site selection, preparation of compost, pasteurizing, spawning, casing and growing, are all very essential steps in mushroom production. Air conditioning helps immensely. Both temperature and humidity must be carefully regulated during planting and growing, and air conditioning makes these practical. It also makes mushroom growing a year round business, so that anytime is prime time. This is a boon to the commercial producer and assures a plentiful source of supply at all times. Air conditioning has made obsolete much of the older unwieldy equipment and some of the more cumbersome practices.

Site selection has come a long way since the greenhouse operators at Kennett Square, Pennsylvania, discovered that they could grow mushrooms in the unused spaces under their greenhouse benches. Many types of structures have been tried, but the most satisfactory results and yields are obtained with those which the industry calls the "single house" and the "double house".

The single house is usually a long, narrow building sixty-five feet long, twenty feet wide, and fifteen feet high. Ordinarily, it houses from ten to twelve growing beds, each five feet wide, arranged in two tiers, five to six beds to a tier. There are about 3,600 square feet of bed space in a single house.

Frequently, two units are joined under one roof to make a "double house". A grower who has at least three double houses—21,600 square feet of growing space—is considered to have a medium-sized operation.

Some of the very largest operations use abandoned limestone quarries or gypsum mines. It then becomes easier to use the "two zone" system, which requires an abundance of space. The two largest growers in the nation, one near Albany, New York, and the other near Butler, Pennsylvania, operate this way, and produce several tons of mushrooms daily. Under this system, one room is used for pasteurizing the compost and propagating the spawn and another room is used for growing the mushrooms. Instead of fixed beds, movable trays are used as spawn beds so the spawn can be transferred easily to the area where the mushrooms are grown.

Most amateur, and many commercial, growers now use synthetic compost, prepared by mixing corn cobs and hay with fertilizer containing nitrogen, phosphorus, and potash. This is a very satisfactory replacement for composted horse manure which growers used traditionally until recent years.

According to the U. S. Department of Agriculture, one of the most successful formulas for synthetic compost so far evolved, was developed cooperatively by J. W. Sinden of the Pennsylvania State University, the Boy-Ar-Dee Mushroom Company at Milton, Pennsylvania, and the Butler Mushroom Company at West Winfield, Pennsylvania. Enough material is prepared for a "double house". It consists of fifteen tons of corn cobs, seven tons of meadow hay, four tons of clover or alfalfa hay, one and one-half tons of dried brewers' grain (or the same amount of dried poultry manure), and half ton of gypsum, a quarter ton of aluminum nitrate, a quarter ton of muriate of potash, and about 10,500 gallons of water to supply the right amount of moisture. However, the chemicals are not added until after the first two aerations and wettings of the material.

The corn cobs and hay are arranged in alternate layers four inches thick and saturated with water. After two days, the mixture is turned and saturated again, and three or four days later this process is repeated. At this point, the chemicals are added to the top of the pile. After another four days, the chemicals are mixed into the material, turned, and given another wetting. After a lapse of four or five more days, the heap is turned again and then arranged into long, well-aerated piles about eight feet wide for filling the spawning beds. Water content of the beds should be between seventy and seventy-five percent. The beds should be filled six to ten inches deep. A ton of moist compost is usually enough for about 100 square feet.

Pasteurization is next, to eliminate harmful fungi, nematodes, and insect pests, and thus to assure good yields. While composting takes about fourteen to fifteen days, pasteurizing usually takes only about four to six days. All doors and

ventilators to the pasteurizing room are closed. With the help of live steam, the temperature of the compost-filled beds is allowed to rise to 135° to 140° F. Beds are kept at this point until all ammonia odor disappears and the pH value of the compost is 8.2 or lower. The beds are wetted during pasteurizing to maintain a moisture content of about sixty-five percent. The area then is ventilated and the room temperature is lowered to between 75° and 80° F. which is considered suitable for spawning.

The spawn—the propagating material—is broadcast over the beds of pasteurized compost and allowed to grow for about three weeks. During the first week, the bed temperature is kept at 70° F. after which it is lowered to between 65° and 70° F. for the remainder of the spawn growing period.

When spawning ends, the beds are "cased" (covered) with an inch of neutral loamy soil at approximately pH 7.0 because mushrooms cannot tolerate an acid or sour soil or one that is sweet or alkaline. The soil is kept moist with a light watering until the first mushrooms begin to appear about three weeks later.

When the mushrooms begin to form, the temperature is lowered to between 50° and 65° F. depending on whether the grower wants a short or long season. At 50° F. the crop develops more slowly with a longer harvest season than at 65° F. The choice is up to the grower.

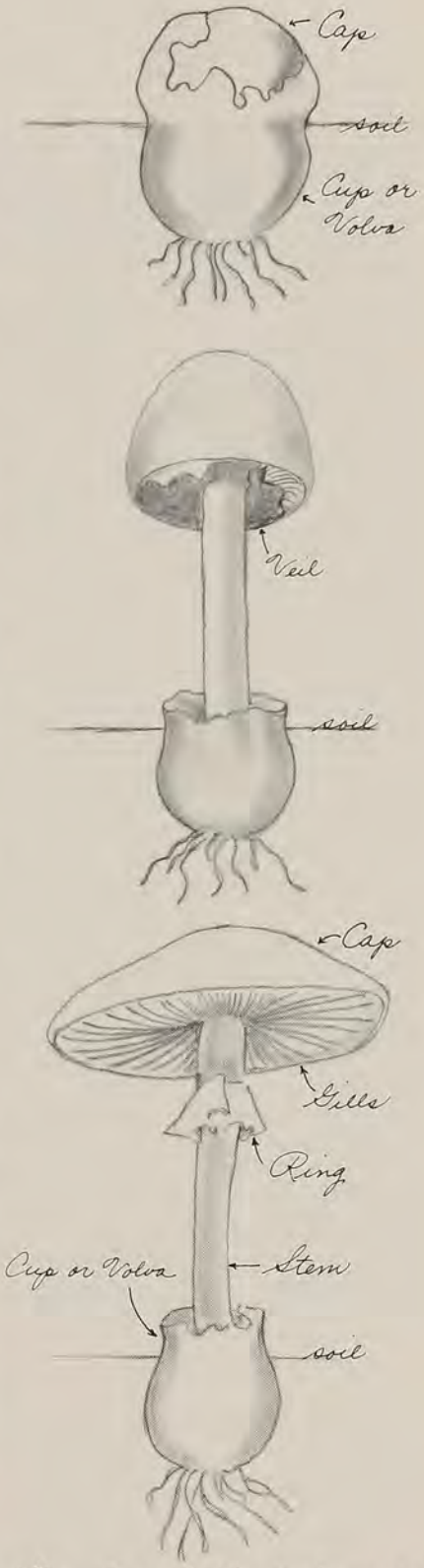
For maximum yields, the moisture level of the soil must be kept high, the relative humidity must be kept over seventy per cent, and there must be plenty of ventilation. Under these conditions, "flushes" or "breaks" of mushrooms will appear suddenly, usually at weekly intervals, and last for two to three months, with the temperature determining the duration of the harvest season.

The best time to harvest mushrooms is just before the cap expands to expose the gills. This is when the mushrooms are from one to three inches in diameter. When the grower picks his mushrooms for the fresh market, he usually cuts off the stumps, sorts the mushrooms for size and other requirements, checks them for freedom from blemishes, and packages them in a seven-ounce or one-pound carton or in a three-pound basket for sale by fruit and vegetable produce dealers. Depending on where he lives, the grower has a choice whether to send his crop to the fresh market, to the canneries, or to the soup makers. Each type of market now claims approximately one-third of all the mushrooms commercially produced in the United States.

Drying and freezing are other ways of preparing mushrooms for market. Growers have found that if quick-frozen, mushrooms will retain their flavor and attractiveness in the raw state for a long time. However, growers in this country have been only nominally successful trying to dry mushrooms.

Growing mushrooms at home has become an exciting pasttime and a fascinating hobby for many Americans. More amateur growers than ever before all across the country are raising mushrooms in home basements, or wherever they can find space that is damp, dark and cool and where humidity, light and temperature can be regulated satisfactorily. Until recently, growing mushrooms at home was limited because preparing the compost and pasteurizing the growing beds were difficult and disagreeable. However, an increasing number of large commercial growers and nurseries are mastering the intricate technique of making pure-culture spawn from mushroom spores and are providing small trays of synthetic compost tailored especially for the home grower. These trays are properly pasteurized, implanted with pure-culture spawn, cased and packaged for easy delivery, along with full growing instructions. With patience, the home grower can expect to be rewarded with up to one pound of freshly picked mushrooms per square foot of bed space.

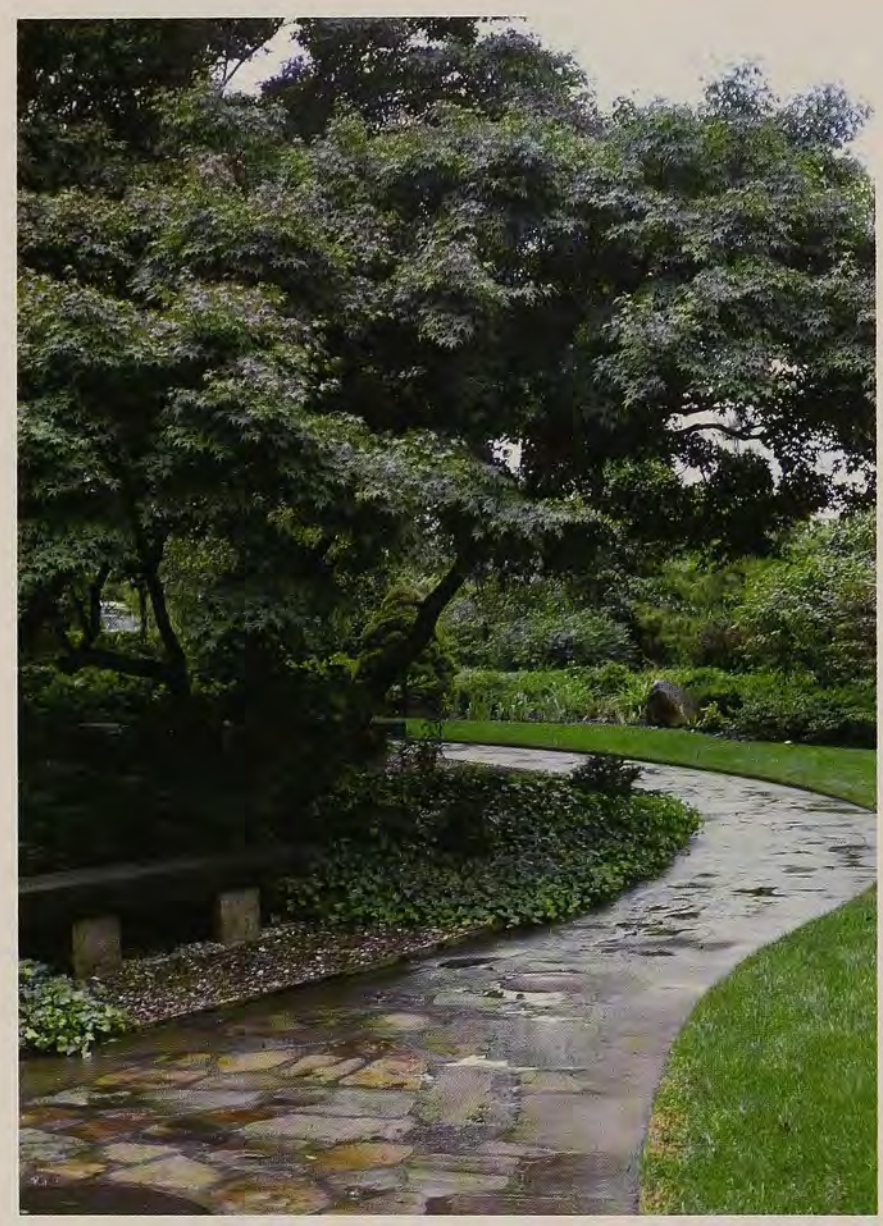
Whether one raises mushrooms or hunts them, an aura of magic and mystery still surrounds these biological wonders—both awaken one's curiosity and to attract one's interest in the wealth of mushrooms which masquerade as toadstools under a backyard tree, a lump of yellow jelly on a log in the woods, or as a flower-like object snuggling in the wet grass on the lawn. ◈



Three stages in the development of a typical mushroom.

Pruning for Artistic Effects

*John M. Patek**



Japanese Maple, Acer palmatum, *a small, multiple-trunk tree.*

Some of the world's most famous gardens have acquired their fame through the artistic effects created with woody plants. Many once famous gardens have lost their original concept and appeal through the failure of succeeding generations to maintain by skilled pruning what had been entrusted to them by their predecessors.

Although a Japanese garden may be embellished with artifices, a truly good Japanese garden is a composition created by suitable plant material pruned for its attainable artistic effects. This is also true of the formal garden and wall gardens of Europe which are products of skillful and constant pruning.

In selecting, placing, or training a plant one should first study the natural artistic characteristics of the plant and determine how they may be developed and applied. The same elements of beauty which apply to a flower arrangement or to a bonsai also apply to the woody material in a garden. A garden in this discussion of pruning is not one which employs the exciting effects of masses of color, but rather the subtle effects of line, mass, texture, light and shade and induces feelings of movement and stability. Thus, in the very selection of a plant, one should consider its manner of growth, and the qualities of its woody parts and foliage.

Having determined the natural artistic characteristics of a plant, one should proceed to accentuate and develop those characteristics by pruning. Cut out every branch or growth that fails to contribute to the effect being sought.

Some woody plants naturally grow in horizontal planes, some grow with vertical lines, some are weeping, others are vase shaped, some look rugged, others are delicate, some are massive, others are lace-like. Each characteristic feature may be developed and accentuated by pruning.

Viburnum plicatum, Japanese snowball, has a horizontalness which can be accentuated by pruning the vertical growth.

Many trees have a distinctly vertical structure which can be improved

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Japanese Snowball, Viburnum plicatum, *with plate-like heads of white florets.*

Weeping, Purple-leafed Beech, Fagus sylvatica *'Purpurea Pendula', a young specimen.*

by pruning out all multiple vertical trunks or branches and shortening horizontal branches. This applies to fastigiate types of *Chamaecyparis* and *Taxus*. When such trees tend to open at the top, they can be braced together by wire loops. When for space or artistic reasons, it is desired to make a tree narrow and upright, the strong side branches can be removed, leaving the shorter or weaker branches. This has the added advantage of exposing the structure and any attractive bark.

Weeping trees have a drooping or fountain effect, and this same effect can be induced in other trees. Fruit trees as crabapples will have the branches weighed down so as to droop. By retaining all drooping branches and pruning all vertical growth, a drooping effect can be attained. In the process of opening of trees, such as pine, to expose the structure, many side branches will normally be removed. Sometimes this will force the remaining branches into an extended drooping growth. (Figure 1 shows *Pinus banksiana*, Jack pine, which was pruned to show trunk structure, bark coloration, and the play of light. This unexpectedly resulted in decidedly drooping branches.) Of the naturally drooping trees, *Acer Palmatum*, particularly the 'Dissectum' cultivars, are especially beautiful and lend themselves to pruning.

The mound-like shapes of small-leaved hollies, azalea, rhododendrons, boxwoods, and some conifers are common to gardens of the formal, Japanese, and rock garden types. Usually grown naturally, in these special gardens they may be pruned by shearing. Common practice is to shape them with electric pruning shears followed by hand pruning of stubby growth at the sheared surface.

Plants such as the cotoneasters and junipers which are selected for their prostrate habits of growth may be greatly improved by pruning. These plants should have overlapping and upright growth removed or shortened so that only a single layer of growth hugs the ground.

Trees and shrubs which do not have decided growth characteristics

Figure 1. Jack Pine, Pinus banksiana.

Figure 2. Mugho Pine, Pinus mugo, as dense mound.

Figure 3. Mugho Pine, Pinus mugo, *open-pruned.*

Figure 4. Firethorn, Pyracantha coccinea *'Lalandii', as a dense wall shrub.*

Figure 5. Firethorn, Pyracantha coccinea *'Lalandii', wall shrub pruned as an espalier-trained specimen.*

may be kept in a desirable compact form by constantly pruning back new growth by the usual methods of pruning. However, it is another problem to make a pleasing shrub out of one which has not been kept under control. Such shrubs can often be pruned advantageously by striving for a tiered effect. Observations of any shrub from the side will show a series of natural levels of growth from the bottom to the top which may be accentuated by thinning and pruning to produce tiers or steps. The result is a pleasing natural appearance.

Pruning to develop all of the artistic elements of a plant as opposed to total mass effect requires artistic feeling as well as pruning skill. It is accomplished most skillfully by the Japanese. Thinning out vegetative growth, removing unnecessary branches, retaining and developing old wood, exposing the structure in an intriguing manner are all elements of this art. Figure 2 shows *Pinus mugo* maintained as a dense mound by shearing the new shoots or candles in the spring. *Pinus mugo* in Figure 3 is treated in the same way, but the supporting structure has been exposed. The location of the pine in Figure 3 at the crest of a slope allows one to look through the structure while that in Figure 2 does not.

Wall gardening with espalier-trained trees and shrubs as developed in Europe is an artistic method of portraying the structure and texture of a plant against a wall or solid background. When the background is obliterated, the artistic beauty is largely lost. Figure 4 shows *Pyracantha coccinea*, 'Lalandii' against a wall before pruning and Figure 5 shows the same plant after pruning.

Pruning for a natural appearance while retaining balance and proportion is a sophisticated type of artistic pruning. The retention of age or its simulation produces a sense of stability and remoteness that add interest and charm to a garden, or its elements. Old distorted branches and shredding or rough bark interestingly exposed have more appeal than new growth, and so new growth may be removed as long as

the plant stays healthy. In exposing the structure of a tree certain rules of good taste should be followed. Ladder effects, or one branch above another should be avoided. If practical, branches should alternate, that is, one branch should not be opposite another. To simulate the effects of age, branches may be stripped to where growth flourishes, and this flourishing growth may be headed back. This is the procedure for Japanese cloud pruning.

Pruning for artistic effects can do far more than merely develop or accentuate the natural characteristics of plants. It can completely alter a woody plant to produce any form desired. A tree can be converted to a shrub by cutting it off near the base and allowing the multiple new shoots to develop. A shrub can be made into a tree by pruning to a single stem. *Viburnum sieboldii;* Siebold Viburnum, and *Elaeagnus angustifolia*, Russian-olive, (see Figure 6) are often grown as trees, although if left to themselves they would be shrubs. The wisteria vine is available in tree form from many nurseries.

As already mentioned, the art of wall gardening or espalier-training is based on growing trees and shrubs as vines. Figure 5 shows a shrub trained as a vine. A shrub which hugs the ground will also hug a wall if planted next to the wall, particularly if any portions growing away from the wall are pruned off. *Cotoneaster horizontalis* may be grown in this manner.

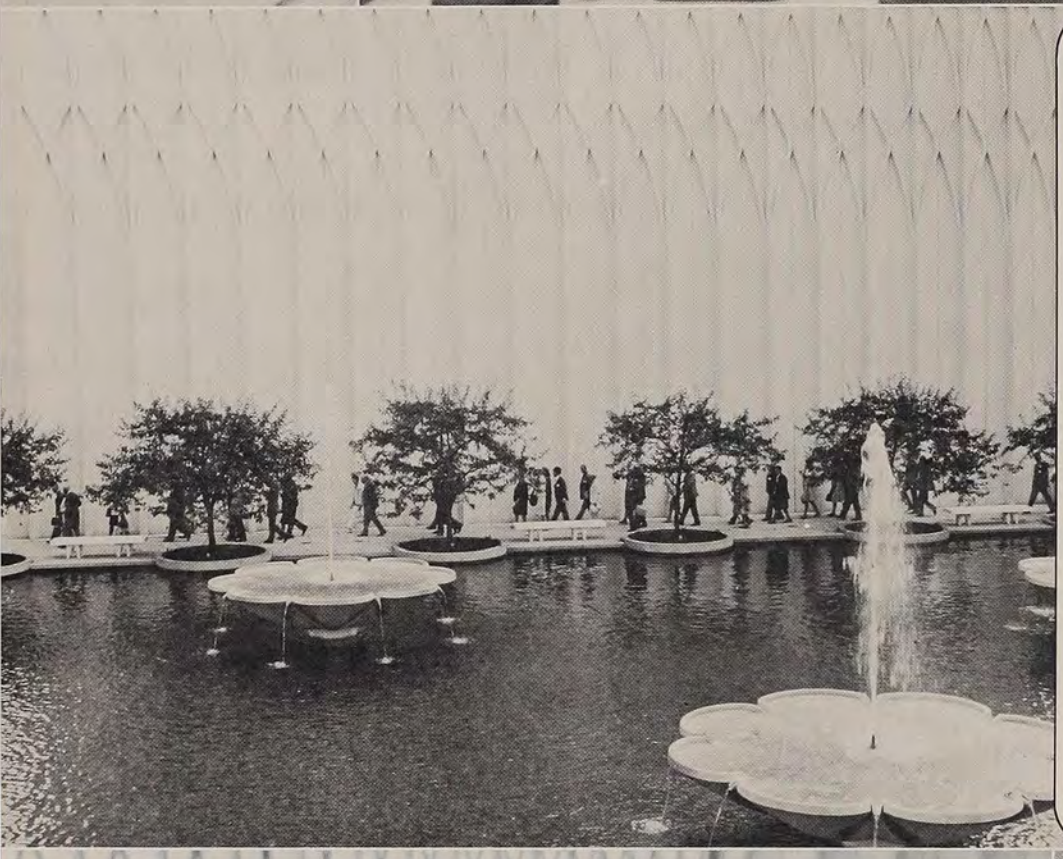
Interesting and unusual forms may be obtained by removing the leaders of coniferous trees. The 'Moerheim' cultivar of the Colorado blue spruce has a tendency toward drooping branches and very artistic forms may be developed by pruning away the leader, (see Figure 7. Figure 8 shows a white fir, *Abies concolor*, which has been grown from a seedling in this way and is only four feet in height. It has the same trunk diameter as other seedlings from the same lot which are now approaching thirty feet.

Pruning for artistic effect is what makes a garden something more than a mere collection of plants.

Figure 6. Russian-olive, Elaeagnus angustifolia, *trimmed to a single trunk.*

Figure 7. Moerheim Spruce, Picea pungens *'Moerheim', with leader removed (foreground plant).*

Figure 8. White Fir, Abies concolor, *with leader removed, as a "shrub".*



Twenty-seventh Congress of The American Horticultural Society

Photographs of the Ornamental Plants Display and of the Bonsai at the Pacific Science Center, featured during the recent A. H. S. Congress. The catalog of *Ornamental Plants Hardy In The Coastal Northwest*, prepared by The Friends of the University of Washington Arboretum and given to Congress registrants, lists some 5680 species and varieties distributed through nearly 1000 genera in 165 plant families. Almost all of these plants were represented in the magnificent display at the Science Center. This world of horticulture—properly classified—sets the pace for the rest of the Country. At the opening of the Congress Governor Daniel J. Evans drew applause several times as he spoke of plans for further financing the Arboretum, of planning communities in his state so nature would survive and human amenities could be preserved—so natural resources would not be exploited. The theme of the Congress was carried out by capable speakers; Dr. Rene Dubos spoke on the thesis that horticulture is biological survival; Dr. Kenneth V. Thimann spoke on horticulture as scientific research, Mr. Dael Wolfle spoke on the urban development aspects of horticulture, and Mr. H. G. Hillier presented a dynamic illustrated program on the theme of horticulture as human aesthetics. Invariably, the Congress returned to plants. Plants on display in the Science Center, plants in gardens, parks and public plantings, plants as the subject of a talk. People and plants go together; the Twenty-seventh A. H. S. Congress proved the point.

BOOKS

Frequently publishers send copies of recently published books to the American Horticultural Society office. Members of A. H. S. may borrow books from the collection, as from a lending library. The following publications have been received in the past few months.

LIGHTING FOR PLANT GROWTH

by
Elwood D. Bickford and Stuart Dunn
Kent State University Press
1972
222 pages, $16.00

Written by a physicist and a plant physiologist, this book will be of little help to the average gardener. Written primarily as a text book it reviews the physical aspects of light energy, the source of such energy, and plant response to it. Of the 222 pages, only sixteen (Chapter thirteen, Applied Horticultural Lighting) give information in any organized way on specific plants, and only the plants listed in this chapter are included in the index. Information in tabular form scattered through the remainder of the book deals with the response of many other species and varities of plants, but no organized method of finding this information is presented to the reader. If the technically-minded reader wants a review volume explaining all facets of *Lighting For Plant Growth*, this book can be recommended. If the advanced gardener is looking for helpful hints and specific instructions for growing plants under lights, this is not the book.

Gilbert S. Daniels
19 July 1972

HANGING GARDENS

by
Jack Kramer
Charles Scribner's Sons, New York
1971
101 pages plus appendix, $5.95

This is both a how-to-do-it book and an idea book. Approximately the first half of the book is devoted to the variety of hanging planters and where to use them. The second half describes a wide selection of the many plants (with cultural hints) which are suitable for use in such containers. Separate chapters are devoted to the use of orchids, begonias, geraniums, and fuchsias. The range of plant material recommended, includes something for nearly any set of growing conditions. Well produced and well illustrated, this book is sure to provide new ideas for even the more experienced gardener.

Gilbert S. Daniels
19 July 1972

Botanicus—The Botanic Garden and The Book. Compiled by Ian Mac Phail, introductory by Joseph Ewan. The Morton Arboretum, 1972. Paperback. Catalog of fifty books from Sterling Morton Library exhibited at Newberry Library for the 50th anniversary of The Morton Arboretum.

The Strange and Beautiful World of Orchids. Friedrich Ebel and Otfried Birnbaum, translated by C. S. V. Salt, Van Nostrand Reinhold Co., 1972. Part 1: 150 pp., description and color photos. Part 2: 207 pp., systematic synopsis of the orchid family; illustrated morphology; historical illustrations; data on flower sizes; bibliography. Hardback. $20.00

The Native Orchids of Florida. Carlyle A. Luer. The New York Botanical Garden, Bronx, N. Y., 1972. 293 pp., Hardbook, $25.00.

Career Opportunities—Ecology, Conservation and Environmental Control. Compiled by J. G. Ferguson staff. J. G. Ferguson Publishing Co., Chicago, Ill, 1972. 211 pp., Paperback, $6.95.

Career Opportunities—Agriculture, Forestry, and Oceanographic Technicians. Edited by Howard Sidney, J. G. Ferguson Co., Chicago, Ill., 1972. 344 pp. Hardback, $11.95.

Island Year. Hazel Heckman (drawings by Laurie Olin). University of Washington Press, Seattle, Wash., 1972. 255 pp. Hardback, $7.95.

The Flower Lover's Book of Natural Arrangements. Georgiana Reynolds Smith. Doubleday and Co., Inc., 277 Park Ave., N. Y., 1972. 143 pp. Hardback, $7.95.

Collegiate Dictionary of Botany. Delbert Swartz. The Ronald Press Co., 79 Madison Ave., N. Y., 1972. 520 pp.

Herbs and Things (Jeanne Rose's Herbal) Jeanne Rose. Grosset and Dunlap, 51 Madison Ave., N. Y., 1972. 323 pp. Hardback, $7.95. Illustrated by Michael S. Moore.

Tree Condition and Mortality Following Defoliation by the Gypsy Moth. Robert W. Campbell and Harry T. Valentine. USDA Forest Service (government Printing Office), 1972. 331 pp. Paperback. USDA Forest Service Research Paper NE-236.

Sturtevant's Edible Plants Of The World. Edited by U. P. Hedrick, Dover Publications, Inc., 180 Varick St., N. Y., 1972. 686 pp. Paperback, $5.00. Unabridged republication of 1919 edition.

A HISTORY OF GARDENS AND GARDENING

by
Edward Hyams
Praeger Publishers, New York
1971
345 pages, $25.00

As the author states in his opening statement, "This book is a history of the art of making gardens." Garden design, not plant material is the basic theme. Covering as it does, a time span from pre-history to the present in all parts of the world the author must of necessity treat only briefly with each era and place. The treatment is historical and the details of garden design are treated only in passing. It is a book largely about garden designers rather than the gardens they designed. The extensive illustrations in black-and-white and color have undoubtedly contributed to the selling price but unfortunately have little bearing on the text. Interesting reading for historical background but of little use for the garden designer or plantsman.

Gilbert S. Daniels
19 July 1972

WILD WEALTH

by
Paul Bigelow Sears,
Marion Rombauer Becker,
Frances Jones Poetker,
and Janice Rebert Forberg
Bobbs-Merrill Co., Inc.,
Indianapolis and New York
1971
322 pages, $20.00

The joint product of an ecologist, a gardener, a florist, and a botanical artist, this book is really three works in one. The first section is an ecological essay which provides not only pleasant reading but basic facts about the ecological balance in nature. There is much to be learned from this section by Dr. Sears, and the story is well presented without the excessive emotion which permeates so much of the ecological literature of the present day crusaders. The second section is the story of Mrs. Becker's garden, and while it is the account of the development of a specific garden, it is filled with helpful information on many different types of plants. The third section by Mrs. Poetker (who is a botanist as well as a florist), is full of original ideas on flower and plant arrangement. Illustrated throughout by Mrs. Forberg, the individual drawings and their extensive captions serve as continuing footnotes to the three sections of the text. This is a book which can be read with pleasure and enjoyed visually, but which also can be referred to in the future for individual bits of information, because, varied as the content is, all of the many subjects covered are listed in detail in the excellent index. Definitely a worthwhile book for the serious gardener.

Gilbert S. Daniels
20 July 1972

GARDENER'S MARKETPLACE

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Appalachian wildflowers grown in their native habitat for your garden. Our collection includes woodland and mountain species, both familiar and rare sorts. Write for information. Gardens of the Blue Ridge: Ashford, McDowell County: North Carolina 28603

NOW...

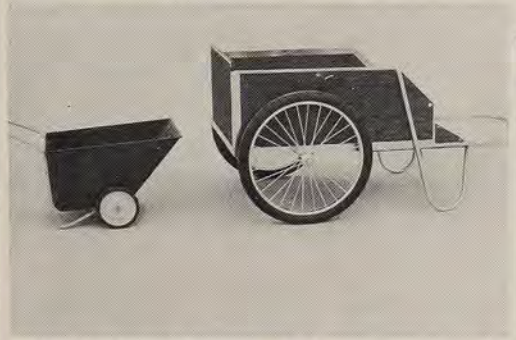
Carry ten times the load of a common wheelbarrow or cart with INCREDIBLE EASE!

This Big NEW Jumbo sized cart is the culmination of 20 *years* of cart research! It has the *largest* load carrying ability of any cart or wheelbarrow available for home and business use!

- Carries 10 times the load of a common wheelbarrow!
- Saves time and steps—make one trip instead of ten!
- So easy to handle, so perfectly balanced you can guide it with JUST ONE HAND!
- Actually feels lighter when it's fully loaded!
- Loads won't fall out forward.
- Carries 5 bales of hay, 5 trash cans!
- Tips down to take on heavy loads without lifting!
- Rolls up steps and down with ease.
- Open end lets you load long handled tools, even *long* extension ladders and lumber.
- Two wheels instead of one keeps loads from tipping sideways.
- Big 26" diameter easy roll *pneumatic* wheels with ball bearings. Special wide hubs to handle heavy loads.
- Stores easily on end, saves space.
- Special stand straddles rows in the garden, without damage to plants.
- Rust resistant steel parts and durable weatherproof plywood for years and years of service.
- No need to keep indoors—turn over and this cart becomes its own garage.
- Just so useful, you'll wonder how you ever did without it.
- Not sold in stores.
- At last—the *perfect* cart for lawn, garden and countless other uses.
- Order for and charge to your business. Borrow to use at home. Soon you will be ordering another to keep home all the time!
- Several smaller models of same unique design also available.
- Please send for FREE CATALOG with all the specifications, sizes and prices.

OFF-SEASON SAVINGS NOW IN EFFECT!

Garden Way Research, Charlotte, Vt. 05445



Here is how this Big NEW Cart compares with a very widely sold Cart (with tiny wheels and almost **no** load space). Our "Jumbo" Cart will carry **15 times** the load of this little cart.

All models available complete or in Money-Saving KIT FORM!

GARDEN WAY RESEARCH
Dept. 4407-T
Charlotte, Vermont 05445

Please send FREE CART CATALOG including prices and OFF-SEASON Savings now in effect.

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TILLER USERS!

Just **ONE HAND!**

The wonderfully different and better idea in Tillers!

The TROY-BILT® is so easy to handle, you guide it with Just ONE HAND!

- Has its revolving tines in the REAR instead of the FRONT!
- Has POWER DRIVEN WHEELS!
- You leave NO footprints nor wheelmarks!
- Has two speeds! Reverse!
- Now in its 11th great year, the TROY-BILT® is built by the builders of the famous ROTO-TILLERS. This latest and greatest of them all is now, more than ever, the favorite coast to coast with home gardeners, growers, nurserymen, tiller renters, landscape gardeners!
- Several models, including ELECTRIC STARTING!
- Does NOT tangle near as much as ordinary Tillers!
- It chops garden residues, weeds, green manure crops, old mulch, any kind of organic matter right into your garden soil without unbearable tangling!
- It turns your whole garden into one big fabulously fertile "compost pile"!
- Does NOT require great strength . . . older people, ladies, too, operate it easily. We have many delighted owners in their 70's, 80's, even 90's who tell us they would have given up gardening if they did not have our Tillers!
- Instant depth control! Hood encloses tines for safety and for close cultivating!
- Furrowing, snow removal and other attachments available!
- Automotive-type engineering—precision gears, Timken bearings, no chains to stretch, wear or work loose!
- Sold direct to keep prices down—would have to be at least $100 higher if sold ordinary ways!
- Satisfaction guaranteed—no time limit!
- Will GREATLY increase your gardening joy!

Why, for heaven's sake,

suffer any longer with the FRONT-END type of tiller shown at left—the type with the revolving blades in FRONT and NO POWER to the wheels — the type that shakes the living daylights out of you — the type that leaves Wheelmarks and Footprints in the nice smooth soil you have just tilled or cultivated?

SO, PLEASE don't buy any other Tiller — don't put up any longer with the Tiller you now have! Mail the coupon NOW for complete details, prices, OFF-SEASON SAVINGS for this wonderfully different and better idea in Tillers — The TROY-BILT® Roto Tiller-Power Composter!

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Troy, New York 12180

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Please send me the whole wonderful story of your Tillers, with and without electric starting, including prices, OFF-SEASON SAVINGS now in effect.

(Please print clearly)

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Address_____

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☐ **We can also furnish parts for your old ROTO-TILLER. Check here for FREE parts-price list.**

How you spray does make a difference.

Now, more than ever, it's important to use just the right amount of spray to rid your garden of harmful insects and disease.

This is the kind of precise control you get with a Hudson sprayer. Here's why you get best results, help protect the environment:

1. **Right mix:** With a Hudson sprayer, you mix spray exactly as recommended. And that's the way it goes on your plants—not too strong or too weak.

2. **Right pressure:** A few strokes of the pump lets you spray at pressure you select—high for a fine mist (good for flowers) or low for a wet spray (best for weeds).

3. **Right amount:** Squeeze handle, spray's on. Release, it's off. Spray just to the point of runoff. Coat the plant, don't drench it.

4. **Right pattern:** Just turn spray nozzle to get a fine or coarse spray. Or for close-up or long-range spraying.

5. **Most important, right place:** With a Hudson sprayer, you place spray right where the trouble is. With its long extension and adjustable nozzle, you easily reach all parts of plant. Especially under the leaves where many insects hide and most disease starts.

For a more beautiful garden—a better environment—keep your spraying right on target—with a Hudson sprayer. Get yours now. How you spray does make a difference!

Easy, precise way to kill weeds, too. **For a more beautiful lawn, just spray ugly weeds away with a Hudson sprayer.**

Special Offer for luck!

Get your "Tree of Life" Pin and Tie Bar with Lucky Ladybug accents. Designed by Coro. Pin is yours for only $1.50; Tie Bar, for only $1.25. Send to: Hudson Offer, Box 8401, Roseville, Minn. 55113. Dept. 710.

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