LASCA LEAVES

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Quarterly publication of the California Arboretum Foundation, Inc.

The Cover

Cattleyas and interrelated hybrids are available today in a wide variety of colors, shapes and sizes.
Photo courtesy of
Fred A. Stewart, Inc.

the Editor's Page

WE LIVE in very public times which is to say that there is hardly an institution today that is not caught up in the mainstream of daily life. The church, no longer cloistered, is challenged by scientific and demographic realities; the traditions, even the basic purposes of educational institutions have become intermixed with problems seemingly remote from learning; the world of sports is today the province of business and labor.

More modest institutions, like arboreta and botanic gardens, are similarly "involved." Smog, a worldwide problem being studied on all fronts, is the subject of one of our Arboretum research programs. Urban beautification, today concerned with such basic matters as the uplift of ghettos, protective zoning, and an adequate number of parks, is reflected in our turfgrass program and in our continuing program of testing and introducing colorful groundcovers, shrubs and trees from other parts of the world. Our year-around workshops and classes for young people and adults are a response to mainstream needs ranging from occupational therapy to practical information and instruction for the home gardener.

We have become a very public institution. Our involvement will likely increase.

Arboretum notes

Research Grants

LAST JANUARY 31, Dr. Paul Cheo, chief of the Arboretum Research Division, received the good news from the National Science Foundation that his application for a research grant had been approved. We dropped by to see him in his combined office-lab in the Administration Building shortly thereafter to offer our congratulations and to learn more about the grant itself and how he went about getting it.

Having read somewhere that getting a research grant today is a specialized and complicated business, we wanted to know first what steps he had taken, how much time was involved, and how much money he received.

"We were fortunate," explained Paul. "We made our request last May and it was granted seven months later. But it took a lot of paper. First we wrote up our proposal. That was thirty pages. Then we made twenty copies. These were for the NSF reviewers who have to make their recommendation — should our proposal be supported or not. If they okay it, then it has to be determined if the money is available. Anyway, we got our grant which came to $23,600. Actually, as you know, the application is handled by our California Arboretum Foundation which also administers the grant."

Dr. Paul Cheo, research chief

The money, we learned, is to pay for the services of one lab assistant for two years — John Gerard, a young biologist from Los Angeles State College — and some new equipment, mainly a freeze-dryer, a device that through evaporation, low temperatures and a vacuum, concentrates biological substances and makes them stable enough for study.

We asked Paul to explain the essence of his proposal to the NSF. "Tobacco mosaic virus," he said, "is commonly used for studying the nature of virus because it is stable and easy to obtain in purified form. Putting this fact aside for the moment, there were many reports that some plants are not susceptible to virus infection. When I was at Washington State University I was studying the reaction of different host plants to virus infection. I found that tobacco mosaic has a wide host range. From this and from subsequent study, I found that though some plants might appear to be not susceptible to virus, they in fact were typical 'Typhoid Mary's,' that is, symptomless carriers. The objective of our grant is to study this highly resistant group of plants to find out why they are resistant. There is evidence that shows that these plants have the ability to produce anti-viral substances after infection, or as a reaction to infection. The final aim of the grant is to isolate and study this anti-viral substance. Inevitably, both the substance and the study will contribute to the overall knowledge of virus and in this way perhaps contribute to the cure of human ailments caused by viral infection — the flu, for example."

Dr. H. Hamilton Williams, turfgrass specialist

A GRANT bearing another objective was received by our turfgrass specialist, Dr. H. Hamilton Williams, last month. It came from the California Fertilizer Association, a powerful group of industrialists who work closely with educational institutions to mutual advantage. The amount, $3,000, is an initial gesture on the part of the CFA, working through its Soil Improvement Committee, to indicate that although it is an association mainly oriented toward the farm, it recognizes the economic as well as esthetic importance of urban agriculture, meaning, essentially, ornamental horticulture.

The money will be used to equip our new Research Laboratory with the means to permit more sophisticated analysis and diagnosis of turfgrass problems associated with the home gardener.

The equipment will be selected by a committee headed by Dr. George W. Schmitz, Department of Soils, California State Polytechnic College. Dr. Schmitz, together with other educators and industry representatives, will work with Dr. Williams in writing the program that will further these aims.

Serendipity in an Herb Garden

THE ARBORETUM is an institution of many parts, including a not very stringent set of rules and regulations governing such matters as picking flowers (forbidden), picnicking (only in specified area outside grounds), playing radios, guitars and other sound makers (not permitted), and driving cars on the grounds (with special permission only).

Because Arboretum roads are shared by trams, pedestrians, peacocks, ducks and an occasional turtle, the use of private vehicles as well as suitable parking space — not on lawn borders because this compacts the earth — is necessarily limited.

It was in this connection that we drove down (in our one-cylinder Cushman) to the Herb Garden the other day. We were greeted by Dr. Glenn Walker, whose official title is Second Vice-President of the Southern California Unit of the Herb Society of America. A friendly man with a disarming manner, the reason for our visit was quickly disposed of and was followed by an exchange of comments on the status of the garden, the effects of recent heavy rains, and finally our casual observation that the Italian parsley we remembered adding as a gustatory fillip to an earthy dish based on Long Island cherrystone clams, seemed not to be available anywhere along the California coast.

Dr. Walker's response was to take us a short distance to a bed of what was unmistakably parsley. "Do you mean this?" he asked. We bent down and read the identifying legend: Italian Parsley, Taylor's Herb Garden. We felt an odyssey had come to an end with *Petroselinum v. sativum*.

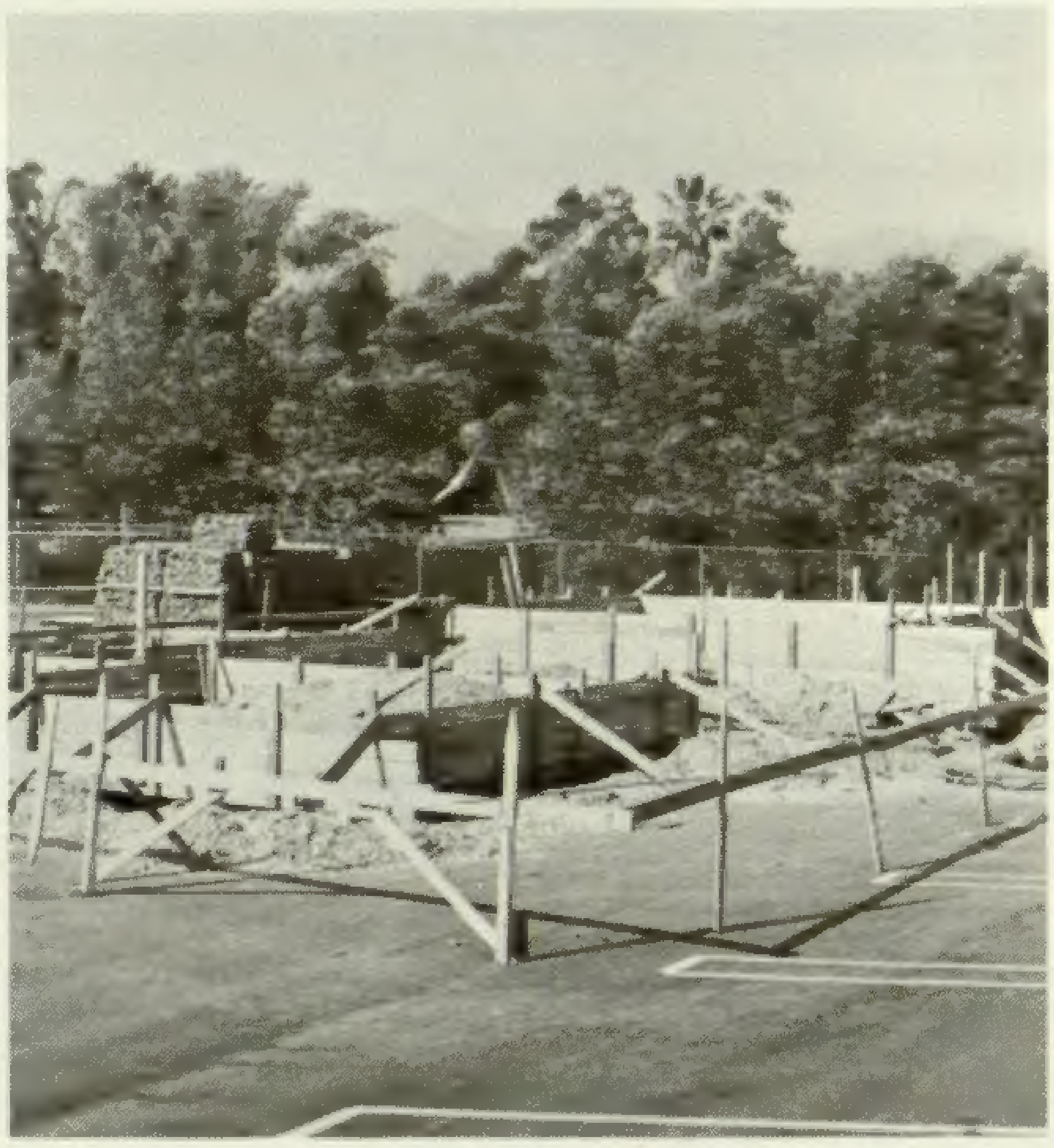
Our interest whetted, we followed Dr. Walker around as he commented on the garden. The kitchen bed is in good condition, the bee section in poor condition, the mint a little scroungy. The natives, meaning California plants used by the Indians, the thymes, lavenders, rosemarys, salvias, sages and wormwoods seemed all to be in pretty good shape.

We learned that practically all of the herbs at the Arboretum came from Taylor's Herb Garden in Rosemead. There are still many gaps, however, and Dr. Walker is working with Dr. Leonid Enari, staff taxonomist and senior biologist, in developing the garden through the acquisition of rare seed from all parts of the world. The latest list-request, we learned, was sent to the Garden of Official Medicinal Plants of the First Moscow Medical Institute.

Dr. Walker, who is an associate professor in the Department of Sociology at California State College in Long Beach, first became interested in herbs during his boyhood on the family farm near Eugene, Oregon. He was intrigued by the odors of leaves, things like wild ginger and mint. Further interest was stimulated by his father, a medical doctor, who was active in rhododendron cultivation, particularly species from England. During World War II he had a Victory Garden but since then hadn't paid too much attention to the subject until he moved to Southern California in 1964. Then he again took up his interest in herbs, finally joining the Herb Society a few years ago at which time he was put in charge of the Simples bed containing time-honored medicinal herbs.

Dr. Walker explained that today he is in charge of what goes in the Arboretum Herb Garden and where, synchronizing his ideas with various members of the staff. The Garden is maintained by Herb Society members, the third Thursday of each month designated as Work Day. Major renovation, pruning, and watering is done by the Arboretum. Weeding, trimming and harvesting by the Society. Speaking of harvesting, Dr. Walker told us that "the lavender and other smellies sold in the Gift Shop come from the Garden and are prepared by our Society members."

The Society is holding its next meeting April 24 at 10:30 a.m. in the Arboretum's Seminar Room. Mrs. Everett Hokanson, chairman of the Society's cook book, is scheduled to give a talk which will be followed by a tasting session featuring herbed breads, salad dressings and dips. It sounds yummy and the public is invited.



Not looking like much of anything in this photo taken March 12, the reconstruction of the old "Lucky" Baldwin railroad station in a section of the Arboretum parking lot just south of the Historical Area is under way.

Scheduled for completion sometime this fall, it will be designated a Historic Point of Interest by the State of California and Los Angeles County. Originally located on Colorado Boulevard just opposite Old Ranch Road in Arcadia, the station was built by Santa Fe in 1885 for Baldwin's private use in return for a right-of-way across his property.

The Culture of Cymbidiums for Southern California Gardens

Ernest Hetherington[1]

IT is generally recognized that more cymbidiums are grown in Southern California than anywhere else in the world. In addition to the professional growers and hybridizers, some of whom have in cultivation several million plants, well over 50,000 amateurs raise these orchids in their gardens, lath houses or greenhouses.

The orchid family is immense and if the general public is inclined to think only of the flamboyant cattleyas when it thinks of orchids, it is perhaps because of the popular conception of an orchid as a fragile flower originating either in a hothouse or a tropical forest and useful mainly as an impressive and expensive corsage.

This definition, at least the climate part, does apply to cattleyas and is one convenient way of distinguishing them from the more easily growable cymbidiums.

At the Los Angeles State and County Arboretum a large and fine collection of orchids has been developed representing many genera.

These are housed in four display greenhouses and are tended by an orchid specialist. In each of the four houses are grown various genera which require the basic cultural conditions maintained in that house. The collection of paphiopedilums (cypripedium or Lady Slipper orchids) at the Arboretum is especially outstanding because of the many contributions made by eminent amateur orchid enthusiasts throughout California. A house is devoted to the flamboyant cattleyas. Of special interest to the orchid enthusiast who visits the Arboretum is the collection of species gathered from jungles throughout the world. Collectors sponsored by the California Arboretum Foundation have made special trips to the jungles of Central and South America to make collections for the Arboretum. Surely, one of the outstanding features of the collection is the large display case in the rotunda entrance to the administration building, which is filled with flowering orchids the year around in an ever changing display. In addition to the thousands of orchids in the four major greenhouses, the large collection of hybrid cymbidiums is housed in a range of satellite greenhouses and lath houses. Foundation members are urged to familiarize themselves with the Arboretum's fine orchid collection.

Here Is Where You Can Grow Them

CYMBIDIUMS can be grown throughout the world in temperate areas such as Southern California. The original native species came from the mountains of Northern India and adjacent areas. These cool growing terrestrials put out a great amount of growth each year compared to other orchids. Cymbidiums will stand considerable summer heat, though they must be given cool nights during late August, September and October to make them flower. This occurs naturally in Southern California. You may grow cymbidiums in sheltered areas in your garden, if they are protected from frost. Southern, western or eastern exposures are best. A lath house, saran screen house, or filtered light area under a lightly leaved tree is good. If you are in an

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[1] President and General Manager, Stewart's Orchids.

especially hot, dry area, pots may be plunged in sawdust to half their depth, with additional bark or sawdust mounded up around the pot to retain moisture. In relatively frost free areas, cymbidiums can be grown directly in the ground in shady locations, though we feel you get best results in containers.

Will Stand Down to Freezing

In Southern California cymbidiums may be grown out of doors and will withstand down to 28 degrees F. without serious damage. If you are in an area where temperatures go below freezing in winter, a glassed in porch, greenhouse or a cool, bright room is fine, provided the minimum night temperature is not too high — 50 degrees F. — 60 degrees F. minimum is best. Buds may drop if kept over 60 degrees F. at night. Polyethylene plastic film makes an excellent temporary winter cover, where moderate frost protection is needed.

General Culture — the How-Where-When-and-What of Cymbidium Culture. Light — Important to Growth and Flowering.

Light is perhaps the most important factor in the successful flowering of cymbidiums. A good general rule is: Give plants sufficient light, so that the foliage is greenish-yellow, rather than verdant green. A good rule of thumb is — give what you may think is too much sun, rather than too little. If growing under trees, place near drip line, rather than near trunk of tree. Measuring light in foot candles, the meter should indicate 2,000 to 4,000 during growing season. Though lath, sheet plastic or other materials are good for shading, woven plastic screening called saran is most often used in Southern California and many other parts of the country. In areas of cold winters, cymbidiums are frequently summered outside in light shade. Insufficient light is responsible for more cymbidiums not blooming than are all other causes.

Shade heavily when plants are in bloom, as flowers will last longer and you will get clearer colors. When plants have finished blooming, take off most of the shading.

Cymbidiums Need Lots of Water

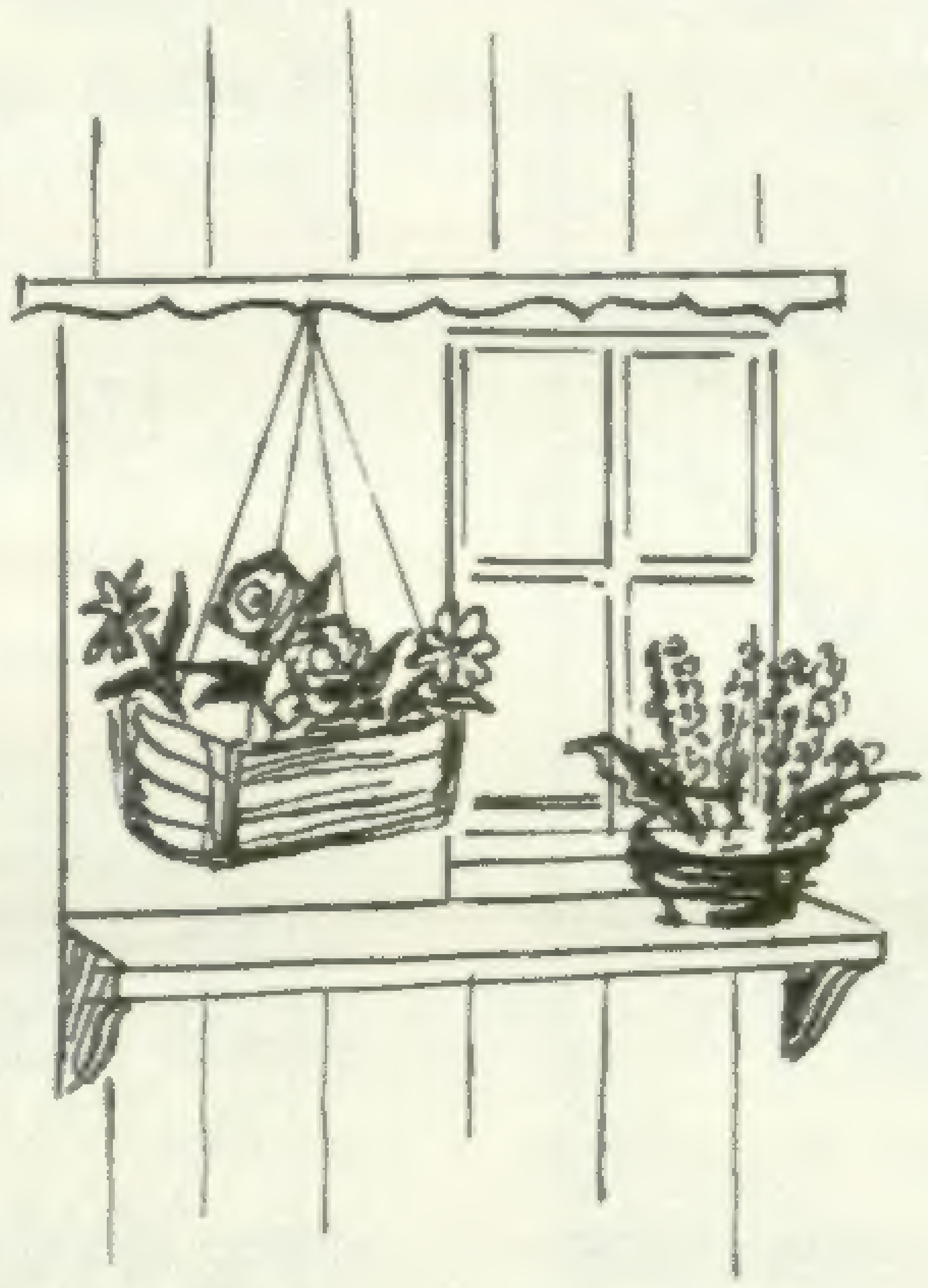
During the active growing season (roughly March-September in most areas), plants should be watered sufficiently to keep compost on the *moist side;* in fact, wet, compared to cattleya culture. One of the main causes of leaf-tip dieback is insufficient water during the growing season. Cymbidiums must have good drainage at all times. Wooden tubs do not dry out as rapidly as clay pots. Overhead sprinklers may be used for watering during the summer, if plants are well soaked. On sunshiny summer days, plants benefit from spraying of foliage, thus keeping temperatures down through evaporation and increased humidity. During winter months, when growth is at a minimum, the plants can be run drier, but never bone-dry. Sufficient water to avoid shriveling of bulbs is a good general rule during cold winter months.

Feeding — Cymbidiums Like Lots of Food

Feeding is very important. The potting mix should contain enough nutrients to provide a reasonable food supply, even if you do not feed. However, your plants will greatly benefit from a regular feeding program.

We recommend our 'Ideal' brand high

nitrogen water soluble (3-1-1) fertilizer, from January through July. Use at the rate of one to two teaspoons to the gallon of water every ten days to two weeks. Do not feed on cold, overcast winter days, as plants cannot use the food. From August through December, use 'Morbloom,' low nitrogen fertilizer (6-30-30), at the same concentration and frequency as the 'Ideal.' When feeding, be sure to drench the pot well. Both of these fertilizers are water soluble and dissolve readily. They may be used with the Hydromix dispenser, Hayes gun, Hozon, and other dispensers. (Other mixes may also be used in the dispensers.) Use Stewart's Top Dressing to promote growths and flower spikes. Once in May and once in late October. 2-6 tablespoons per mature plant, depending on size; 1 teaspoon for seedlings. Water and fertilize as usual.



Temperatures

Cymbidiums are quite tolerant of a wide range of temperatures. When grown outside in Southern California, they will stand normal summer temperatures in the 80's and 90's. Be sure there is free circulation of air. During the summer, cymbidiums benefit from a good leaf syringing several times a day, if possible. Under these growing conditions, they will tolerate temperatures to freezing (32 degrees F.) with relatively no harm. They will even withstand several degrees of frost; however, flower spikes are apt to be injured by these low temperatures. Even in Southern California, it is best to have some sort of a winter shelter, if only to keep excessive winter rains off the plants.

When growing in a greenhouse, more optimum temperatures may be maintained. Summer greenhouse temperatures may rise to 80 or 90 degrees with no harm. Night cooling in late summer is important. When plants are showing spike or in bloom, try and maintain a minimum temperature range at night from 45 degrees F., and not over 60 degrees F. If over this at night, you are risking bud drop. Unflowered seedlings and non-flowering propagations can be grown warm the year around until flowering size.

Hot Dry Areas — Keeping House Cool

In the hot arid parts of the country, the evaporative cooler, or so-called desert coolers, are a great aid in maintaining humidity and keeping down excessively high day temperatures, if plants are grown in a greenhouse. They work on the principle that if hot, dry air is passed through water (wet pads), it loses its temperature and picks up moisture. This is why coolers of this type work so well in the arid southwest. The cooler is installed outside the house and air blown in through a duct under the benches. Often temperatures as much as 10 to 20 degrees below maximum outside can be maintained, if weather is hot and outside humidity low.

Soil or Potting Mix

Cymbidiums can be grown in soils suitable to other shade and acid loving plants. They require a medium that is slightly acid and has a high organic content. The drainage must be very good. Though they require large amounts of water during the growing season, they will not tolerate any standing water around their roots. Most composts today generally contain many or all of the following ingredients in varying proportions:

(1) Leaf mold for physical properties and food value.

(2) Clay free silt sand for body.

(3) Garden peat for physical properties, acidity, food value and moisture retention.

(4) Palco wood (ground redwood bark) for buffering action, Acid pH, and general physical properties.

(5) Fir bark for physical properties, acid reaction, food and moisture retention.

(6) Lime for proper acidity (Around pH 6).

(7) Fertilizers for food.

(8) Trace elements for balanced nutrition.

If you mix your soil, make sure it is open and porous, has high organic content with an acid reaction, and that the drainage is good. The simplest thing to do is to plant your cymbidiums in Stewart's prepared cymbidium mix, available in standard 2 cu. ft. bags.

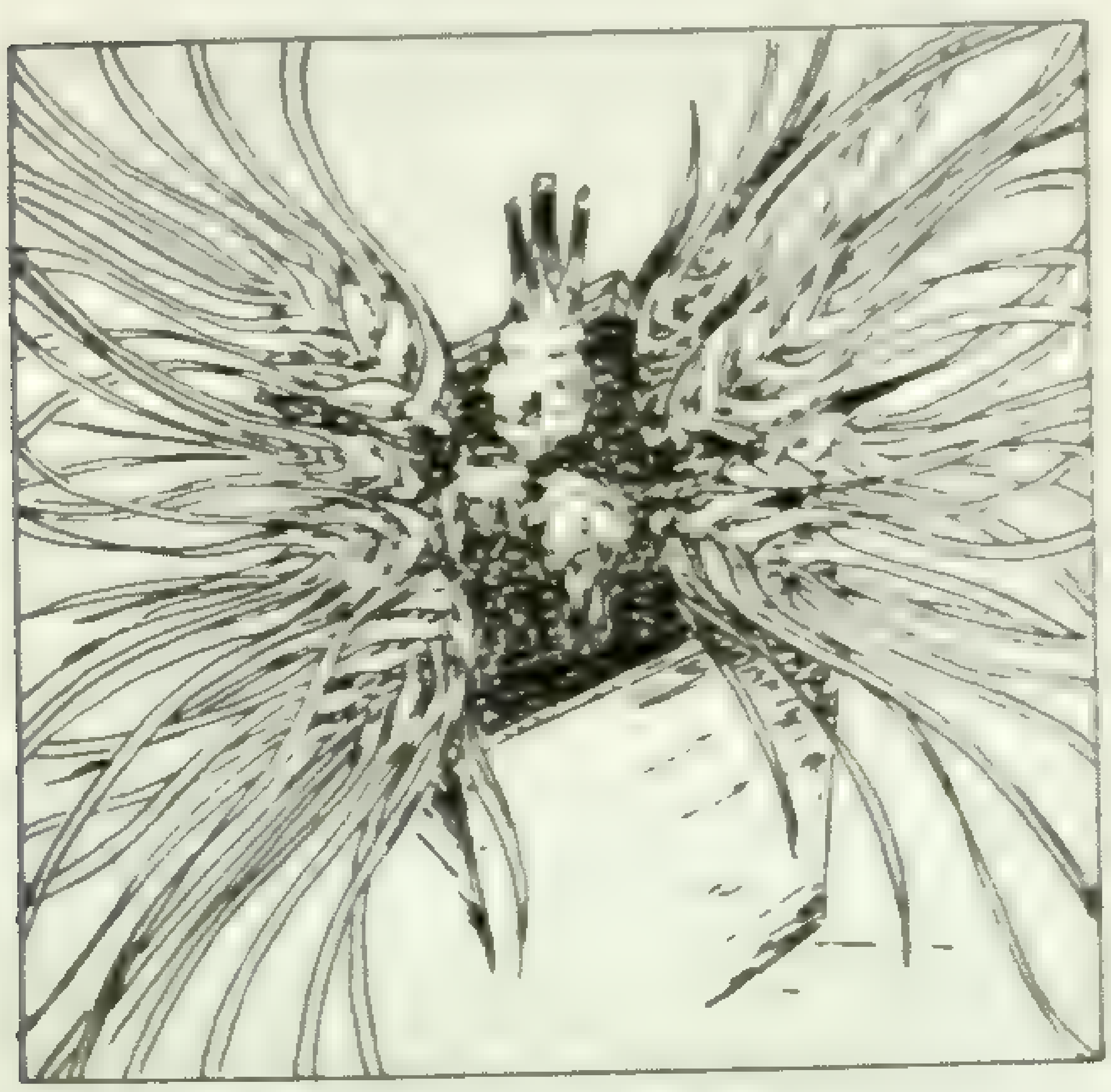
Cymbidiums Have Few Pests

Fortunately, cymbidiums are subject to fewer pests and diseases than are most garden plants. Care must be taken to see that slugs and snails are kept under control, especially during flowering season, as they can ruin a fine spike overnight. Both the powder and liquid killers are effective. Orchid scale can be cleaned off with a toothbrush and plants sprayed with Malathion or Spectracide solution. There are other equally effective sprays. Red Spider is perhaps the most persistent and difficult to detect of the pests. It can be found under the leaves, where it sucks the surface sap and makes the undersides appear scratchy-white or silvery, where the surface cells have lost their sap. Malathion, Kelthane and Cygon are effective. There are a few rot and virus diseases found on cymbidiums. Their spread can be controlled by proper precautionary measures, such as segregating, sterilizing cutting tools and keeping the plants in good health. A good fungicide spray such as Fungitox or Captan applied in late spring and fall is beneficial.

How and When to Divide

This plant has just finished blooming and the pot is filled with bulbs. There is no room in which the new bulbs can grow. You have the option of shifting this plant on without dividing, or of dividing, as shown in B. The best time to divide, if the plant is not blooming is in March. If blooming, April or May is best, as soon as blooms are cut.

This is looking down on the plant, showing where division will be made. The object is to separate the plant into blooming size 3-6 bulb divisions. The dormant, leafless bulbs, called back-bulbs, are removed to be restarted. Larger divisions are advisable, if all the bulbs are strong and have leaves and roots. Remember that it takes a good sized, well established plant to produce the best flowers.



Before attempting division, wash or shake as much soil off roots as possible.

Examine plant to see where the separation can best be made. Firmly grasp the lower portions of the bulbs with your hands and vigorously pull them apart. A sharp sterile knife will help in severing the rhizome, which joins the bulbs. Wash old mix from around the roots, remove any dead roots, cleanse the wound area, and seal with asphalt tree seal compound.

Place the newly divided cymbidium into a pot or tub — large enough to contain it for 2-3 years. Cover the base of the growths or bulbs with potting mix. Firm mix about the roots, being careful roots are not balled into center of pot, but well segregated throughout the mix. Make sure soil is worked in well around the roots. Give light watering to settle soil around the roots. Place the plant temporarily in a well shaded, moist location and supply moisture by frequently spraying foliage and outside of pot. This dry period will allow cuts or fractures to heal over. When active root action shows, normal lighting, food and watering can be resumed.

AN ASIAN TREE FOR SOUTHERN CALIFORNIA

Ross Goodrich

IN VIEW OF ALL of the good qualities of *Zelkova serrata* it is a little sad that it has not been planted more often in Southern California. When a tree of its type is being considered the Chinese elm usually wins the toss because it is almost evergreen and grows faster. But the Zelkova is a distinct and handsome tree that has more than this to offer. It has even been called elegant by some observers although this is a pretty fancy word for such a sturdy tree.

Through spring and summer its rounding head is covered with elm-like leaves of from two to four and one-half inches in length, medium to dark green in color. Autumn usually finds the leaves a dark mahogany red making the tree again a pleasant sight. In winter the framework of its trunk and bare branches is attractive against the background of other trees or the sky. The grey bark is interestingly marked with small brown lenticels that vary from horizontal lines of several inches in length down to mere dots.

The shade of the tree in summer is quite even, with few spots where light gets through to make uncomfortable the person beneath who is seeking shelter from the sun. The leaves are attacked very little by insects and are not much of a mess when they finally fall to the ground.

A good example of *Zelkova serrata* is in the Asian Section of the Arboretum. It is about thirty-five feet in height and the same width with a trunk that is between nine and ten inches thick. This size makes it easily seen from the tram as it passes the far end of the Upper Lagoon. The tree is seventeen years old and has retained its natural shape all this time; its framework was not made by pruning. A few dead branches, self-pruned by its own shade, have been removed, and a very few crossing ones; otherwise it is as it grew.

Zelkova serrata is native to Japan, Korea, Eastern China and Taiwan. This particular tree was given to the Arboretum by Willard Hagen, Arboriculturist, of Arcadia.

Zelkova serrata: In full leaf six to seven months of the year. Photo on left was taken in January, the one on the right in June.

A PROGRESS REPORT:

Electricity in Climate Control for Winter-Green Bermudagrass

H. Hamilton Williams, Biologist
Turfgrass Research and Education

CLIMATE EXERTS A MORE POWERFUL INFLUENCE on the physiology of plants than any other single factor in the environment. Resulting from the interaction of solar energy and the physical features of the environment, varying intensities and periods of heat and light have a determining effect on plant development and behavior.

Bermudagrasses have a high heat and light requirement. Even when other conditions are optimum, bermuda will lose vigor and fail to grow proportionately when these factors become limiting as in shaded locations or during sub-tropic or temperate zone winters. Having no definite dormant period, bermuda will grow proportionately as heat and light from natural or artificial sources approach its maximum requirements. Loss of color from bermuda foliage is due to the high rate of destruction of its chlorophyl under conditions of high light intensity and low temperature and a concomitant low rate of chlorophyl synthesis. Thus the familiar straw-colored, 'dormant' bermuda of our winter season reflects only the inadequacies of climate in our particular environment.

In a broad sense, home gardeners are generally aware of the response of plants to horticultural practices such as mowing, watering, fertilizing and the like. Seldom do they realize that the visible effects in plant growth may have been produced indirectly by changes such practices exert on the climatic environment.

For example, close mowing permits more light to reach the soil surface, thus increasing soil temperatures and stimulating light-sensitive seeds (often weed seeds) to germinate. The surface soil, being more exposed, loses moisture faster through evaporation which results in a lower humidity, thus inhibiting the spread of disease-producing fungi or of competing plants having a high moisture requirement.

Certain Benefits and Limitations of Water

WATER HAS A WIDE RANGE of influences on climate, according to its use and disposition within the terrain. In large bodies, such as lakes or oceans, it tends to alternately absorb and release large amounts of heat energy so as to modify extremes of temperature. In metered amounts and timed applications, water was used recently in an experiment at the University of California South Coast Field Station, Santa Ana, to maintain night temperatures adequate to keep bermudagrass green through the winter. Because of the large volume required to be effective, this method does not appear to have a wide practical application except in areas such as Santa Ana where winter temperatures are modified by coastal influences.

In Europe and other places, heated water or steam has been piped under turf to maintain soil temperatures adequate for the growth of grasses during the winter. This practice, also, has not proven to be economically feasible.

The evaporation of water is promoted through the absorption of heat energy and contributes to an increase in humidity and a decrease in temperature, a condition which would reduce transpiration. This is the principle involved in the horticultural practice of syringing to alleviate incipient (temporary) wilting.

Singularly, water has the capacity to absorb large quantities of heat without a comparable rise in its temperature. For this reason it is generally inadvisable to irrigate lawns in the late afternoon when higher temperatures and lower humidities are desirable into the night for improved disease control, or even for better germination of seed in a newly planted lawn. For this same reason, also, it has been shown to be undesirable to permit excessive amounts of water as rain or irrigation to infiltrate into the soil when attempts are being made to maintain higher than normal soil temperatures. Tarps of clear plastic have been used to protect turf areas from this unwanted precipitation.

Certain Benefits and Limitations of Plastic Tarps

ACTING TO TRANSMIT incoming solar radiation and to inhibit re-radiation of heat from the soil, a similar protective covering of clear plastic, supported a few inches above the turf, has been shown to be effective in maintaining soil temperatures adequate to sustain winter color in grasses and certain other plants in mild climates. Esthetic considerations and problems such as excessive humidity, reduced air circulation, and the difficulty of application and removal make this practice one of questionable value in many situations.

A new type of plastic is being developed that shows promise in modifying the spectrum of the light it transmits in favor of the wave lengths that are most effectively used by plants. This added value of a plastic covering could enhance its usefulness tremendously if used in combination with all the other factors previously mentioned for climate control.

Varieties and Management

Certain improved varieties of bermudagrass inherently remain greener through longer periods of the year than others. Good management practices such as thatch control and the prudent use of nitrogen fertilizers can induce vigor and contribute to an even longer period of green, even with common bermuda. However, color is lost, regardless of the excellence of care and other considerations when temperatures drop sufficiently and light intensities are high. Increasing light levels over large turf areas is at present impractical, but the problem of maintaining adequate temperatures in the soil is within the ability of present day technology.

The Electrical Resistance Cable

A very practical source of heat energy is the electrical resistance cable. These cables have been used in colder parts of the country for many years, implanted in walks and driveways to keep them snow-free in winter. They have been used in plant propagation to supply bottom heat in seed and cutting beds. Studies conducted here at the Arboretum and at other places across the country have demonstrated the practicality of using these cables embedded in the lawn to help maintain temperatures adequate for growth and color in grasses during the winter. This excursion into climate control by supplying supplemental heat electrically to the soil in the root zone has resulted in opening the possibility for many practical applications, such as in athletic fields, golf or bowling greens, and other high value, high use turf areas, not excluding the home lawn.

History of Existing Installations

Perhaps the first attempt at using this electrical resistance cable in turf was made by J. R. Escrit at Bingley, England, as early as 1951. Several commercial installations were subsequently made in England, Scotland and Sweden. The Farm Electrification Research Branch of the U. S. Agricultural Research Service, working cooperatively with the Departments of Agronomy and Agricultural Engineering at Purdue University in Indiana were the first to investigate the use of the cable in America.

Later installations have been successfully operated at Lethbridge in Alberta, Canada, at Busch Stadium in St. Louis, at Falcon Stadium at the U. S. Air Force Academy in Colorado Springs, at Texas A. & M. University in College Station, and at several other locations.

The grasses used have included the full range of the varieties used for lawns, chiefly St. Augustine, bermudagrasses, bentgrasses, bluegrasses, zoysia and rye.

Studies at the Arboretum

INVESTIGATIONS AT the Arboretum were initiated during the late summer of 1966. Ten reels of heating cable were supplied by the Easy-Heat Division of the Singer Company of Lakeville, Indiana, along with accompanying thermostat controls. The cost of installing electrical service to the research site and connecting the cables to the control panels was underwritten through a grant by the Southern California Edison Company. Specialized equipment used in inserting cable into the sod was supplied by The Ryan Equipment Company of St. Paul, Minnesota and the Pacific Toro Company, including its affiliate Moist-O-Matic Division, of Los Angeles and Riverside. Recording Thermographs were loaned by California Turfgrass Nurseries of Camarillo. Installation and inspection of electrical service and connections were performed by the Mechanical Division of Los Angeles County.

Ten plots were laid out in a well-established stand of Tifgreen bermudagrass, each 3′x20′, and separated by a 3′x20′ control plot. These were arranged in two rows of five plots each, spaced 6′ apart. An additional control plot was added along one length of each of these rows at the east and west end.

The plots were randomized but, due to the limitation of equipment, were not replicated. Based on information then available, a spacing and burial depth of 6″ was selected. Plots were designated as follows:

Plot No.	Key	Wattage of Cable* per lineal foot	Watt Density of Plot per Square Foot	Operating Temperature (Degrees F.)
1	D	1.25	2.5	50
2	A	5.0	10.0	50
3	C	2.5	5.0	50
4	C	2.5	5.0	60
5	A	5.0	10.0	55
6	B	3.75	7.5	50
7	B	3.75	7.5	60
8	C	2.5	5.0	55
9	A	5.0	10.0	60
10	B	3.75	7.5	55

* Physical Description of Cable: Solid core resistance wire (Nichrome and copper alloy) with P. V. C. primary insulation 3/64″ and nylon jacket, with copper overbraid grounding provision. Hot to cold lead junction of waterproof, encapsulated, pressure type sleeve connectors joining heating section to 10′ U. F. type cold leads of stranded #10 AWG copper conductors. — Courtesy Easy Heat Division, Singer Co.

During the first year the minimum operating temperature that would produce satisfactory results was to be determined, as well as the minimum watt density capable of sustaining that temperature. It was projected that during the second year, all plots would then be operated at this minimum temperature, with an overview on the performance at the various watt levels.

Opening trenches ½" wide and 6" deep with the Moist-O-Matic Mole Trencher. Accurate spacing of 6" was obtained by use of a 1" x 6" straightedge.

Installing the Cable

THE cable at Texas A. & M. University and at Falcon and Busch Stadiums was installed in bare soil, using a modified sub-soil plow to open the trenches. Turf was grown later. At Lambeau Field (Green Bay Packers), cable was installed in existing turf, using a rolling coulter to slit the bluegrass sod, followed by a cable-laying device. The Texas A. & M. University installation consisted of cable spaced variously from 3 to 12 inches and attached to ½" mesh hardware cloth which was then placed in their plots at depths of 2, 4 and 6 inches.

The Arboretum installation required a completely different approach due to the nature of the investigation. First, the well-established Tifgreen bermudagrass sod had a tough and extensive rhizome and root system that required heavy and powerful equipment to slit. With such equipment it would have been extremely awkward to make the numerous 3" radius turns required by the 6" spacing of the cable. Also, slits in this well-knit sod could not be closed accurately enough to insure good soil-to-cable contact necessary for reliable heat exchange.

The first approach to the problem involved the unsuccessful use of a Ryan Sod Cutter employing their Mole Attachment. This consisted of a vertical fin or blade, its leading edge sharpened, with a bullet-like tip at the bottom which opened a small diameter tunnel as it moved under the soil. An eccentric cam drive on the sod cutter rapidly oscillated the blade during forward movement. A specially designed, short woven wire device, called the Kellems Grip, attached the cable behind the bullet and pulled it through the tunnel as it was being opened. Due to the density of the sod, the blade did not cut effectively. The extreme drag thus created coupled with the succulence of the grass caused the rubber-covered traction drum to spin excessively, thus scuffing the turf quite seriously.

Even if this equipment had opened the trench successfully, it is doubtful if its effect on the cable would have been desirable. This cable had a rather fragile embroidery of copper around the outside for grounding, which was damaged by being dragged through the tunnel. Also, the jerking motion of the Mole as it pulled the cable could have broken the resistance wire in many places. This equipment was designed to pull plastic tubing underground in the installation of irrigation systems, but did not appear to be satisfactory for use with this elec-

Cable being installed by hand into the trenches cut in bermudagrass sod.

Backfilling trenches and firming soil over the cables was a tedious operation. Trenches totalled over 1/3 of a mile in length.

tric cable. Also, this system would have involved pulling the leading end of the cable through the entire length of the trench, the stress becoming progressively greater as more cable was being pulled behind it. The design and construction of the cable would not enable it to withstand such excessive stress.

The method that finally proved satisfactory involved excavating the trenches ½" wide, using a modified arrangement of tynes on the Toro Mole Trencher, a piece of equipment especially designed by Ed Hunter of the Moist-O-Matic research Division, Riverside. These carbide-tipped tynes have staggered angular bends towards the end, enabling an operator to open a trench up to 3" wide by selecting the proper set for mounting into a hub-disk. The depth of cut can be regulated to about 8". Soil is removed by the whirling tynes and deposited at the surface, parallel with the trenches, by a chute.

Accurate spacing was obtained between the trenches by using a 1" x 6" straightedge, anchored in place, as a guide for the wheels of the Toro Mole.

In the absence of a laying device, the resistance cable was then inserted into the trenches of the test plots by hand from individual reels, and immediately secured at the 6" depth with soil. This backfilling process was rather tedious since the trench was only ½" wide and the soil had a tendency to bridge over rather than fall in. This necessitated much packing in of small quantities of soil at a time, using a contrived tamp of ½" plywood.

The magnitude of this task is better appreciated when one realizes that the total length of the trenches amounted to over ⅓ of a mile. However, due to the extreme importance of eliminating all air spaces around the cables, every precaution was taken to firm the soil back into place.

The ten-foot cold leads from the cables were installed to the individual thermostat control, entering from underground through conduit. Similarly, the leads to temperature sensors left the thermostat through conduit to underground and the sensors installed in the center of each plot at a depth of 3", positioned halfway between two cable-bearing trenches.

Duplicate trenches were excavated and backfilled in the two east and west control plots, although no cable was installed. Any possible effect of this vertical cutting could then be observed by comparison with the remaining checks.

Installation was completed too late in the 1966-67 winter to gain much information. However, preliminary tests were made that yielded very promising results. The system was again energized on December 1, 1967. Outside temperatures were sufficiently low to engender observable results by December 27. Numerous records of temperatures and ratings of the plots were taken before the termination date of the 14th of February, 1968. These were considered too inconclusive to be included here.

Similar tests were run between December 1, 1968 and March 1, 1969, except all plots were operated by thermostat control at 60° F. During this period the weather was characterized by some of the coldest periods ever recorded at the Arboretum, as well as the wettest. The abnormal amount of precipitation nullified any meaningful performance by the cable, especially so, since no provision had been made for employing plastic tarping. However, all the heated plots were satisfactorily green except 1-D with only 2½ watts per foot heat density. Results were further obscured by a heavy invasion of *Poa annua*, Annual Bluegrass, which grew well even in the check plots.

Extensive studies are now under way at the Arboretum to determine effective measures for pre-emergence control of *P. annua*. The more promising of these results will be employed next winter when further trials with the heating cables will be conducted.

Observations And Results

A review and analysis of the data taken so far during this investigation has revealed several interesting trends, some deficiencies in the equipment used and a glaring shortage of recording instrumentation.

A very high quality of turf was produced on the plots designated to be maintained at 55° and 60°, minimum, by thermostat control. Theoretically, this imbalance in soil and air temperature, especially at night, would encourage the development of a greater root system, retard top growth, increase nutrient intake, stimulate chlorophyl formation, increase carbohydrate levels, and produce a dense, fibrous leaf and stem tissue. To date, no laboratory tests or measurements have been made to ascertain the degree to which any of these may have occurred. However, visual results observed suggested that all or most of these physiological processes were taking place.

The growth of the turf was very slow and did not necessitate mowing during the test run of over two months. This would suggest that the lower air temperature acted as a growth retardant. It is probable that leaf temperature was elevated above that of unheated plots but may have lost heat by radiation and convection air currents. The resultant leaf temperature was probably adequate for chlorophyl formation and for photosynthesis to proceed at productive rates, which would have resulted in the excellent leaf color and texture observed.

There was a differential between the growth of turf proportionate to the temperature maintained in the soil. Physical limitations precluded more extensive tests that might have disclosed a maximum growth rate under the environmental limitations of the season. In situations where a higher growth rate would be required, such as in areas of high traffic and use, adequate temperatures might be provided but light might become limiting in both quantity and quality for the satisfactory growth of bermudagrass.

Preliminary tests involving three nitrogen levels were not adequate to show any significant results. However, it is almost certain that nitrogen could become an important factor under more controlled conditions.

The low maintenance of the plots and the high quality turf resulting could suggest that the cost of supplying electricity for the heat energy might be equally offset by a lower maintenance cost than that of other methods used to sustain winter color in bermuda, such as overseeding. This would make this type of installation one of great interest to the home gardener.

Unfortunately, no meters were available to determine the actual power consumption. Also, various management programs would need to be investigated that might minimize heat loss such as the use of plastic tarps, permissible thicknesses of thatch in the turf as a natural insulation, regulation of the amount of water applied, mowing height, etc.

Data on temperatures were taken during the late afternoon and proved to be of limited validity in this study. Only a one-week period of night temperatures was recorded and this indicated a range of 18° in the soil while air temperatures for the same period ranged through 48°. Several factors might be involved: Inaccurate thermostat, unfavorable location of sensor, maladjustment of recording thermograph, or inadequate watt density of cable. Further study is needed to make a determination.

It appears that the cable could have been spaced to a more economical 12" apart since check plots adjacent to the heated ones showed considerable response.

Conclusions

THE resistance cable energized by low-cost electricity available in most parts of Southern California proved to be an excellent method of maintaining adequate temperatures in the soil for the production of a beautiful, green bermudagrass turf throughout the winter. There appears to be a practical application of this method in all types of lawns, but especially in high value turf such as athletic fields, golf and bowling greens.

Installation costs could be expected to be lowered by the use of improved implements to implant the cable into established turf. Electrical service at many sites is already adequate, especially at athletic fields where facilities for night lighting exist. Cables may be operated during off-peak hours and at even more favorable rates where night lighting is used. Accessories such as plastic tarp for control of moisture and prevention of heat loss could further reduce operating costs.

Thus it is projected that sustaining winter color in bermuda and other lawn grasses can be accomplished successfully through the use of the electric resistance cable and at a cost competitive with other methods now being used.

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KINESCOPIA VIDEOTAPENSIS

"Green Leaves, the Story of Your Arboretum"

Maria and Bill Stewart

WHEN KNBC airs this Public Service Television Series on the work of our Department Sunday mornings at 11:30, it's anyone's guess who is going to be watching. Are Sam and Helen Ayres going to want to stagger all the way up the hill from the spot at FAR HORIZONS where they are busily tending their newly replanted Hakea cuculata? Will Ralph Cornell feel it is worth his while to interrupt the morning training session with J-Bird, his amiable blue jay? And what about Hal Roach, the pillar of St. Luke's, will he be able to slip out of his pew just as services are well under way? But worst of all, how in the world can our favorite Supervisor-Emeritus, John Anson Ford, possibly shake free of all those grandchildren long enough to watch what has happened to the Los Angeles County Department of Arboreta and Botanic Gardens which he brought into being! It has taken over a year and a half, fitted into week-ends and other odd times, of filming in different seasons and varying moods all kinds of diverse subjects, and we surely hope *someone* is watching!

With Arboretum arborist Harold Martinez at the controls of his aerial boom, producer - cameraman Don Brauer and scriptwriter - cue card holder Maria Stewart are air-lifted for a production shot of turfgrass plots.

During these months, Bill has been initiated into the mysteries of shooting film segments, taping sound, cue narration, ad-libbing, and all kinds of specialized techniques for which a Ph.D. in Plant Physiology somehow failed to equip him. Edward J. Kay was the one who got him into this fascinating predicament. And now that the series of thirteen shows is finally "in the can," we begin to appreciate the scope of his contribution to our public relations program. Not only did he, as the producer, persuade Atlantic-Richfield Company of the value of underwriting the cost of the technical side of the production, but he persuaded Bill to be the narrator by arranging to have the finished sound films of each of the programs donated to the Arboretum after they are finished with the television run. We can use them extensively in our educational activities, and eventually they will be stored in our archives so that future historians will have an accurate record of the development of the Department up to this point. This gift of the films made the work entailed in their preparation worthwhile as they, along with the collection of LASCA LEAVES and the Biennial Reports of our Department, make as complete a documentation of the founding and running of a public botanic garden as has ever been possible.

We were just started on the series when Mr. Kay moved to Portugal, and Don Brauer, our cameraman, stepped into the breach. Having produced two shows of his own, *Territory: Underwater* and *Ski Breed,* Don was no novice. But it was a triple burden to produce, write, and shoot all at once, so Maria became his volunteer assistant.

It was really enlightening to learn how a half hour television program is put together. Here are some of the steps we took:

1. We listed about thirty special subjects with which we deal at the Arboretum that would be interesting and informative to the general public and wrote a synopsis of each. From these Atlantic-Richfield chose eight which seemed most promising. We then made a pilot show of one of them, *Youth Education,* which was shown to the Atlantic-Richfield staff for approval and to secure their financial assistance.

2. Each of the eight shows then was outlined in a general way to guide the filming. Writing the script and shooting the footage for each show's special opening and closing came next, followed by planning the transitions between the film segments and shooting the main segments.

3. All of the script used in the sound sequences was printed on tele-prompter cards — some unfeeling folks call them "idiot cards!" For Maria the *high* point of the whole project came the day she, the camera, and Don were cozily jammed into the bucket of the aerial lift in order to film a sound-on-tape sequence with an overall view of the turf plots. She had to hang over the side to flip the tele-prompter cards out of camera range while 70 feet above the turf!

4. The crucial phase of cutting and editing the film fell to Don Brauer, as well as selecting the background music and sound effects which were recorded on tape.

5. Then we were ready to trim the script to the finished film which must be exactly timed to the split second: of the 28 minutes and 42 seconds allotted to us, the peacock at the beginning uses 12 seconds, the standard opening on each show is 1 minute 18 seconds, and the standard closing is 1 minute 4 seconds, leaving exactly 26 minutes and 8 seconds for the program.

6. At the studio we dubbed in the narration which tied the film segments together at the same time the sound on tape was synchronized with the film, a delicate maneuver which we'll tell you more about in a minute.

7. And finally Don Brauer cut the reel of 16 mm. audio tape and the 16 mm. film into a final composite on video tape which puts the show, at last, "in the can!"

A continuing frustration in dealing intelligently with any subject in which you are completely absorbed is felt when you have to decide how much of the story you are going to be able to fit in. After painfully eliminating all but the essentials, we invariably still had much more script prepared than we could possibly squeeze into twenty-six-plus minutes. There was so much we wanted to include that was simply impossible to work in. But on the other hand, there were occasional disappointments in the filming when scenes had to be cut because of problems with light, sound, or other technical complications. So among the most challenging sessions were those times when a nineteen second statement had to be trimmed to fourteen seconds, or when a five syllable adjective had to be replaced by a two syllable one with precise meaning, in order that sound and film would be properly synchronized.

FOR Bill, the part that brought the most consternation (panic would not be too strong a word for that first session!) was being placed at a desk, alone in huge Studio Five (where the news show is put together each afternoon), with a live mike in front of him into which he would speak the narration whenever a voice from his head-set barked "Cue!" On the other side of the thick wall in the main Studio Five Control Room sat the technical director at a large console with dozens of colored lights from which he was in touch with the projection room where the films and slides were being run so that he could show our film on several of the twenty-three TV screens in front of him in both color and black and white. He also controlled the tiny monitor screen at Bill's desk which was black and white only. (This posed quite a problem when he was verbally trying to project an enthusiastic description of a black and white picture into a brightly colored scene!) Another console in the Control Room sprouted numberless knobs and switches and was presided over by the audio-mixer who was plugged into still another cell where the sound tape was being fed into the Kinescope Recording Department. Don Brauer was in the center, stop watch in hand, eyes on the monitor screen, ears covered with the head set by which he communicated with Bill and the other scattered unseen components; and from here he orchestrated the production. The cue man sat on one side of him and Maria sat on the other, noting parts of the film where light and dark needed to be balanced. If Bill, or anyone, made one little slip, this imposing structure ground to a costly halt; it would be necessary to go back to the beginning and start again.

Luckily, with each succeeding program we all learned more of the skills which made it easier to do, and, we hope, yielded better and better shows. After the first eight programs were completed, our sponsors asked for five more, bringing the series to thirteen shows. The officials of Atlantic-Richfield Company have taken a very generous step in sponsoring our program with no interruption for commercial advertising; so when we acknowledge their help, it is with a genuinely deep appreciation.

Something else we learned about was how, during the taping session in Studio Five, Tele-Cine projects our film into a Video-Coms machine, and in this way the pictures are transformed into electrical impulses. These are sent by telephone wire to the transmitter at the top of Mt. Wilson, and the electrical impulses are beamed throughout southern California and into our homes. Our television sets at home have transmitters which reassemble the electrical impulses into millions of colored dots forming the picture we see on the screen. When some members of Las Voluntarias went to a studio preview of the opening show, "Arboretum Heritage," Lucky Baldwin's great-granddaughter was one of those present, and we can't help but agree with her comment made when the group was given a tour behind the scenes: "I've been shown all through the Jet Propulsion Laboratory, but this looks a lot more complex!"

Now that the series is completed, we must confess that there were times when we wished that the scientific method could have been used to temper the artistic impulses of some of our co-workers. In science we seek the truth wherever it may take us, but we soon found out that in the world of television, the audience IS the truth! But any minor irritations are completely blotted out by the real fun of the whole adventure, especially the pleasure — and privilege — of working with a gifted and congenial man like Don Brauer.

Though it was a worthwhile and exciting experience for Bill, the one aspect which was most difficult for him was the requirement to narrate activities of the Department without using the names of those who are actually doing the work being shown. It's true we all work side by side, each making his contribution to the success of the whole, and it falls to the Director to act as spokesman. But all the way from Michael Williams, our youngest Tree Trimmer Assistant, to Dr. Harry Walker, the dean of our scientific staff, it would have been nice to be able to name every single person on the staff because it is truly our highly capable and cohesive crew that is the soul of our Department. But Eddie Kay pointed out that if this were done, there would be no time for the show!

Now that we see how valuable a record this has turned out to be, we think sometime another series should be done featuring all the volunteers whose devoted labors add to the richness which is ours to share. Only a few of our dedicated founders were mentioned here. They have now been joined by thousands of citizens who volunteer their time in many ways to help us in the Department of Arboreta and Botanic Gardens grow in giving service to all the people of Los Angeles County. Their contribution is so vital and so special we hope that it too will be preserved in film and sound in a series devoted exclusively to them!

Lasca Leaves

The official publication of the California Arboretum Foundation, Inc.

Sponsors of

LOS ANGELES STATE AND COUNTY ARBORETUM

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Los Angeles County Department

of

Arboreta and Botanic Gardens

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CALENDAR 1969

FLOWER SHOWS

Arboretum — Arcadia

April 5, 6
Aril Show

April 19, 20
Iris Show

April 26, 27
Amaryllis Show

May 10, 11
Geranium Show

May 18
Epiphyllum Show

May 30, 31, June 1
Bonsai — Santa Anita Bonsai Society

June 7, 8
Bromeliad Show

June 27, 28, 29
Gladiolus Show

July 3, 4, 5, 6
Cactus and Succulent Society of America Show

July 13, 14
American Begonia Show
San Gabriel Branch

South Coast Botanic Garden — Palos Verdes

Saturday, April 19
Silver Spur Garden Club
Open to the public
2 - 5 p.m.

Tuesday, May 13
Los Colinas Garden Club
Open to the public
12:30 - 3:30 p.m.

Tuesday, May 20
Riviera Garden Club
Open to the public
12:30 - 3:30 p.m.

July 18, 19, & 20
South Coast Botanic Garden presents its Seventh Annual
"FIESTA DE LAS FLORES"
Open to the public
Friday, July 18 from 1 - 7 p.m.
Saturday, July 19 from 10 a.m. to 7 p.m.
Sunday, July 20 from 10 a.m. to 6 p.m.

LECTURES

Arboretum

March 21 — 8 p.m.
Theodore Payne Foundation
"Flora and Fauna of the Channel Islands"
Speaker — Allan L. Ryan

South Coast Botanic Garden

May 16 — 8 p.m.
"Roses in the Coastal Environment" by Dr. Dennison Morey
Reception preceding at 7:30 p.m.
Open to the public

CONTINUING CLASSES

Home Owners Class: Lawn Care — Arboretum — Lecture Hall
Wednesdays — 9 - 12 Noon — to June 18
Instructor: Dr. H. Hamilton Williams, Staff Turf Grass Specialist

California History — Descanso Gardens — Hospitality House
Tuesdays — 7 - 10 p.m.
Instructor: Patricia Warren, Historical Curator

TELEVISION SERIES

Each Sunday for 13 weeks — 11:30 a.m.
Channel 4 — KNBC
"Green Leaves" — Dr. William S. Stewart, Department Director

Correction
The September 1968 issue of LL is Volume XVIII, No. 3, not Volume XIX as printed.

SCE

Southern California Edison Company

BOOKSHELF

Joseph Wood Krutch Herbal
G. P. Putnam's Sons, N.Y. 1965 $17.50
255 pg. Illustrated.

This is the kind of book not likely to have been written by a young man as, indeed, it was not (JWK was seventy-two when it was published). It is redolent of experience and maturity. Reading it one feels certain it belongs on the bookshelves of everyone, young or old, who entertains some fancy for plants, history and the fine use of language.

A literary critic, authority on the drama, author of numerous books on literary figures and subjects, and onetime professor of English at Columbia University, JWK has in recent years been active as a more or less full time naturalist. In the Joseph Wood Krutch Herbal the background shows. Mr. Krutch's relaxed, deceptively simple literary style together with philosophical observations that stimulate without antagonizing, are alone enough to make the book a delight. Beyond this the random collection of comment and information — the hundred plants discussed were chosen, the author tells us, largely on the basis of the number of interesting things which had been or could be said about them — broadens our appreciation of familiar plants, such as the carrot, banana and rose, and unfamiliar plants like capsicum, teasel and woad. A few spelling errors and questionable botanical classifications were spotted, but nothing, I've been assured, to lead the reader seriously astray.

The book is handsomely put together, contains a useful index and bibliography, and is illustrated with reproductions of woodcuts more than 400 years old.

One other thing. Everyone drops his h's when talking of herbs or herbalists and my dictionary, I find, agrees. When it comes to a herbal, however, it's not so 'umble.

DD

Fundamentals of Ornithology, Josselyn Van Tyne and Andrew J. Berger, John Wiley & Sons, Inc., New York, 1959.

"The Kirtland's Warbler," with its loud, persistent song and its relative unconcern over the presence of man, is a fascinating bird. The bird, the fragrance of the sweet fern, the cold, clear mornings, and the hot, dry afternoons are not soon forgotten."

Fundamentals of Ornithology, new only to the Lasca library, is a study of birds that describes them in detail, with attention paid to their evolutionary and ecological position. It provides readers from the casually interested to the specialist with a virtually endless supply of information.

Presented in standard textbook form, the book begins with avian paleontology and closes with 204 pages of capsulized classification of world birds by family to which is added a comprehensive glossary. Information is well-organized and compact, making the book useful as a reference text. References to other works are abundant.

Conceived originally to accompany Van Tyne's graduate class in ornithology, the book's references provide a comparison between classical and modern works in the field. After Van Tyne's death, the book was completed by Berger, who excels in presenting the unique esthetic aspects of birds while discussing biologically unique aspects of class *Aves*: "Throughout the animal kingdom birds are outstanding for the variety of sounds they make and for the versatility of their songs. Other vertebrate animals are, by comparison, a quiet lot."

Robert Copper

Recent additions to the Lasca Library

On Integration in Plants, by Rudolf Dostal. 200 p. Harvard University Press. 1967.

Woodland Portraits, by Jeannette Klute. Little, Brown and Co., Boston. 1954.

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone 447-8207

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Annual Membership	10.00
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All contributions deductible under Federal Income Tax Law

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The Cover

'Burgundy Mound,' an osteospermum hybrid to be introduced soon to the nursery trade by the Arboretum. (See page 36)

the Editor's Page

THE SUMMER SOLSTICE has passed and the hot days lie ahead. It is the period of estivation for many plants and many people, the condition ameliorated by sprinklers and pools.

Life at the Arboretum will take on a different cast, departmental work slowed because of vacations, attendance increased for the same reason. Our grounds will fill with out-of-state visitors exploring the flora of Southern California while comparing it with what they left back home, with senior citizens coming for a tram tour in a garden oasis, and with unleashed day-campers from Lair-of-the-Bear, Smile-A-While, and similar repositories for the fugitive young. While this is going on workmen will be completing the new Research Laboratory and continuing with the restoration of the old Santa Anita depot. There will be many inquiries about *Camptotheca acuminata,* the rare tree that is the source of the drug, camptothecin, now being tested at the Cancer Chemotherapy National Service Center in Bethesda, Maryland. And the Arboretum's role will be explained — its assistance in helping to locate more camptothecas, its identification of tree samples sent in by a helpful public, its donation of one mature tree to the battle against cancer, and its offer to donate its remaining camptotheca which still may be seen close to the west shore of the upper lagoon.

It will be an active summer, and for this we are grateful.

Arboretum notes

Foundation Presidency

TWO ISSUES AGO we reported on the change of presidential chairs on the Board of Governors. Now it is the turn of the Board of Trustees, the governing body of the California Arboretum Foundation.

After serving nine years as a member and the past two as president of this Board, Dr. Arie J. Haagen-Smit, the well known Caltech scientist and smog fighter, last month turned over his gavel and leadership to longtime Arcadia resident Ernest E. Hetherington, who, when he is not occupied with his duties as president and general manager of the Fred A. Stewart Orchid Company, can generally be found pursuing some worthy cause in the interest of the Arboretum.

Dr. Arie J. Haagen-Smit and Ernest E. Hetherington.

The exchange came about as a result of an election which the Foundation holds each year. Dr. Haagen-Smit didn't lose. He had completed the nine-year limit, or three three-year terms allowed for membership on the Board.

We might profitably recap the Board structure at this point. There are a total of twenty-five members of the Board of Trustees. These are elected by the entire membership of the Foundation. There are four officers. They are elected by the trustees. Nominees are selected by a committee consisting of a chairman, member of the Board, and a member at large. They are appointed by the president. Members of the Board serve three-year terms with nine years the maximum.

This brings us to where we started. Dr. Haagen-Smit now becomes an honorary trustee for one year. Joining him as honorary trustees are Mrs. Rudolph J. Richards of Pomona, and past president Ralph D. Cornell. Elected with Mr. Hetherington were Mrs. Gordon K. Smith of San Marino, first vice-president; Mrs. John N. Fehrer of Altadena, second vice-president; and Donald Camphouse of Arcadia, secretary-treasurer. Reappointed for new three-year terms on the Board were Mrs. Miriam P. Kirk, Mrs. Gordon K. Smith, Mrs. Forrest Q. Stanton, and Mrs. Harry J. Bauer of Pasadena, and Mrs. George Marshall of West Los Angeles. Appointed to the Board for the first time were Mrs. Peter Douglas of Glendora, Ralph Spencer of Palos Verdes Estates, and Robert P. Strub of San Marino.

Dr. Stewart

IT HAS BEEN often observed that men come and go but institutions live on. The qualifier to this generalization, of course, is that it is men who make or mold institutions and the presence or absence of one man can make all the difference in the world. Dr. Stewart's announcement last March, expressed in a typically considerate, low-keyed letter to every member of the staff, that he will be leaving the Department at the end of this year to become scientific director of the new Pacific Tropical Garden in Hawaii, came as a shock to everyone. We asked Hal Roach, trustee and past president of the California Arboretum Foundation and a longtime friend of Dr. Stewart, if he would comment on a departure that will mark the end of an era. Hal graciously responded with the following paragraphs which we think speak for all of us.

"No words of mine can adequately express the sense of loss we are all feeling as the realization comes home that Bill and Maria Stewart are about to leave us after fourteen dedicated and fabulously productive years.

"Under the discipline of the high professional standards set by Dr. Stewart, the Arboretum has 'come of age' as a true center of horticultural and botanical research while its fame as a spot where one may shed the wear and tear and strain of the everyday world and slip quietly into a world of serene peace by simply passing through a gate, continues to grow.

"Dr. Stewart's dedication to academic and professional excellence in the laboratory and at the test site did not prevent him from being a warmly human being who never lost sight of the need for people participation, and the Christmas piñata parties held at the old Hugo Reid Adobe for so many years under the personal direction of Bill and Maria are memories we shall never forget.

"Still full of vigor, imagination and drive, Dr. and Mrs. Stewart go on to a new challenge to found a wholly new haven for the oppressed spirits as well as continuing the search for knowledge into the mysteries of the world of growing things in the one spot where, perhaps, things grow better than anywhere else in the world.

"I know that the good wishes of everyone who came to know them, go with them as they set out on what Bill has called his 'last great challenge.'"

Gift Shop

WONDERING which of the more than seven hundred items for sale at the Foundation Gift Shop were the most popular with Arboretum visitors, we checked recently with the ladies who run the shop and came away with some thought-provoking answers. It appears that the horticultural — maybe it is just the written word — runs a distant second to the ornithological. Price, we feel fairly certain, figures largely in this reckoning. A peacock postcard, for example, costs five cents, a pamphlet on Arboretum peacocks ten cents. Twenty-five cents buys a package of bird food, fifty cents buys a Handbook on Orchid Culture. Peacock feathers are ten or thirty-five cents, depending on whether or not they have ocelli, which are the beautiful "eyes" on the train feathers, a peacock scarf is a dollar and a quarter. On the other hand, each of the Flowering Booklets — Trees, Shrubs, Vines, and Color on the Ground — is one dollar, thus perhaps placing these products of the Foundation, Los Angeles Beautiful, and the Southern California Horticultural Institute, in the category of Best Buy. More expensive, and worth it, are the Sunset Magazine how-to books which cover just about every horticultural and construction possibility the home do-it-yourselfer might think of. This is about all the inventory we are prepared to list here and we hope it is enough to entice Foundation members to come in to the shop and look around for themselves.

Aphids feeding on oak leaf. Note full-grown winged adult and young nymphs all with rather distinct color markings. Also note whitish cast skin (lower right center) shed by an aphid in changing from one instar to the next. All specimens greatly enlarged.

Aphid Investigations at the Los Angeles State and County Arboretum

Harry G. Walker, Mortimer D. Leonard and Leonid Enari

Introduction

A brief survey in 1966 of insect pests in the Arboretum indicated that aphids, or as they are commonly called, plant lice, were among the most common and widespread. The survey indicated further that although many species of plants were heavily infested there were species that appeared to be relatively immune. This suggested that the Arboretum with its wide range of host plants from various parts of the world offered an unusual opportunity for a study of the different species of aphids present and their seasonal host range. In addition, it has been possible since to secure information on those plants that are relatively free from aphid attack, information that should prove helpful to Southern California residents in the selection of plants for their home gardens.

Research Project

AS A RESULT OF these observations, a cooperative project was set up to make such a study with Harry G. Walker, Arboretum entomologist, being responsible for the collection of the aphids at least three different times during a given year, Leonid Enari, Arboretum botanist and taxonomist, being responsible for the identification of the host plants, and Mortimer D. Leonard, Collaborator, United States Department of Agriculture, and his associates being responsible for the identification of the aphids. This project will soon have been in operation for three years and over 4500 collections of aphids have been made. During this time, aphids have been collected from about one-half of the 3420 species of plants growing at the Arboretum. Some plants have been infested each year and some are infested much of the time, while others have been infested at certain seasons of the year, or possibly only once or twice during the three year period of the survey. In fact, new aphid host plants have continued to be found during each new survey of the grounds.

Size and Feeding Habits

MANY SPECIES OF aphids are very tiny, some being almost microscopic in size, while others may range up to and over one-fourth inch in length. Being so small, they are often overlooked. One farmer called his Experiment Station and complained about little alligator-like creatures seriously damaging his tomato plants. Examination of the plants revealed that the undersides of the leaves were literally covered with aphids, and that what he thought were little alligators were actually lady beetle larvae feeding on the aphids. This he could not believe until he was shown, through a hand lens, the lady beetle larvae catching and feeding on the small aphids which he had not even seen.

As indicated, many species of aphids feed largely on the undersides of the leaves, and the most succulent tender foliage is usually preferred. However, some species prefer the older foliage and some feed on different parts of the plant, such as the roots, bark or tiny twigs, blossoms and fruit or seeds. Aphids are sucking insects and they feed by inserting their tiny mouth parts into the plant cells and sucking out the sap. In addition to the actual removal of sap, the aphids may inject a toxic substance into the plant or transfer one of many virus or other plant diseases from infected to healthy plants.

The feeding of a few aphids would undoubtedly go unnoticed, except for possible disease or toxic symptoms. However, as the aphid populations increase, the infested leaves may curl and become spotted, turn yellow and even die, while some species may produce large warty excrescences on the bark. Other kinds may produce pseudogalls and some may produce true galls. Thus, heavily infested plants normally take on a sickly and unsightly appearance and many fruit and vegetable crops become unsalable.

In feeding, the aphids remove large quantities of sap from the plants which they excrete as a sweet, sticky or waxy substance called "honeydew." Honeydew has been noticed dropping from heavily infested willow trees, almost like rain. This would cause the leaves of plants or even automobiles parked under them to take on a sticky waxy appearance. In addition, bees, flies, and some species of ants are often attracted to the honeydew in large numbers. Ants are known to carry aphids from unfavorable to suitable situations and these aphids are often referred to as the ants' milk cows. The presence of large numbers of ants on a plant often indicates that the plants are infested with aphids. As the honeydew accumulates, a black sooty mold may grow on it which causes the plants to turn black.

Appearance

AS PREVIOUSLY indicated, aphids are tiny soft bodied insects with what is commonly referred to as incomplete metamorphosis. In other words, the young or nymphal stage resembles the adult stage. The skeleton or rigid part of an insect's body is on the outside and as it grows, it must shed or molt this outer covering, which can often be seen on the host plant, as whitish semi-transparent skins. Many aphids are greenish in color, closely resembling the leaves on which they are feeding, while others may vary in color from dark red to pinkish to brown to yellow, to whitish to bluish or even black. On the other hand, some species such as the cabbage aphid or the wooly apple aphid, secrete and cover themselves with a white powdery substance or long thick strands of a cottony-wax-like material.

Life History

OVER THE YEARS aphids have developed a very complicated life history that has enabled them to survive during all kinds of weather. In the Northern States they overwinter largely in the egg stage. Others, like the greenbug that attacks wheat, overwinter only in the deep south, migrating northward each spring, some years causing great damage, other years being of little importance. The eggs hatch in the spring, developing into full grown wingless females that give birth to living young asexually. These in turn do likewise through several generations until the host plant on which they are feeding begins to become unsuitable for aphid production, when winged forms are produced (see photo). These then fly to other hosts, some aphids having several specific hosts on which they feed during different periods of the year. The winged adults may continue to give birth to living young asexually, or under certain conditions both male and female forms may develop which can mate and lay fertile eggs to carry the aphids over winter or other unfavorable weather conditions.

Here in Southern California, aphids continue to reproduce all year long, the hot summer months with temperatures over 90° or 95° F. being much harder on the aphids than the winter months. As a result, aphids often largely disappear during the hot summer months, to reappear in increasing numbers in the fall, with possibly some reduction in the winter and then becoming most abundant in the spring when plants are normally in their most succulent and vigorous growth stage.

Identification

THE WORK ON THE identification of the large number of aphids collected to date has been delayed by the lack of assistance for clearing and mounting the aphids on slides for microscopic study. Many of the different species of aphids resemble each other so closely, and with so much variation from specimen to specimen within a given species, that it is often most difficult to make accurate determination even under the best of conditions.

The identifications completed to date indicate that about 100 different species of aphids have been found at the Arboretum, at least three of which are new species that have not been previously described. Some of the species are restricted to only a very few closely related species of host plants, while others have much wider host ranges. For example, *Myzus persicae* Sulzer has been found on over 500 species of host plants in the 1966 and 1967 collections and will undoubtedly reach a higher host range than this by the time the 1968 collections are identified. Several other species of aphids have been found on more than 100 host plants, while others may have less than 10 host plants.

Control

APHIDS ARE ATTACKED and often controlled by a wide variety of parasitic wasps, and by such predators as the larvae and adults of the Lady Beetles, the larvae of the green lacewings (Neuroplera) and by the larvae of many of the Syrphid flies.

If chemical control is required, aphids may be controlled by a number of contact or systemic insecticides. Two of the most commonly used and readily available materials are Malathion, a contact insecticide, and Meta-systox R, a systemic insecticide, that is taken up by the plant which itself then becomes toxic to the aphids. Before pesticides are applied it is important that the directions on the container be carefully read and then used as directed in order to avoid accidents and to insure safe and effective results.

GRAY DAYS ARE LOVELY, TOO

Sometimes while summer tarries, fogs ride high,
Sending a grayness on the land; beneath the gray-white sky
The trees are dull, pale olives more subdued;
The yellow-green of vines and grass is misty-dewed.

And in the soft, gray gloom, a single rose,
Clear pink, full-blown, on hanging vine, more intimately glows
Than on the brightest day when flowers seem
Mere gayer repetitions in the sunny theme.

Petunia's velvet is black-purple steeped:
And even flowers that flaunt sunshine's own yellow, glow more deep
Mid framing such as artist might essay,
The soft, harmonious drabness of a cloudy day.

Lydia Bowen

Poor Plants — Poor People[1]

Arie J. Haagen-Smit, Ph.D.

WITH SMOG ALERTS, eye irritation and oil slicks, it is quite timely and fashionable to talk about problems which have to do with the medium we live in.

It is disappointing, but nevertheless true, that we are *not* the rulers of the world, that we are not free to do anything we want. The laws of nature govern *us* as well as the smallest piece of *living* and dead matter. We of this century have discovered that our Earth is not so big after all, that our national resources are not infinite. Air, water and soil can deteriorate and this has happened in some cases with disastrous results.

To meet these problems intelligently we must know the relation between us and our environment. This area of study has been called *Ecology*. The name comes from *Oikos* = house
logos = discourse

Ecology then is the *study of our house,* meaning our environment. This may be the total *Biosphere* of the earth, continents, or smaller natural units such as forests, islands or even the small world of a square foot of soil.

A thorough knowledge of the functioning of this house, our environment, is of fundamental significance to our survival. Many civilizations of the past have succumbed because of a lack of understanding of the laws of nature. They cannot be flouted for long without severe punishment. Exhaustion of the soil, slash and burn techniques, led to the downfall of early empires of the Mayas in Mexico and the Persians in Western Asia.

Not too long ago I visited such an attractive system — a little island off the coast of Maine. Nature had done well for this piece of rock sticking out of the ocean. It was covered with pine and spruce and almost impenetrable because of berry bushes. Its beach was a slippery mass of kelp, of algae, and tidal pools filled with shells and an assortment of small fry. It was in those ocean waters that the first living creatures appeared, some 2-3 billion years ago according to the geologist. These primitive forms have long ago disappeared, but some of the offspring are the algae of today.

The ocean was an ideal spot for the beginning of life; temperature, humidity and steady food supply, all reducing the risk to the development of the first organisms. There must have been countless trials before one survived.

A major event was the acquired ability to use the sun's energy. When photosynthesis had evolved, the organisms were freer to move because they carried a power pack with them, which furnished them with an additional source of energy. Once the plant world was established the animals followed, and some time in geologic history both forms of life moved onto the land. Looking at the kelp waving back and forth it looked very much alive, as if it still wanted to come out of the water. Maybe some distant relative will make it even today.

But leaving the sheltered surroundings of the ocean is not without danger. My friends the elkhound and the Newfoundland loved to scrounge around the tide pools for some tasty tidbits and so did the many birds and other island dwellers. However, 400 million years back there were no witnesses to the hesitating settlement on solid ground. The animals came some 20 million years later.

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[1] *This article is an abbreviated version of a lecture Dr. Haagen-Smit delivered in Washington, D.C. last month after being awarded the Hodgkins Medal by the Smithsonian Institution for "contributions to positive knowledge of the physical environment and its influences upon organisms, with special reference to man and his culture."*

The danger was the varying temperature, the wind, lack of water, lack of nutrient. It was a rough world for the adventurous mutant, but those that established themselves adapted further to the changed world and today there are a million successful trials known; ¼ million in the plant world and ½ million in the animal world. Most remarkable are the tricks used to overcome the limitation set by the environment.

SOME OF THE DESCENDENTS of a green algae formed an alliance with some other organism — a fungus — and together they weathered the new situation. The ground of the inner island is covered with this combination — the lichen. The algae lives happily inside the fungus, protected from the fluctuating humidity, while the fungus profits from the photosynthetic ability of the algae which supplies him with nutrient sugars.

This cover of mosses and other lower plants forms a part of the forest floor and every year in the fall a supply of leaves is added. The dead leaves, needles, twigs and fallen branches that lie in heaps upon the forest floor appear at a casual glance to be a lifeless, rotting mass. Actually, they form the roof-top of the hidden world of the forest soil.

This soil-cover shelters more life than can be found in any other stratum of the forest or probably any other environment on earth. The inhabitants exist in numbers that stagger the imagination.

Some years ago, some scientists blocked off a small section of forest soil in N.Y. State and removed the top layer of earth to a depth of one inch. They made a careful count of the insects and other invertebrates found in one square foot of this top layer. In all, there was an average of some 1400 living creatures, including 865 mites, 265 springtails, 22 millipedes, 19 adult beetles, and various numbers of 12 other forms.

Had an estimate also been made of the miscoscopic populations, it might have ranged up to 2 billion bacteria, many millions of fungi, protozoa and algae in a mere teaspoonful of soil. The underground is a scene of considerable turmoil; tremendous engineering works are accomplished. Tunnels are dug — earth is removed. Food is hauled in, waste disposal goes on without a holiday. Were it not for the work of the soil creatures, the forest would soon be choked in its own waste. Essential supplies of substances necessary for plant growth would be locked up in these dead remains and renewal of the forest would cease. The wastes are turned under, plowed and broken down into their constituent chemical parts, mixed with the soil grains that furnish the medium where the roots of the plants find their nutrient.

All the materials returned to the soil undergo a most complex transformation commonly known as decay, or rotting. But there is nothing common about it. It is a most complicated process and still actively studied. It is an exciting study of the world of the cryptozoa or creatures of the dark. Among them are found early trials in the evolution which formed a stable environment in the dark and damp soil. Most of these hate to leave but some do, often at night, such as snails and slugs.

Some animals overcame the limitation of the environment by building protective coverings. Termites build houses 20 and more feet high. They were first-rate air conditioning engineers and saw to it that temperature and the carbondioxide was properly ventilated. They also were gardeners and inside the mound they cultivated fungus gardens to supply the queen with nutrients.

The bed of mulch is rich in nutrient; a seed carried by the wind will find a place to send its roots down and a new form of life is born, maybe a violet, maybe a pine tree.

The adaptation to the surroundings is fascinating. I am rather fond of the family of the Asclepideacea. The African Violet and the bridal flower, Stephanotis. In the same family belong the stapelias, succulents from the African desert, queer but beautiful forms of symmetry. The only drawback is their odor, but they attract blowflies for pollination in a fight for survival in the deserts. Another representation of this family solved its nutritional problems by transforming its leaf in a vase filled with rainwater in which the root can grow. We can say that wherever there was room, some empty niche, some organism found a place to live. This may be a cactus living on the bare volcanic rocks above the Grand Canyon or a mesembryanthemum sprouting from the salt-soaked sand on the beach.

BUT THEN CAME MAN — in great quantities. The density of population increased from 2 per square mile in 6000 B.C. to 6 per square mile in 1 A.D. But in the year 2000 there will be 100 per square mile or about 6 billion people. There are 200 million more every year on our planet. It was the industrial revolution, the use of energy from coal and fossil fuel in general that made this population growth possible.

Every baby born is presented with 1 gallon of gasoline and 2 gallons of fuel oil for every day of its life.

Burning of the fuel would not be bad by itself; its byproducts, soot and sulfur fumes have bothered people for many centuries now. Blackened houses in the industrial and residential areas in England show the signs of the use of coal for heating purposes. London black fogs are well-known and have served as frightening examples of the mismanagement of the atmosphere, but life goes on. Laws are passed but no overnight cure is forthcoming. A professor in Chelsea complained about the damage to his orchids in 1892. He writes: "None but those who have tried to grow plants in or near a great city will have any idea of the difficulties that have to be encountered, and will sufficiently appreciate the steps taken by one of our local societies, the Field Naturalist Society, to combat these difficulties. Any effort to introduce suitable trees into our large cities, anything but beautiful as yet, deserves the support of every enlightened citizen, for not only would they beautify our dismal streets and squares, but they would also tend to purify the atmosphere we are condemned to breathe.

"Nothing could be more depressing than to walk through one of Mr. Veitch's wonderful orchid houses at Chelsea after two or three days of London fog, and to see every bloom withered, and even the buds killed, by the sulphur-laden atmosphere. Nor has the Royal Horticultural Society been behindhand in this matter, and, ever ready to enlist the sympathies of botanists, it enabled Professor Oliver to investigate the nature of the injuries done by the fog, and to suggest some remedial measures for counteracting the disastrous effects until some prohibitive legislation, or some brilliant invention will, let us hope, banish the smoke fiend forever."

This legislation had to wait more than half a century. But even today there is still damage and the sculptures in front of the colleges in Oxford are still getting darker by the day.

OUR COUNTRY IS NOT doing much better. The Cleopatra's Needle behind the Metropolitan Museum in New York has suffered more in the few years that it has been there than in the thousands of years while in Egypt. Los Angeles has become famous for its smog; 1000 square miles of eye irritation, poor visibility, plant damage and other symptoms. Even the astronauts could see our shame. The sources are well-known . . . too many cars, too much industry.

A rigid program is under way to cure this situation. But the all-clear is still a long way off. There are numerous other problems which have to do with the other resources — water and soil. The time of slash and burn, strip mining, gold washing, is over but there are still the scars for everyone to see.

But new problems arose in the demand for more products from our land. Intensive cultivation demanded the use of insecticides, herbicides, and nematocides, but because of careless use of such substances DDT has turned up in the penguins in the south polar regions and I am sure in us too. And a modern version of the children's story sounds like this: "The bird eats the fish that ate the plant that ate the DDT that man made." It has upset the soil, flora and fauna which we have seen is essential for the preparation of the environment of the roots of higher plants. To the chemist DDT is only 2 chlorodiphenyltrichloroethane and he is proud that he has found a more toxic chemical than any before. He probably never asked what happened to the use that is made of his synthesis. Recent experiments have shown that the toxic chemicals destroy part of the underground workers. The recovery is a slow one, taking sometimes a year or more. We must preach intelligent restraint in the use of these chemicals.

The lichens, fit for the most extreme environmental changes, scorching sun or polar cold, were unprepared for the chemical warfare. *Poor plants* — they could not take it and they disappeared from the industrial areas — a sure sign of air pollution and don't forget that we have to breathe this air too!

In England a white moth has been replaced by a mutation which is dark and cannot easily be spotted by enemies in the blackened homes and trees.

WE STILL HAVE a choice, but there are many easy ways out, ways to duck our responsibility:

You can go away, as the soil creatures did

You can mutate as the *white* moth did

or you can buy a smog suit and gas mask.

Or — and I think that this is the right way — you can fight for clean air and join the battle for intelligent land and water use. Support those in government who are willing to pass legislation necessary to protect our natural resources. Support the officials who try to enforce the rules and regulations. They are fighting in the front line and have to take the brunt of the opposition. They need your support. They are there to help you.

But above all, *educate*. Education has a top priority, for only an enlightened public can make the right decisions. This education begins in kindergarten and keeps on for the rest of your life. Those who need an extra push might heed these lines from a song by Tom Lehrer:

"Just go out for a breath of air,

And you will be ready for medicare;

The city streets are really quite a thrill,

If the hoods don't get you, the monoxide will."

Arboretum Plant Introduction

Francis Ching

NAME:

Osteospermum fruticosum —
'Burgundy Mound'

COMMON NAME:

South African Trailing Daisy

CLASSIFICATION:

Evergreen groundcover

FLOWERS:

Burgundy-colored and in great quantity in early spring

EXPOSURE:

Full sun, lightly nipped with heavy frost. Minimum temperature tolerance to 21° F.

INTRODUCED BY:

Los Angeles State and
County Arboretum
301 North Baldwin Avenue,
Arcadia, California

In 1958 the Arboretum introduced *Osteospermum fruticosum* to the local nursery trade. Distinguished by its ground-hugging type of growth and purple flowers, this South African Trailing Daisy has since become one of the most popular groundcovers in southern California.

Seven years ago, in early 1962, variations were noted in the original plants. The flower petals of the variants were pure white on top with a purplish underside, the plant itself exhibited greater vigor than the originals, and it tended toward a more upright type growth. For purposes of identification this variant was named 'Snow White.' Since that time a large planting of it on the south side of the administration building has put on a spectacular display each year from February through April. The white and purple flowering forms are apparently hybrids, however, and according to Dr. Tycho Norlindh, the Swedish botanist who has published a monograph on osteospermum, the typical flower of *Osteospermum fruticosum* is white.

Two years ago another hybrid was selected which horticulturists at the Arboretum feel will prove as popular as its predecessor. Named 'Burgundy Mound,' it is set apart from other osteospermum by two identifying characteristics. One is that the plant spreads with a distinct mounding effect — two year old plants may be two feet in diameter, a figure which increases with age, and may grow to a height of ten inches. The other is that the flowers, which appear in profusion for approximately ten weeks in early spring, have burgundy-colored petals with a lighter shade of striation marks. 'Burgundy Mound' will be made available to the nursery trade starting in August of this year.

The Arboretum gratefully acknowledges the contribution of Dr. Samuel Ayres, Jr. to the Arboretum Plant Introduction Program. Cuttings of the original *Osteospermum fruticosum* were made available by Dr. Ayres in 1953 from the National Botanic Gardens, Kirstenbosch, South Africa.

Lasca Leaves

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STAFF

Know Your Soil

Myron S. Anderson[1]

THERE IS MUCH WE SHOULD know about soils. A volcano belches forth ashes and lava, but this is not soil until it has undergone chemical changes and has been developed by biological processes. Mountains such as Mount Shasta rise far above the timberline where very little life exists. Rock powder, not soil particles, wash down from the top. This serves to emphasize the fact that there is no soil until living organisms contribute to its development.

A handful of productive soil is teeming with life. Billions of bacteria are present: other microorganisms in lesser numbers are there. Insects such as centipedes and beetles escape as soil samples are taken, while sluggish earthworms remain to be recognized. Bodies of many former inhabitants of the soil make an organic contribution to its development. Eggs from many small animals are there to provide future fauna.

In school we learned that soil is a natural resource which has been classified to promote better understanding of its properties and uses. To illustrate classification we have two classes of animals, one class has a backbone, and the other class is without vertebrae. The fungus plants are of a different group than those that produce flowers; the evergreens are different from those whose leaves fall. How about soils? Red soils are grouped differently from black or gray ones and furthermore soils with high clay content differ from the more sandy ones.

Knowledge of soil properties has been accumulating for a long time. Slowly order has been made of the varied scientific information. Pertinent data belong to several sciences such as geology, geography, climatology, botany, bacteriology, chemistry, physics, agronomy and horticulture. The member of this group most closely related to soil science is usually geology. It is sometimes said that a basis of soil classification is about 75 percent geological data. But geological information alone provides an inadequate basis for soil classification. Attempts have been made to classify soils on a geological basis alone but such efforts have ended in failure.

Soil classification in the United States began to take form about the turn of the century. Some 40 years ago a classification system was developed under the leadership of Curtis Marbut and was published by the United States Department of Agriculture. This system soon had a wide acceptance. With certain minor changes it now serves as a basis by which soils may be effectively classified. This fact, together with the extensive soil data accumulated, has led to general acceptance of soil science as a separate branch of the natural sciences and as a newly recognized discipline. The essence of the classification system is shown in the following table:

SOIL CLASSIFICATION
(Developed from Marbut System)

Order
The highest category; Zonal, Intrazonal and Azonal soils.

Pedocal versus Pedalfer
A category based on accumulation of lime carbonate or sesqueoxides in B horizons. (Presently not much used.)

Great Soil Group
A broad group with major profile characteristics in common as Chernozem.

Family
A group of soils with similar profiles.

Soil Series
Soils with essentially identical profiles as Muscatine Series.

Soil Type
Lowest category includes series name and terms describing texture of surface soil, as Diablo silty clay.

Two features of the Marbut classification system are of particular value, the Great Soil Group and the Soil Series. Soil Se-

[1]Dr. Anderson, now retired, worked as a chemist and soil scientist at the U.S. Dept. of Agriculture for 40 years. His long list of publications and journal articles are credited with influencing the direction of soil science research in the 20s.

ries designation was in use well before Marbut began his work for the United States Department of Agriculture but he used it in the more complete classification.

Soil Series names are usually well known in an area. Thus a cotton grower of the southeastern Piedmont knows that the reddish soils called the Cecil Series, are among the most productive ones. The corn-belt farmer of Iowa knows that the Webster silt loam, nearly black in color with a deep surface development, is perhaps the best corn-producing soil in the world. In the Los Angeles area three types are well known: Huerhuero Loam contains no lime carbonate and is a fairly good soil of the area. Forsoacita Loam has a dark surface layer and responds well to cultural practices. Diablo Silty Clay may be difficult to work but has local value.

Soil surveys have been under way in the United States since the early years of the present century. A county is the usual unit area. For the most part, a particular county lies essentially within a great soil group. The great groups are of marked importance in providing certain general information characteristics of the area. These reports are of immense value to one choosing a farm, ranch, or acreage property. Specific information for a soil series tells crops well adapted, fertilizer needs and desirable cultural practices. These reports give prevailing slope, soil texture, color, water supply, fertilizer needs, crop adaptations and sometimes percolation rates and other data of local value.

A county agricultural agent normally has access to soil survey reports and to a great deal of information concerning local soils which he has gathered by conversation with crop growers of the area. It is often possible to arrange for the testing of soil samples through his office. Such test results include acidity status and available plant nutrients present. They are frequently more valuable to a grower of field crops than for a home gardener who is usually less interested in economics than in having a glorious garden.

Learn to know your soil, its series name, its good and its not-so-good qualities and how to treat it for growing different plants. In these days of fine plant production one should learn to use proper fertilizer treatments. In the absence of specific information try the 10-10-10 grade of commercial fertilizer at the rate of a small handful per linear yard of the row. Too much fertilizer will burn the plants. Where your soil is irrigated remember that, from time to time, the excess of water-soluble residue should be washed from the soil profile to be carried off in the drainage water.

For those who may be interested in further soil study a list of great names in soil science and selected references to literature should be helpful.

Important international soil scientists:

Columella	Rome
Dokuchaev	Russia
Laws	England
Whitney	United States
Marbut	United States
Hilgard	United States
Atterberg	Sweden
Hellriegel	Germany

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A Siberian Alder

Ross Goodrich

A*lnus incana Sibirica* was one of the first alders planted in the Arboretum. It was grown from seed in the Arboretum nursery in 1951 and the young trees were set out in the field the following year.

Five of them were planted on a small rise of ground in the northwest corner of the Asian Section. Four of these remain here, one having been moved a few years ago to another area. They have grown well, apparently being one of the alders that like a hillside location in contrast to our native *A. rhombifolia* that does better in damper spots.

The tallest of the remaining four has grown to forty feet with its spire reaching quite a bit above the other three and the neighboring shrubbery. It is narrowly cone shaped as are the others and has a lower branch spread of twenty feet.

The trees are fully leafed out in April with brilliant green foliage. The leaves are more or less orbicular. They have very pronounced veins and edges that are coarsely toothed or doubly serrate which gives them a crinkly look at first glance in the spring. As summer comes on the leaves turn darker green, but the hot weather does not burn their edges as it does many other deciduous trees in this area. No smog damage has been noticed and the leaves stay on the tree until the middle of November.

When the leaves are gone, a good many of the dried seed cones remain on the tree; they are very attractive, decorating the otherwise bare branches throughout the winter.

A second planting of three *A. incana Sibirica* was made in 1958 with plants that were grown from seed in 1956, again in the Arboretum nursery. Two of these survive and have the same characteristics as the older ones but seem to have grown at a slower rate. They are near the first planting but in a slightly lower spot with less drainage which might indicate that they do indeed prefer a well-drained location.

The tree is native to Siberia, but what part of this great area, or all of it, is not known. Perhaps when the world's inhabitants again get on better speaking terms with each other, the extent of its natural distribution will be learned.

In general, alders are not highly regarded as ornamental for landscape planting. Of the thirty-five trees and shrubs that constitute the genus, a considerable number are commercially exploited for their lumber used for furniture and in cabinetmaking, and for their bark used for tanning and dyeing.

BOOKSHELF

LIVING TREES OF THE WORLD,* by Thomas H. Everett; Doubleday & Company, Inc., N.Y. 315 pg. Photographs.

The reproductive process of *Homo sapiens* is biologically impressive and endlessly interesting — which may be understating the case. Attracting somewhat less attention, but hardly less impressive and certainly more varied, are the various processes by which trees reproduce themselves. Trees may be unisexual or bisexual. They may have male and female flowers on the same or separate tree, their ovules and male sperms may have different forms and connect in different ways.

For example, the oldest species of tree extant, the well known *Ginkgo biloba,* is unisexual and dioecious — meaning male and female ginkgos are completely separate — although its sex is hard to tell until it blooms. Fertilization in this tree is accomplished by male cells propelling themselves through films of moisture to the egg cells. The resultant seeds develop into nuts which are covered by a kind of thin, orange-colored skin that has a very offensive odor, a fact Arboretum tour guides rarely fail to mention in the course of their daily rounds. Not so well known is the fact that when the skin is removed, the nuts, washed and roasted, are a favorite food in China.

This is the kind of fascinating information to be found in Thomas H. Everett's **Living Trees of the World.** His book — or one like it, if there is such — can only be regarded as essential for anyone whose interest in trees extends beyond an admiring stare.

The sex life, classification, uses, and esthetic and botanical characteristics of close to two thousand trees are described in straightforward, well-organized prose. In a short introduction Mr. Everett gives a clear explanation of just what kind of plant a tree is and an explanation of the classification system he uses in which the "family trees" of trees are traced by means of divisions, classes, orders, families, genera and species. He begins his discussion of each genus by telling us the number of species it contains — oaks about 450, ficus about 800 — and offers many helpful suggestions to aid the amateur identify trees and distinguish between those of similar appearance, for example, conifers like firs and spruces that belong to the same family — *Pinaceae* — but different genera. Firs, he points out, have upright axillary cones, spruces have pendulous cones, usually at the ends of their branches.

Adding immensely to the value of the book are the numerous color and black-and-white photographs taken by a roster of outstanding lensmen, including at least one familiar to LASCA readers, Ralph Cornell. The book is visually gratifying in other ways. The type is attractive and easily legible, the general layout as orderly as the writing. A brief but useful glossary precedes the index.

FICUS: THE EXOTIC SPECIES,* by Ira J. Condit, University of California, Division of Agricultural Sciences. 363 pg. 1969 Illustrated.

Everything the reader would want to know about this book short of reading it may be found in the preface by the author and in the foreword by Dr. William S. Stewart, director of the County of Los Angeles Department of Arboreta and Botanic Gardens.

Dr. Condit, whose current title is Professor Emeritus, Department of Horticultural Science, Citrus Research Center and Agricultural Experiment Station, University of California, Riverside, became interested in the Common Fig, *Ficus carica,* a half century ago and devoted a great many of the intervening years to the study of this fruit. His book represents the culmination of this study and is described by Dr. Stewart as " . . . a rare synthesis of his (Dr. Condit's) broad and varied knowledge . . . it is the only modern book to deal exclusively with this subject. The work admirably fulfills its objective of presenting, under one cover, the greater part of the information thus far gained on both truly exotic and cultivated species of the genus."

South Australian NATIONAL PARKS AND WILD LIFE RESERVES,* published by the Commissioners of the National Park and Wild Life Reserves, Adelaide, Australia. Photographs and drawings.

At first glance one might be put off a bit by the grab-bag layout of this paperback handbook first published in 1936. Closer inspection reveals it to be a rather engrossing guide to the flora and fauna of South Australia, deadened on the one hand by tiresome parochial detail, enlivened on the other by such expressions as "people being catered for" where we say "catered to," "to boil the billy" and other interesting locutions common to the area.

The 110 species of orchids, the various

eucalypts and other flora of the Mount Lofty Ranges are likely to be of particular interest to southern California naturalists who share a Mediterranean climate with their counterparts in the hills around Adelaide. The list of plants, native and otherwise, growing in Belair National Park includes, as might be expected, many growing here at the Arboretum.

A good half of the handbook is given over to the description of the mammals, reptiles, fish, birds and insects of the area. One-inch-long Bull Dog and Jumping ants can make life miserable for picnickers who at the same time must be on the watch for a variety of interesting, sometimes venomous snakes and pre-historic-looking lizards. Color and black-and-white photographs, drawings and graphs contribute to the interest and factual detail of the book.

DD

Books on California Missions

Father Junipero Serra founded the first mission in California two hundred years ago on July 16, 1769. In the two centuries since the simple *emramadas* — brush huts thatched with tules — were built by the Indians, there have been many changes made in all of the 21 missions in California. Most of the existing ones were built after the earthquake of 1812 and long after the death of Father Serra.

There are many excellent books on the missions. **The Time of the Bells** is a colorful and exciting story of their founding, development and death. It is one of the series commissioned by the Copley Press by Richard F. Pourade. The maps and colored drawings are excellent.

Edith Buckland Webb has written a classic in **Indian Life at the Old Mission.*** It is well researched, written, and footnoted. The photographs are outstanding. A children's book that also tells about life at the missions is the one by Helen Bauer — **California Mission Days.***

The finest book of mission painting is **A Gallery of California Mission Paintings** by Edwin Deakin, edited by Ruth I. Mahood and published by the Los Angeles County Museum of Natural History. Edwin Deakin painted the missions in the 1870's when they were in the greatest state of disrepair. A companion book is **Architecture of the California Missions*** by Kurt Baer. This is a highly technical book on the missions, their ruin and restoration. There are many fine illustrations in black and white. This is the kind of book to read after one has visited the missions in California as well as the churches in Mexico.

Sunset Books has published **The California Missions: A Pictorial History** which combines the best of all of the books on the missions. There are many illustrations and photographs both in color and black and white. It also contains a "Visitor's Guide to the Missions," "Chronology of California Mission History," "Mission Recipes," and an excellent bibliography. If you are traveling in California this year, this is the kind of book you will want to have with you.

Patricia A. Warren

*Available in the Lasca Library.

CALENDAR 1969

June - September

FLOWER SHOWS

Arboretum **Arcadia**

June 27, 28, 29
Gladiolus Show

July 4, 5, 6
Cactus and Succulent
Society of America

July 12, 13
American Begonia Show,
San Gabriel Branch

September 6, 7
American Begonia Society
National Flower Show

Descanso Gardens

June 21 through August 10

Festival of Gardens, Lights
and Fountains
8 a.m. to 10 p.m. daily

South Coast Botanic Garden

July 18, 19, 20

Fiesta de las Flores
Hours: Friday 1 - 7 p.m.
Saturday and Sunday,
10 - 6 p.m.

Speaking for the Foundation

FOR OVER TWENTY YEARS, almost as long as I have lived in Arcadia, I have been a visitor to the Arboretum. This goes back close to the conception and founding of the Foundation and Arboretum. That was in 1947, when the Los Angeles County Board of Supervisors and the Arboretum Committee of the Southern California Horticultural Institute inspected a possible site. My wife reminds me of how we would take strolls through the area via the Old Ranch Road entrance. We were really out in the country then; visitation to the Arboretum was strictly informal.

The years have passed quickly. Now, after all this time as a casual visitor, Foundation member, and member of committees, I find I am still learning to know the Arboretum and its activities.

An Arboretum differs from a park in that while it, too, is a park, it engages in education and research. Our Foundation, because it is the service organization of the Arboretum, is more deeply involved in many Arboretum activities than most Foundation officers and members realize.

Visiting the Arboretum and knowing it are two quite different things. The latter can be a fascinating and long-time avocation. Because a knowledgeable Foundation membership is sure to be a growing and enthusiastic group, I urge that all Foundation members assign to themselves the responsibility of being well informed on the Arboretum Foundation, its organization, history and functions. Our brochure is the prime source of basic information, with other literature available from the Foundation office.

For some years the sole purpose of the Foundation was to create and organize the Arboretum. After that genesis, it became the service organization for the Arboretum. And that is what it is today. Its lifeblood, its entire reason for existence, is service to the Arboretum. I do not think we shall ever lack for projects. There are so many things yet to be done. Of prime importance in my mind and in the minds of tens of thousands of horticulturally interested persons throughout Southern California, is the need for a flower show building. Properly, this will be known as the Horticultural Hall and Education Center. The color brochure, to tell the story of the need, the where, why and how it can be done, is being printed. Soon you, your friends and acquaintances will be given a copy of this brochure, and, indeed, asked to help in whatever way you feel best on the project. With a nice display hall and educational center, of which we can be proud, the many flower shows, which are at present held in the basement of the library building, and even in tents, can be staged in a beautiful flower show building.

There is much I wish to speak of in following issues of Lasca Leaves. As a volunteer member of a volunteer organization, it is easier for me to voice a personal opinion. Foremost in my mind, as far as personal opinions are concerned, is that the Arboretum is very definitely the center of horticultural activity and interest in Southern California. Nothing like it exists anywhere in this area. Secondly, it is one of the world's great botanical gardens. Twenty years is a fledgling, as far as the botanical gardens are concerned; however, we have come a long way. The relative youth of our organization should be the mainspring which drives us to achieve the splendid goals which we must set for ourselves. With your help, this can be a certainty.

Ernest Hetherington

President

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone 447-8207

MEMBERSHIPS

Annual Membership	10.00
Annual Contributing Membership	25.00
Annual Business Membership	100.00
Annual Sustaining Membership	100.00
Annual Sponsor Membership	250.00
Life Membership	500.00
Founders	1,000.00
Benefactors	5,000.00 or more

Club memberships are available at any amount, from $10.00 a year or more
All contributions deductible under Federal Income Tax Law

ADDRESS
Box 688—Arcadia—California—91006

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December
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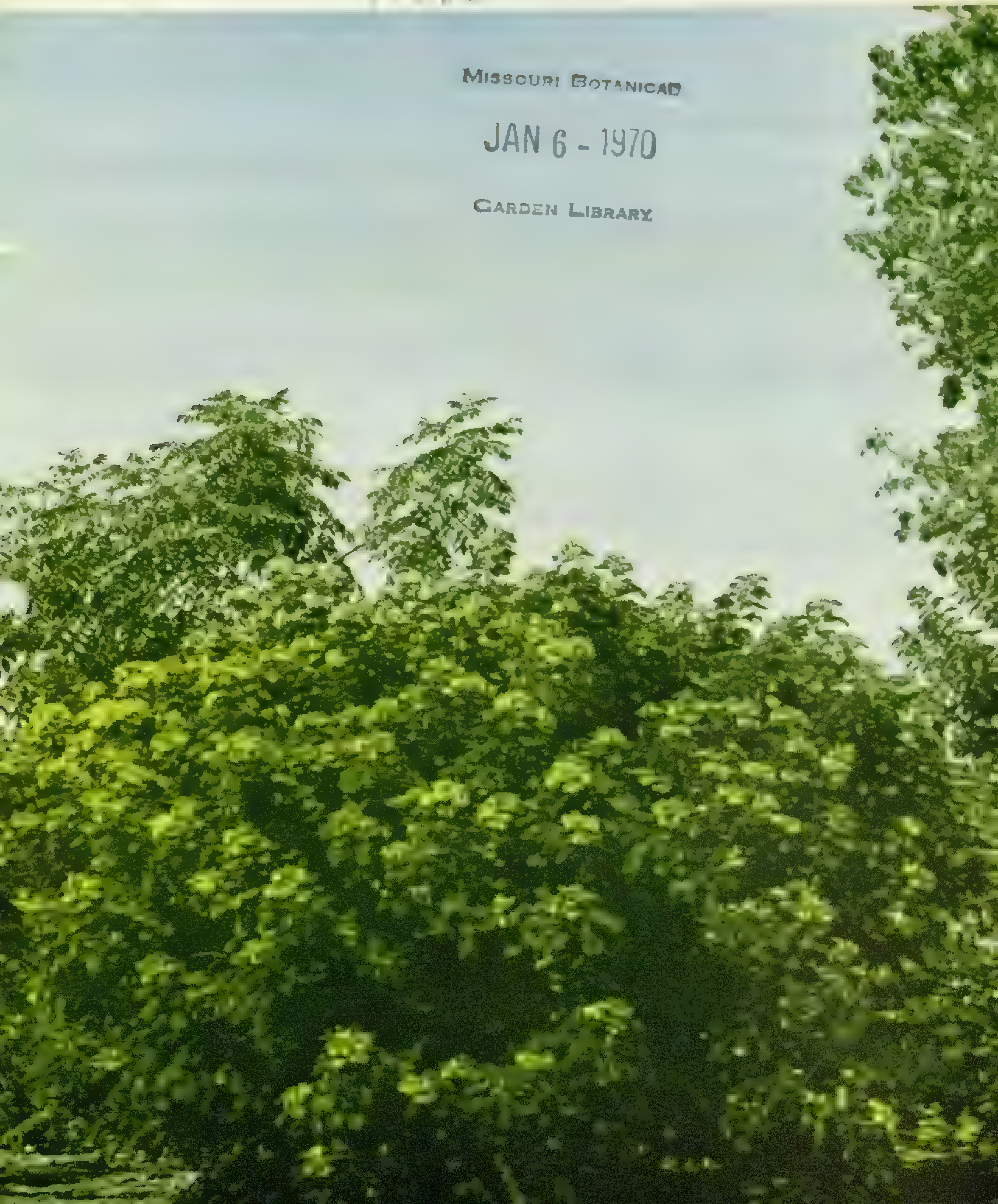
No. 3 & 4

Lasca Leaves



September-December 1969
Vol. XIX
No. 3 & 4

Lasca Leaves

Quarterly publication of the California Arboretum Foundation, Inc.

The Cover

Cassia surattensis var. *suffruticosa*. Evergreen shrub, native to Brazil. Introduced by Arboretum in August, 1963.

the Editor's Page

THE RESPONSE of Foundation members to last August's questionnaire concerning Lasca Leaves was gratifying on several counts. To begin with, the fact that nearly 50% of the membership took time in the middle of summer to fill out a two-page questionnaire is alone enough to make us very grateful. That their replies were returned so promptly was a reassuring indication of a sincere interest in the magazine. As was expected, there was criticism, implied and direct, but the overall results can be interpreted as a general vote of confidence in our editorial and publishing policies. The views expressed were of great help to the publications committee and to me in deciding what direction to take.

To recap some of the tabulations: The first question (Do you read every issue, some issues, none?) elicited the greatest number (81%) of responses. In order, the answers were 210, 69, and 3 who apparently never read us at all. The response on the critical question of having color in each issue was closely divided — 55% to 45% in favor of color. But 94% would still read the magazine even if it were all black and white, a response the committee welcomed in view of the high cost of color reproduction. Only 60% indicated a willingness to help defray publishing costs with higher dues or the payment of an additional five dollars a year, a margin suggesting the need for further exploration in this area.

The problem remains of making Lasca Leaves financially feasible. A possible solution involves broadening our editorial content. I hope this can be reflected in our next issue.

Arboretum notes

The Search

THE POWER of the press and the inherent goodness of people were demonstrated again this past September, October and November, when upwards of 3,000 samples of leaves poured in to the Arboretum in response to a news story that originated at the Arboretum and had reverberations as far away as Manila.

The samples arrived in an assortment of envelopes and cardboard containers, usually with some brief note enclosed, like "Hope this is what you're looking for!" Unfortunately, all but two of the samples were not what we were looking for; they were, in fact, mostly avocado leaves, making it clear that however familiar the fruit may be, its leaves are largely anonymous.

As is pretty well known by now, we were looking for samples that could be identified as coming from *Camptotheca acuminata,* the rare tree that is the source of a highly promising anti-cancer drug.

Our news story was prompted by the National Cancer Institute's need to find mature specimens thought to be growing in this area. The Los Angeles Times, which ran several stories on the search, was surprised and delighted at its readers' response, and its science editor, Dr. Irving Bengelsdorf, conscientiously passed on to us tree samples and letters reaching his desk. Inevitably, there were sad letters from people seeking help for relatives suffering from cancer. These we either answered as best we could, or passed on to authorities at the Cancer Chemotherapy National Service Center in Bethesda.

As for the two samples that *were* what we were looking for, one came from an outstanding, three-trunked specimen growing in the backyard of the West Los Angeles home of actor Eduard Franz, who, with Mrs. Franz, made a sure identification of their tree from pictures in the paper. The other camptotheca is growing practically in our backyard. It was located at the Arcadia home of Mrs. James Curry by a keen-eyed professional tree-trimmer, Wayne Ferguson.

The story, of course, is not over. Tests continue at the CCNSC. Meanwhile, some horticultural and other gaps are filled in by Robert Smith's article in this issue, which we very much appreciate his writing for us.

Las Voluntarias

HARDLY ANY public museum, hospital, or zoo operates these days without a corps of volunteers to fill in the gaps resulting from chronic budgetary limitations. The Arboretum is no different and, typically, many of the services it provides are made possible by its own corps of dedicated women known as Las Voluntarias. A recent campaign to recruit and train new volunteers as instructors in the school field trip program has been highly successful. Mrs. Alice Douglas, Las Voluntarias president, thought our readers would be interested in how the training sessions developed. We agreed, and this is what she wrote: "With the completion of the fourth training course for volunteer school tour guides at the Arboretum, the dynamic growth in the quality of the training and the number of trainees participating is so exciting that we want to share our experience with all readers of *Lasca Leaves* and hope it may eventually become a model for volunteer participation in arboretums and botanic gardens throughout the country.

"The first training program for Las Voluntarias was attended sporadically by a charter group formed to aid the preservation of the historical section of the Arboretum. There were four meetings and some recommended reading. Three of the group chose to guide children on school tours through the area. The other members chose to catalog the possessions of the historical area and to beautify the Queen Anne Cottage and the Hugo Reid Adobe with dusting, mending, and arranging fresh flowers.

"Our latest training program, which ended December 1, was the best organized, most comprehensive, and most demanding of time and mind, which probably accounts for its success. The course began with 15 hours of orientation designed to give a general understanding of the department, its facilities and functions. Of the 45 volunteers who completed the orientation, 31 elected to continue and complete the intensive training sessions that would equip them to serve as school field trip instructors in nature and conservation, plant science, and early California history. These sessions consisted of eight three-hour periods in the classroom and the field. The number of volunteers choosing this particular area of service speaks well, I think, for the training and the instructors, and also for the volunteers.

"The opportunity to offer volunteer guides a course specially structured to meet their needs came about after the Arboretum Youth Education Section received a financial windfall in the form of a gift from a local garden club to be used for education. Mrs. Gertrude Woods, Arboretum education specialist, seized the chance to set up this unusual extension to the training program which had been offered by Las Voluntarias every fall since January 1967. Benedict Strasser, consultant in science education from the office of the Los Angeles County Superintendent of Schools; Joanne Woods, consultant in the University of Southern California Teacher Training Department; Seymour Sitkoff, science supervisor, and Douglas MacDonald, elementary supervisor of social studies, from the Los Angeles City Board of Education; Deloy Stromme, science specialist, East Elementary District Office of the Los Angeles City Schools; and Dr. Elizabeth Hone, co-author of 'Concepts in Science,' a textbook used throughout the state, were invited by Mrs. Woods to structure a workshop ac-

Meeting first with the education specialists in the classroom, volunteer guides learned teaching techniques that were later demonstrated in the field.

cording to the priority needs expressed by the trainees themselves. (To the delight of all, the group unanimously agreed to contribute their time to the project.)

"What resulted was a kind of inductive learning situation based on the most advanced methods of teaching presented by the educators Mrs. Woods had invited. This same kind of learning situation and the same teaching methods will now be passed on to the children by the volunteers in their new roles as field instructors.

"Each volunteer completing the program has agreed to give one school field trip a week during the school year. And, wherever possible, each class will be divided between two volunteers in an effort to give each child more individual attention. The net result will be to close the gap between the number of requests by the schools of Los Angeles County and the number of field trips given, which, in the past year, accommodated nearly 22,000 children from 75 school districts. So it is with great pride

One of the finest rewards of the program was taking field trips "solo" with eager, inquisitive children.

On their first field trips, volunteers divided into teams, each taking half a class.

that we now look forward to a partial fulfillment of this need. From this time on the volunteers at the Arboretum will offer field trips for school children in Nature and Conservation, Plant Science, and History. We are very proud of this fact. Is there another arboretum or botanic garden with so many volunteers involved in such a program?

"Credit for contributing to the training and structuring of the workshop must also go to three members of the Arboretum tour guide staff belonging to the Public Information Division: Robert Copper, David Van Ausdal, and Robert Erny; also to two members of Las Voluntarias, Margaret Griffith-Jones, first vice president in charge of membership, and Helen Thompson, tour guide chairman. The 15 hours of orientation were all arranged by Dr. Duane Crummett and Mrs. Griffith-Jones, and many of the staff members of the Arboretum gave their time, knowledge, humor, and good will to start the ladies on their way toward a volunteer career which will enrich the lives of all the children in the surrounding school districts."

What A Gardener Should Know About Soil Acidity

By Myron S. Anderson[1]

SOIL ACIDITY is developed mostly by the action of water on soil-forming minerals of silicate forms such as feldspars, micas and others. Bases, particularly calcium, magnesium and sodium are replaced by the hydrogen of water. The process is hastened by the decomposition of organic matter that grows on and near the soil surface.

Acid soils are developed only where the rainfall is relatively high, perhaps at least 25 inches annually. This means that acid soils may be formed from the Atlantic coast to the eastern part of Nebraska. Then again there are areas near the Pacific Coast where rainfall is adequate for acid soil formation.

Soil acidity and the need of lime application are closely related terms. Soil acidity is often designated by the term pH to indicate the degree of acidity or alkalinity that may prevail when the soil is mixed with water. The values normally found in soil range from about a pH of 4.0 in very acid soil to about 8.5 in soils with a considerable content of lime carbonate. Neutrality is pH 7.0. One should keep in mind that the pH values become smaller as the acid becomes stronger.

The following table shows the interpretations often given to soil pH readings.

Soil pH	Degree of Acidity or Alkalinity
8.5	Strongly calcareous (Alkalinity)
7.5	Moderately alkaline
7.0	Neutral
6.5	Very slightly acid
6.0	Slightly acid
5.0	Strongly acid
4.0	Very strongly acid

[1] Dr. Anderson is a retired soil scientist with 40 years' experience, much of it with the U.S. Dept. of Agriculture, as researcher and author.

Much of the apparent acidic value is derived from surface action of clay and organic matter. It does not change greatly by moderate dilution with water. Many farmers know something of what pH means with respect to need for lime additions. It is very important also that the gardener know the practical importance of the term.

The gardener's knowledge of pH aids him in the selection of plants that grow well at the acidity present in his particular garden plot. The following table indicates a few plants that grow well at each of the pH values indicated:

Very acid (4.5-5.0): azaleas, rhododendrons, potatoes, cranberries, watermelons.

Moderately acid (5.0-5.5): buckwheat, corn, grapes, cucumbers, strawberries.

Nearly neutral (6.5-7.0): cabbage, eggplants, red clover, turnips, muskmelons.

Slightly alkaline, calcareous (7.0-8.0): alfalfa, asparagus, beet, celery, parsnip.

Major adjustments of pH are possible but not always practical, but small changes may be both practical and beneficial for the gardener. It sometimes happens that a lawn or garden on an adjoining lot at a higher level may be heavily limed. The surface drainage to the lower level lot may interfere with the growing of azaleas or other acid-loving plants. The situation may be corrected, however, if the gardener treats the lower lot with powdered sulfur applied at the rate of about one ounce per square foot of soil mixed to a depth of 3 or 4 inches. Bacterial action quickly oxidizes the sulfur to form sulfuric acid, a situation favorable for plants requiring an acid soil. A similar situation sometimes arises in the vicinity of a new building. Waste lime or cement, frequently discarded, serves to make the soil too alkaline for suitable growth of certain plants.

Plants needing a near-neutral soil will grow well with moderate applications of limestone. Such soils, however, frequently tend to revert rather rapidly toward a more acid condition than when freshly limed.

Far reaching changes often take place when very acid soils are limed. Results are more pronounced when hydrated lime is used than when ground limestone is the material added. High acidity (low pH) brings into the soil water relatively high concentrations of iron and aluminum. Soluble aluminum compounds are frequently toxic to plants. Limestone applications tend to lower the content of soluble aluminum.

Solubility of phosphates tends to be highest near neutrality and therefore most usable for plants. When lime is added there is a danger that certain of the minor elements may be changed to a form plants can not use. Some of these necessary minerals are copper, zinc and manganese. The danger may appear when the pH of the soil is near neutrality but increases as alkalinity becomes pronounced. As a rule ground limestone for soil application would contain from 5 to 10 percent of magnesium carbonate.

A gardener takes pride in the excellence of the plants he grows. He does best when he has a proper relationship between soil acidity and the requirements of his particular plants. This is a short story of soil acidity, the selection of suitable plants for the soil available and the making of soil pH adjustments when it is desirable to do so.

PALM TREE BEFORE THE MIST

So many days I've looked across the canyon
Upon a haze-blue slope where blurry trees
Melt softly into bush-rounds in a tapestry
Of hidden individualities.

One stormy day a mist hung on the valley
Gold-glinted from the west where skies were calm.
And at the canyon, dark out of the mist
Appeared in sudden silhouette, a palm
Of perfect symmetry. I'd never seen
This tree before, commanding as a queen.

I've looked since for the palm. Yes, it is there,
But gray and insignificant once more.
Why should rare circumstance, alone, reveal
So many treasures at our very door?

Lydia Bowen

CAMPTOTHECA ACUMINATA

Biography of Camptothecin, a promising cancer drug

By Robert L. Smith[1]

ENCOURAGED BY THE effectiveness of certain plant extracts in the treatment of cancer, medical scientists are now screening about 5,000 foreign and domestic plants per year for compounds showing anti-cancer activity.

During the first, or screening phase of these investigations, all types of trees, shrubs, herbaceous perennials, and annuals are tested regardless of source or abundance. The investigators have only one concern, and that is — how the plant extract affects tumor systems implanted in laboratory animals.

Plant availability becomes a critical problem, however, if (as sometimes happens) a rare species turns out to be one of the 2% that shows promise and reaches the second phase of the investigation. At this stage, a minimum of 25 pounds of dry plant material is needed for additional animal tests, and to isolate and identify the active agent. For example, in 1961, when extracts of *Camptotheca acuminata* Decne (a comparatively rare deciduous tree from Asia) showed anti-leukemia activity, there were only a few known trees in the United States. Two of these, from which the original preliminary screening samples were taken, were grown from seed introduced from China in 1934 by the U.S. Department of Agriculture, and are located at the Plant Introduction Station, Chico, California.

Since large branches had already been harvested from the Chico specimens, it was not possible to take additional samples without sacrificing the seed crop (urgently needed for additional plantings), and perhaps even risking the life

Technician Henry Allinger examines foliage of thirty-year-old specimen of Camptotheca acuminata being grown at the U.S. Plant Introduction Station, Chico, California.

[1] Research Horticulturist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Plant Introduction Station, Chico, California.

of the trees. Although specimen trees in the forests of China are reported to be 4 feet in diameter and 80 feet in height, wood from this source could not be obtained.

The problem: To find new and sufficient sources of *Camptotheca* to meet research needs until seedling trees could be produced at Chico.

SINCE THERE WAS evidence that seed had also been introduced by nurserymen in the early 1930's, Dr. Robert E. Perdue, Jr., botanist with the U.S. Department of Agriculture in charge of plant procurement for cancer research, immediately started a west coast search for specimens of *Camptotheca.*

Through his efforts, 17 trees were located in California, in addition to the two specimens at the Los Angeles State and County Arboretum. Arrangements were made and most of the trees, including one of the Arboretum specimens, were harvested for the cancer program. In some cases the donor wanted the tree replaced by a young seedling. These were supplied by the Chico Station at a later date as they became available.

With this backlog of raw material, the animal tests continued without interruption. Also, Dr. M. E. Wall, at the Research Triangle Institute, Durham, North Carolina, was able to isolate and identify the active agent, an alkaloid which has been named camptothecin.

Although chemists began to experiment on producing camptothecin synthetically, there was no assurance that they would succeed.

To be more certain of having a future supply of plant material, seed germination trials were begun at Chico. If the seed proved viable it would not only insure a supply of plant material, but would also provide opportunity to investigate the cultural requirements of this species. The seed was subjected to a variety of

Nine-month-old seedling showing serrate leaf margins typical of young plants.

pre-germination treatments. Fresh fruit containing the seed was stratified in moist sand at 40°F for various time periods, then planted. In addition, it was dried before planting and planted fresh. These same treatments were also used on seed extracted from the fruit.

Germination of 70% or better was obtained when the seed was either removed from the fruit or left in fruit that had been dried before planting. Not having to extract the seed greatly speeded up the planting process. Using the germination test results as guidelines, 1,000 seeds were planted in the spring of 1965 and about 5,000 each spring thereafter through 1969.

ONCE THE SUPPLY of *Camptotheca* seedlings was established, time was devoted to cultural investigations. One of the first studies was to determine if individual trees could be propagated by cuttings or by budding. In preliminary tests both methods proved successful. With "T" budding, the best results were obtained in September when the scionwood was more mature.

Leafy cuttings, on the other hand, were collected at different times during the growing season and set in a 50/50 mixture of sand and peat. Intermittent mist was used to keep the cuttings from drying. Rooting hormones were applied to the base of each cutting and bottom heat was maintained at 70°F. Cuttings taken in May and June gave the most satisfactory rooting and produced healthy, vigorous stock.

Camptotheca flowers are visited by honey bees and wasps as well as the Swallowtail butterfly shown. The female flower is in the upper portion of the picture and the males below.

These data will be of value at a later date when individual seedling selections are made for disease resistance, vigor, or high camptothecin content. Such individual trees can be rapidly propagated by use of techniques described above.

Another area of investigation was based on the fact that camptothecin is a nitrogen-bearing compound. As such, it would be of interest to know how different application rates of nitrogen fertilizer affect the growth rate of the tree and its camptothecin content.

Ammonium sulfate was applied to a group of 3-year-old seedlings at the rate of 500 pounds per acre. A second group received 1,000 pounds per acre, and a third, the control group, was left unfertilized.

Trunk diameters and tree heights were measured at the time of fertilizer application, and again 18 months later when the trees were harvested for analysis. Only a slight increase in average trunk diameter over the control was recorded for the 500 lb/A group. Trees that received 1,000 lb/A, however, had an average trunk diameter increase of about 1/2 inch greater than the control. Although *Camptotheca* proved highly re-

Camptotheca fruit as it appears on the tree in early October. Fruit changes from green-to-straw color as it matures in mid-November.

sponsive to nitrogen fertilizer at the higher application rate, attempts to correlate growth rate and camptothecin content were inconclusive. Additional experiments of a more precise nature are being planned, to determine the relationship between these two factors.

Flowering *Camptotheca* is reported to be polygamous. Apparently each raceme terminates in a female flower and is subtended by several male flowers.

IN A PRELIMINARY STUDY, lateral flowers were removed from a number of immature racemes, and the terminal flower was enclosed in a paper bag fastened to the stem. No fruit developed in these bags; however, in the control group, where the complete raceme was enclosed, fruit developed normally from the terminal flower.

If, in addition to the pistillate and staminate flowers in each raceme, there were also blooms that have both sexes, they were undetected in the experimental group.

The flowers are visited by honeybees, butterflies, and wasps that may be effecting pollination. On the other hand, fruit developed under bags that excluded these larger insects. Additional studies will be needed to determine the exact pollination mechanism.

After the fruit is set, it develops rapidly and is usually ready for harvest by late November.

After harvest the fruit is dried and planted in nursery flats. A sterilized germination medium, containing one-third each of peat, sand, and loam, has given good results. Germination takes place in the greenhouse in about 2 weeks. When the seedlings reach 2 inches in height they are transplanted to 3-inch peat pots. By April they are about 14 inches tall, and are planted either to the field or into nursery beds, under lath. The latter method has been used mostly at Chico. One growing season under lath produces a tree about 3 feet in height. It is transplanted to the field the following February, when dormant.

In field plantings, trees are set about 2 feet apart. With regular summer irriga-

Chipper reduces tree bulk and makes drying easier. Also, disintegrates dry leaves that would interfere with the extraction process.

tion and applications of fertilizer, the seedlings reach from 10 to 12 feet in 3 years. By then they are old enough to harvest and process for extraction.

The first step in harvesting is to cut the seedlings off slightly above ground level. Usually every other row is cut, to thin the planting and allow the remaining trees more room for growth. Cut trees are removed from the nursery and spread out on the ground, one layer deep, to dry the leaves. The leaves have only a small quantity of camptothecin, compared to the stem, branches, and roots, and they interfere with the extraction process.

ONE WEEK IN THE Chico sun at an average high temperature of 100°F dries the leaves sufficiently for them to shake or fall off when the tree is run through the chipper, the next step in the process. After chipping, the material is spread out on polyethylene tarps in a 2-inch layer to finish drying. If it is not perfectly dry, mold could develop in bulk shipments or storage and spoil the sample. Dry material is sacked-off in wool bags in preparation for shipment.

After the tree tops are processed, the roots are harvested with a hydraulically operated knife attached to a tractor. The knife undercuts to a depth of 18 inches, and partially lifts the root system for removal by hand. Before they go through the chipper, the roots are washed and carefully examined, to make certain that there are no clinging rocks or dirt that could damage the chipper blade.

The *Camptotheca* tree donated by the Arboretum was chipped and dried in a similar manner.

Five thousand pounds (dry weight) of *Camptotheca* wood was harvested this summer and sent to the Monsanto Research Corporation, Dayton, Ohio, for chemical extraction.

After extraction, the camptothecin is concentrated and purified for use in clinical trials. Although thus far the drug has only been administered to a few advanced cancer patients, doctors are encouraged by objective responses in several cases. They are optimistic about the effectiveness of this drug, and they will (for the first time) have sufficient camptothecin for more detailed and comprehensive tests and experiments.

Chipped and dried Camptotheca wood being sacked-off and made ready for shipment to the Monsanto Research Laboratory at Dayton, Ohio, for extraction.

The results of these tests may determine the future of *Camptotheca* as a potential crop. In the meantime, attempts are being made to locate additional trees which may prove of special value as seed sources, or which may represent strains that have higher camptothecin content than those at Chico.

IF CHEMISTS are unable to produce camptothecin synthetically, the next step will be to select seedling trees known (through analysis) to be high in this alkaloid. These will be used in a breeding program to develop strains that have, if possible, an even higher camptothecin content.

The preliminary data and observations at Chico on the production of these trees may prove useful if large amounts of the drug are needed, and if *Camptotheca* becomes a new crop in the arsenal of weapons in the war against cancer.

Ground Covers: Their Uses and Limitations

Francis T. Ching

Introduction

Ground covers are essentially low-growing plants that may be used as a lawn substitute or as a lawn complement. A wide variety of plants fall into this category, but mainly they are vines, perennials, annuals, succulents, and low-growing shrubs. These plants are effective in varying degrees in minimizing certain environmental problems. For this reason, and also because they offer so many choices to home gardeners and landscape architects, they have become increasingly popular in recent years.

Lawn Substitute

ONE OF THE first uses for ground covers on a large scale was to provide an easy way out of mowing a lawn. Ground covers such as Algerian ivy (*Hedera canariensis*), hottentot-fig (*Carpobrotus edulis*), coyote brush (*Baccharis pilularis*), ivy geranium (*Pelargonium peltatum*) are easy to plant and grow rapidly. Besides serving as a lawn substitute, they can also be used to eliminate dusty, weedy and unkept areas where minimum maintenance is desired.

Low maintenance, however, should not be considered a general characteristic of ground covers. Just as they differ in size, shape, and color so they can vary in all degrees of difficulty in establishing and maintaining. As an example, dichondra is often used in place of a grass for a lawn but it is comparatively harder to establish and maintain because of its susceptibility to various types of weeds, insects and diseases that, singly, can constitute a problem and, collectively, can result in a catastrophe.

Color and Landscaping

YEAR AROUND COVER for extensive ground areas is an asset under most conditions. A bonus is added when that cover can offer colorful flowers for a few weeks to several months duration. These colorful ground covers have provided the landscape architect some valuable materials to work with along with trees, shrubs, and lawns.

At the Arboretum, extensive plantings of trailing South African daisy (*Osteospermum fruticosum*) and Cape weed (*Arctotheca calendula*) offer bright colors during late winter and spring months. Verbena, gazanias and ice plants offer spectacular colors during the spring and summer months. When not in flower, all of these plants offer a green to grey cover of foliage for the remainder of the year.

During the early spring months, a display of California native plants for ground cover uses may be seen at Rancho Santa Ana in Claremont. Large plantings of coral bells (*Heuchera sanguinea*), manzanitas (*Arctostaphylos*) and California lilac (*Ceanothus*) offer a colorful display and a cover of drought-tolerant green plants for the rest of the year.

In many inland valley areas, and to a greater degree in coastal areas, large plantings of ivy geranium and bougainvillea thrive almost throughout the year.

Erosion and Fire Prevention

ANOTHER IMPORTANT interest in ground covers stems from their potential as a fire retardant and as a possible tool in erosion control. Fire and erosion control are interrelated.

Sedum rubrotinctum can serve as an easy-to-maintain lawn substitute or lawn border. Among other virtues: it is colorful throughout the year and controls erosion when used as a cover on moderate grades. Used in a mountain-side area it provides minimum fuel for fire.

In past years new shrub growth in mountainous areas has been desirable for slope protection and for esthetic values. Fire, however, has been able to sweep through these highly flammable areas very quickly threatening nearby homes. Fire-fighting equipment and personnel in any number are almost useless under these conditions.

Whenever a fire occurs in the heavily populated foothills and in mountainous areas, one of the first follow-up activities is to seed the area with fast-germinating and fast-growing grasses. This action is often a gamble as adequate rains are necessary for the seeds to germinate. Too much rain will wash the seeds away and can also cause erosion. Too little rain will not allow proper germination, or the seeds may germinate and then die due to lack of moisture. This gamble and its risks was graphically demonstrated by the Glendora fire in late 1968. In early 1969, in spite of intensive seeding of grass, sudden and heavy rain caused widespread flooding and mud slides.

A forest fire is dependent upon such conditions as wind, soil moisture, humidity and, most important, the type and amount of plant fuel available. It has been estimated that 40 acres of burning chaparral is equal to the energy of the atomic bomb dropped on Hiroshima. Since this native type cover grows so densely and is so highly flammable, clearing and replacement is necessary.

Fire and Erosion Retardants — Ground Covers

WITHOUT A DOUBT, ground covers, when properly selected, planted and maintained, will go a long way toward minimizing the hazards of fire and erosion.

Selection of the right plant for the prevailing conditions is the first consideration. Where erosion is a threat, selection of a ground cover that will quickly establish itself is most important. Where fire is the predominant hazard, the most suitable plant is one that is low growing, succulent, has a high moisture content and contains a minimum of woody material.

Where mixed types of plants are used, moisture requirements must be similar so that watering needs for all plants are the same.

A sprinkler system is an absolute necessity for large slopes in high fire areas. Plants on slopes must be watered slowly so that the moisture will penetrate into the soil and not just run off the surface. The sprinkler system, if automatic, should be set so that the sprinklers are off and on for periods of time. In this way moisture can soak into the ground to a desirable depth.

Until the planted ground cover has taken hold, weeds can be a problem. Fumigation is one of the best means of getting rid of weed seeds although this can be very expensive when large areas are involved. A rather simple but efficient way to control weeds is to water the area to be planted thoroughly to encourage weed growth. After the weed seeds have germinated and are growing, a contact spray will easily eradicate them. Selective pre-emergence and post-emergence herbicides are other methods of controlling weeds — directions must be carefully followed when these chemicals are used.

Control of woody plant material, especially chaparral, is a problem of an entirely different nature. Established plants can be cut back or sprayed with a contact spray but this is only a temporary control as the plant will usually produce new shoots from the stems, trunks or roots. Chaparral will resprout even following a severe forest fire. New plant growth or the trunks or stems of the plants should be cut and the newly cut surfaces painted with a combination of 2, 4-D and 3, 4, 5-T. Treatment should be repeated as necessary. Spraying with these chemicals should be done only by experienced people as these chemicals are active against all plants.

AS A RESULT of many years of study and planting, the Arboretum today has developed one of the largest displays of ground covers anywhere, and at the same time a considerable store of information.

In 1956 the Arboretum produced its first plant introduction, *Felicia amelloides* 'Santa Anita,' a ground cover. The most recent, some 30 plant introductions later, is *Osteospermum fruticosum* 'Burgundy Mound.'

The horticultural and botanical staff of the Arboretum have under observation many other plants that show promise as ground covers. These plants, obtained from arboretums and botanical gardens throughout the world and through plant breeding, will be released if they are horticulturally desirable.

Drought Tolerant Ground Covers

Description	Exposure	Rate of Growth	Flower Color
Spreading, low growing to 6″ high; grey foliate	Full Sun	Fast	Yellow
Low growing, eventually reaching 3′ high; light green foliage	Full Sun	Moderate	White

Arctotheca calendula
Cape Weed
Baccharis pilularis
Coyote Brush
Ceanothus griseus horizontalis
Carmel Creeper
Gazania uniflora
Trailing Gazania
Helianthemum nummularium
Sunrose
Lantana montevidensis
Trailing Lantana
Santolina chamaecyparissus
Lavender Cotton
Santolina virens
Green Santolina
Verbena rigida

New juniper garden at Arboretum offers visitors display of over 60 ground cover, shrub, and columnar types. Several varieties of sweet alyssum fill out the area.

Ground Covers as Lawn Substitutes

Armeria maritima
Sea Pink
Arctotheca calendula
Cape Weed
Asparagus sprengeri
Baccharis pilularis
Coyote Brush
Ceanothus griseus horizontalis
Carmel Creeper (Calif. Lilac)
Dianthus sp.
Duchesnea indica
Mock Strawberry
Euonymus fortunei radicans
Winter Creeper
Festuca ovina 'Glauca'
Blue Fescue
Fragaria chiloensis
Wild Strawberry
Fragaria #25
Gazania uniflora
Trailing Gazania
Hedera canariensis
Algerian Ivy
Hedera helix
English Ivy
Helianthamum nummularium
Sunrose
Huchera sanguinea
Coral Bells
Hypericum calycinum
Aaron's Beard
Ice Plants
Carpobrotus
Hottentot Fig
Cephalophyllum speciosum
'Red Spike'
Delosperma alba
Trailing Ice Plant
Drosanthemum floribundum
Drosanthemum hispidum
Rosea Ice Plant
Hymenocyclus crocea
Lampranthus sp.
Juniperus sp.
Prostrate, spreading varieties
Lippia repens
Lonicera japonica
Japanese Honeysuckle
Lotus berthelotii
Parrots Beak
Ophiopogon japonicum
Mondo Grass
Osteospermum fruticosum
Trailing South African Daisy
Pachysandra terminalis
Japanese Spurge
Pelargonium peltatum
Ivy Geranium
Polygonum capitatum
Potentilla verna
Spring Cinquefoil
Rosmarinus officinalis 'Prostratus'
Trailing Rosemary
Sagina subulata
Irish Moss
Sagina subulata 'Aurea'
Scotch Moss
Thymus serpyllum
Creeping Thyme
Trachelospermum asiaticum
Trachelospermum jasminoides
Star Jasmine
Verbena peruviana
Peruvian Verbena
Verbena rigida
Rigid-leaved Verbena
Vinca major
Periwinkle
Vinca minor
Dwarf Periwinkle

Ground Covers for Hillsides — Erosion Control

Arctotheca calendula
Cape Weed
Baccharis pilularis
Coyote Brush
Ceanothus griseus horizontalis
Carmel Creeper (Calif. Lilac)
Delosperma alba
Trailing Ice Plant
Duchesnea indica
Mock Strawberry
Gazania uniflora
Trailing Gazania
Hedera canariensis
Algerian Ivy
Hypericum calycinum
Aaron's Beard
Juniperus (prostrate forms)
'San Jose'
'Conferta'
'Bar Harbor'
'Webberi'
'Wiltonii'
'Tamariscifolia'
Lantana montevidensis
Trailing Lantana
Lonicera japonica
Japanese Honeysuckle
Pelargonium peltatum
Ivy Geranium
Osteospermum fruticosum
Trailing South African Daisy
Rosmarinus officinalis 'Prostratus'
Trailing Rosemary
Vinca major
Periwinkle
Vinca minor
Dwarf Periwinkle

The Arboretum's Braille Terrace

By Maria Stewart

PERHAPS ONE OF the most dramatic activities of the Arboretum Foundation is also one that few people know about: the development of the Braille Terrace through the cooperation of the Herb Society of America, Southern California Unit.

Over the years, the Herb Society has given tremendous amounts of time and hard, earnest work assisting the Arboretum staff to bring into being the delightful Herb Garden, of which the Braille Terrace is a part.

Being an ardent member of the Herb Society and a devoted volunteer at the Braille Institute makes Jean Cozart a unique person to head the "Brailled Scented Terrace," to use its formal name. She has with single-minded enthusiasm guided the plantings, tours, and general development of this area, and comes all the way from Canoga Park to do it!

Now, two local garden clubs have stepped forward to assist in expanding the use of the Braille Terrace by sightless visitors, both children and adults. The Arcadia Garden Club under the leadership of its president has a number of members who are planning participation in a general way. The Santa Anita Highlands Garden Club has organized a special Braille Terrace Section whose members are contributing financially and who are actively working to extend the usefulness of this special area.

Blind visitors, as they walk along the elbow-high wall which forms the terrace, are urged to feel, press, pluck and smell the scented and textured plants growing there. Inevitably, these much-handled herbs need frequent replacement. The Highlands gardeners, with one of their members acting as coordinator, are helping to grow replacement plants in their backyards. Later, they replant them at the terrace and groom the area, particularly before a tour is expected.

Some very impressive work was done this past summer by members of the Highlands Garden Club, Mrs. James Nicholson, left, and Mrs. Joan Bineault, who were in charge of the experimental children's project. For Timmy Gill, Dick Oehm, and Kathy Miller, students at Longden Elementary School in Temple City, they marked off a tiny plot adjacent to the Braille Terrace where the children could grow their own flowers and vegetables. Though sightless, the children learned to use tools for digging, raking, planting, and watering. The experiment proved such a success it is sure to be continued so that other special students of the San Gabriel Valley can have the fun Dick felt when he said exuberantly one hot summer day, "I guess I'm just a born farmer!"

Adults from the Braille Institute, men and women of different ages and different degrees of sightlessness, are given special tours of the terrace. At the end of each tour, Herb Society members served iced lemon herb tea with cardamon, anise, and rose-lilac-flower cookies. Each visitor carries away woven baskets of potpourri and lavender, and many leave with sprigs of various herbs and enthusiastic plans to start herb gardens of their own!

More special tours are planned for this fall and winter, particularly for blind and partially sighted children from the San Gabriel Valley. Regular classes of school children which include blind students will be making more use of the Braille Terrace as the sightless children become familiar enough with the plantings there to act as guides for other sightless members. With this in mind plant labels frequently include more information in Braille than in Roman letters. Because older people sometimes lose their sight after the time when it is easy to learn braille, future plans include a push-button, recorded introduction to the Braille Terrace describing the plants and the general scene.

It was Dr. Samuel Ayres, Jr., first president of the Arboretum Foundation, along with Dr. Charles L. Lowmand and Dr. Elizabeth Hohl, who were early proponents of a garden for the blind at the Arboretum. It must give them a feeling of satisfaction to see the Braille Terrace becoming a valuable and inspirational part of the Arboretum scene.

A footnote to this report, and a sad one it is, comes from the National Arboretum in Washington. Its beautifully planned Touch and See Trail has had to be closed because of vandalism. We can only hope the action is temporary.

CALENDAR 1970

January-March

FLOWER SHOWS

Arboretum — **Arcadia**

March 7, 8
Temple City Camellia Society Show

March 13, 14, 15
Southland Orchid Show

March 28, 29
Aril Iris Show

Descanso Gardens — **La Canada**

February 28, March 1
Los Angeles Camellia Council Show

March 21, 22
Daffodil Show

South Coast Botanic Garden — **Palos Verdes Peninsula**

March 18
L.A. Bay Harbor District
Garden Clubs Show

LECTURES

Free Native Plant Lectures presented by the Theodore Payne Foundation:

At Arboretum

January 23 — 8:00 p.m.
"Growing California's Alpine Plants"
James B. Roof, Director
Regional Parks Botanic Garden
Berkeley

March 20 — 8:00 p.m.
"California Succulents and their Uses"
Mrs. Joyce L. Tate, Chairman
Uses Research Committee
Cactus and Succulent Society of America

At Descanso Gardens

February 11 — 8:00 p.m.
"Erosion Control & Fire Retardant Plants"
Panel Discussion
Dr. Duane O. Crummett
Chief, Education Division
Dept. of Arboreta & Botanic Gardens

BOOKSHELF

THE DICTIONARY OF GARDEN PLANTS IN COLOUR by Roy Hay and Patrick M. Synge, c1969, published in collaboration with the Royal Horticultural Society.

The difficult choice of which plants to grow is one all gardeners face. Further, description alone can never convey what description accompanied by colored illustrations can, as a photograph presents both inspiration and challenge to the prospective grower. **The Dictionary of Garden Plants in Colour** represents the author's painstaking and eye-filling attempt to supply home gardeners as well as professionals with a comprehensive "dictionary," which is badly needed.

A team of expert photographers worked through three complete flowering seasons to acquire 4,000 color photographs, of which 2,048 were selected for inclusion in the book. Each photo carries the botanical name of the plant it portrays and the photos are divided into sections for various types of plants, for example, Alpine and Rock Garden, Perennial, Greenhouse and House Plants.

Preceding the photographs is a section on culture, and following them a larger section with descriptions and information on their genera. An unusual feature is the cross-referencing to common and uncommon name, botanic and English cultivar name, where the latter differs from that used in the United States.

The authors, themselves prominent in the fields of horticulture and horticultural writings, have not hesitated to consult with experts in the various genera, nor to employ the services of the most skilled and best known horticultural photographers. Lord Aberconway, President of the Royal Horticultural Society, noted "Indeed the R. H. S. seeks to limit the books which they publish, or are prepared to sponsor, to those which they are confident will be of outstanding quality. **The Dictionary of Garden Plants in Colour** fulfills this requirement, and I recommend it with confidence to all who wish to identify their plants, and to grow the best."

Margaret P. Smith

OF SPECIAL INTEREST

ORNAMENTAL PESTICIDE APPLICATION GUIDE (for Nurserymen, PCO's and Commercial Horticulturists), by W. T. Thomson, Thomson Publications, 471 pg. 1969.

FLOWERS OF EUROPE, by Oleg Polunin; Oxford Univ. Press, 662 pg. Photographs.

TREES, by Andreas Feininger; Viking Press, 116 pg. 1968. Photographs.

USING WAYSIDE PLANTS, by Nelson Coon; Hearthside Press, Inc., 288 pg. 1969. Photographs.

FLORA OF ALASKA AND NEIGHBORING TERRITORIES, by Eric Hulten; Stanford Univ. Press, 1008 pg. 1968. Illustrated.

DO'S AND DON'TS OF HOME LANDSCAPE DESIGN, by Robert J. Stoffel; Hearthside Press, 192 pg. 1968. Photographs.

FLOWERING SHRUBS, TREES AND CLIMBERS FOR SOUTHERN AFRICA, by Sima Eliovson, Howard Timmins, 260 pg. 1969. Photographs.

REPORTS OF THE PRINCETON UNIVERSITY EXPEDITIONS TO PATAGONIA, 1896-1899, Vols. I and VIII (Botany), edited by William B. Scott; Princeton Univ., 1903. Illustrated.

All listings available in Lasca Library.

Southern California Edison Company

An Arboretum is not all trees...

This electrically controlled growth chamber was added recently to the new research laboratory of the Los Angeles State and County Arboretum. By providing an almost endlessly variable environment in terms of temperature, humidity and light conditions, it permits some fascinating studies of plant growth and plant-insect relationships. □ On the upper tray a study is being made of the effect of parasites of gall-producing insects on a species of coyote brush, one of California's most prevalent ground covers. At the bottom, Vinca rosea plants are shown in varying stages of growth under artificial daylight.

Speaking for the Foundation

ON A WARM sunny Sunday afternoon in November it was my privilege to preside over the dedication ceremonies of the Manfred Meyberg Memorial Waterfall, donated by Mrs. Manfred Meyberg, relatives and friends. A beautiful cascade tumbles over rocks and in free fall down the entire north side of Tallac Knoll into a large catchment pool. The ceremonies were very inspiring, for the speakers told of the life and horticultural achievements of the man. Mr. Meyberg was president of Germains, one of Southern California's foremost horticultural companies. For many years he worked beyond the call of business duties for the beautification of Southern California. He was an influence in the establishment of the Arboretum, a member of the Los Angeles Men's Garden Club, a prime mover in the still-to-be-remembered Los Angeles International Flower Shows, and a benefactor of many other garden groups.

Because of such men, we have the Los Angeles State and County Arboreta and Botanic Gardens. On the same theme the not too well known story of the conception and founding of our Arboretum is the story of dedicated persons such as that great person, Dr. Samuel Ayres. Dr. Ayres and a group of other horticulturists decided that Los Angeles needed an Arboretum. The search for a site was not easy. When it was found, it took all the expertise and influence of these men to secure the property, establish a parent organization (The Foundation) and to steer this infant Arboretum through the early years of its development.

Twenty years have passed, and far more has been done at the Arboretum than could have been envisioned. There are many more twenty-years ahead, and much yet to be done. The need for participation by the Foundation and for service to the Arboretum by Foundation members is as great as ever. I know of no greater satisfaction for anyone horticulturally inclined than to support our Foundation. The Arboretum should become known throughout the southland, as the green heart of Southern California. I use the word heart for it is that organ which pumps life throughout the body. Surely, our Arboretum pumps knowledge, love of horticulture and inspiration throughout the life stream of our area. We have a priceless possession in the Arboretum. Let us all be proud and feel privileged to serve the Foundation in its work to make Southern California a lovelier place in which to live.

Ernest Hetherington
President

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone 447-8207

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Annual Contributing Membership	25.00
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Lasca Leaves

The official publication of the California Arboretum Foundation, Inc.

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The Cover

Reproduced, courtesy of the artist, from *the Elegant Era,* a Sketchbook of the Ornate Architecture and Delicate Detail of Yesterday's Southland, by Helen Luitjens. Best-West Publications, 1968.

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Arboretum notes

Baldwin Bonanza

THOSE INDEFATIGABLE ladies who comprise Las Voluntarias have done it again. They have thought up, developed, and will execute on Sunday, May 3, a unique treasure sale — a Baldwin Bonanza — that promises to bring in money (to be used to aid various Arboretum projects), bring pleasure to the visiting public, and bring satisfaction to those who buy.

The cornucopia of sale items will include old books and paintings from the Baldwin era, a host of handcrafted objects, sachets, ornamental and culinary potted plants, and just about anything else the fertile Las Voluntarias minds can think of. The area of the grounds set off for the bonanza will be decorated in the gay nineties manner, complete with popcorn machine and mechanical organ. Serving as co-chairmen are Mr. and Mrs. Peter Douglas who deserve a grateful nod for having taken on the sizable task of putting the whole thing together.

A preview, open only to Foundation members, Las Voluntarias, and their guests, will be held the previous evening, Saturday, May 2, from 6 p.m. to 10 p.m. in the Lecture Hall. Expected to be as gay and optimistic as an election campaign kick-off, it will ask a euphemistic donation of ten dollars per person as a contribution toward a delectable buffet preceded by appropriate aperitifs. Surely, a bonanza not to be missed.

Volunteer Work

THINKING THAT potential new members as well as general readers would be interested in a broader picture of the work of Las Voluntarias than that presented in her last letter, Alice Douglas, former president and now secretary of the Arboretum's official volunteer organization, has written the following amplification:

"I think I may have given the impression in my last letter that all volunteers at the Arboretum are docents, or, as we call them, 'field leaders,' for school children on nature and conservation, plant science, and early California history field trips. There *are* 31 women working in this program, but they also double in many other areas of volunteer activities. Actually, as of February 1, Las Voluntarias had 86 working members, 4 on leave of absence, and our founder and honorary member, Maria Stewart, starting a new life in Kauai. All of these women are deeply involved in bringing attention to, and helping to preserve, this 127-acre arboretum amidst the growing industries and housing tracts of the San Gabriel Valley.

"To explain the varied activities of Las Voluntarias, let me take you on a tour of the Arboretum, starting at the Information Window. From 10:00 a.m. until 1:00 or 2:00 p.m. one of our members is there to greet the visitor, answer the telephone, sign in groups, refer questions to the proper staff members, a job which varies every day. Here is where field leaders stash their purses, read the bulletins, and meet the school bus drivers who begin to arrive from 9:30 a.m. on. Go through the gate to the Peacock Pavilion and you will find two members, whose presence is as familiar as the regular staff, in the gift shop of the California Arboretum Foundation. They do everything from selling, to typing, to sacking bird food, sorting peacock feathers and counting pennies from the corn machines, anything to help the shop run smoothly. Walk up to the greenhouses, and you will find members doing a myriad of tasks; at the moment making divisions and cuttings to start dozens of plants on their way toward a gigantic treasure sale which Las Voluntarias is going to staff in aid of the California Arboretum Foundation on Sunday, May 3.

"Now walk south to the library, where you will find members hidden among the rows of books, indexing and cataloguing. Down the hall, members type for the education division, work in the herbarium, have done illustrations for a book to be published by Dr. Enari, help Dr. Walker in his work concerning white flies and aphids. Leave this building and walk into the rotunda and you will find the graphic arts committee changing the exhibits, or you might find them hanging orchid prints along the hall of the administration building, or down in the lecture hall where they hung the large collection of botanical art and illustration from the Hunt Botanical Library, which was open to the public from November 22 through December 14, and all those hours its was guarded by members of Las Voluntarias. Go back into the administration building and down the hall to the plant pathologist's laboratory and you will find volunteers helping with research, and I must not forget to tell you that many members devote countless hours to receptions, previews and dedications — the hospitality ladies.

"Work in the youth education section for volunteers is as varied as the plants in their greenhouse: registering children for classes, taking inventory, cleaning cupboards, display and art work for classes and the museum, transplanting 3,000 tabebuia seedlings from flats for Arbor Day, assisting wherever and whenever they can. Down the road in the Queen Anne Cottage, you will find the flower arrangers busy every Friday putting fresh bouquets on the mantelpieces, dusting, mending, all the jobs of keeping this Victorian house a delight for the visitors. The same work goes on to keep the Hugo Reid Adobe dusted (an almost impossible job as the packed dirt floor turns to dust as you sweep it) and filled with bowls of fruits, vegetables, and flowers that might have been available to a housewife of 1840. Over in the coach barn, the loft is a hum of activity under the supervision of Mrs. Warren, the Associate Curator, with volunteers accessioning and cataloguing gifts, researching the history of acquisitions, sorting and identifying photographs, keeping the costume collection in good condition, trying to make order out of what could and once was a chaos of old and dusty artifacts.

"We cannot leave the historical area without mention of Los Ayudantes (the helpers), a marvelous group of every age who for various reasons are ineligible to join Las Voluntarias. The oldest member, a man who confesses to being historical himself, is seen quite often arranging the historical exhibit in the rotunda, or out helping patch together a corral fence with a bit of rawhide. The youngest are formed into a group interested in history and have their own officers and meetings and field trips to other historical sites. They even started a dig this summer but the only thing uncovered in the hard packed earth were some turtle eggs. These young people, after fire and wind struck the Arboretum with such disastrous force in December, arrived, without being asked, to help clean up and stayed to work many hours. They came to save an environment they had learned the history of and had grown to love.

"Just as our membership list is obsolete, because of new members, the day it is printed, so is any list of jobs that the volunteers are engaged in. Everything is constantly changing, and this flexibility is what makes the Arboretum a challenging place to serve."

Vitamin C — A Natural Smog Resistance Mechanism in Plants?

by George P. Hanson, Linda Thorne, and Carlos D. Jativa[1]

VITAMIN C may be a factor responsible for smog resistance in plants. We have found that petunia varieties tolerant of smog have a higher concentration of this scurvy-preventing vitamin than do sensitive varieties.

Ascorbic acid, better known to the layman as vitamin C, has long been employed as a remedy for the common cold. Even before the existence of vitamin C pills grandma recommended it in the form of orange juice and lemonade. Although its function in the human body is poorly understood, the C-vitamin is believed to reduce man's susceptibility to infection. It is known that man's requirements for vitamin C are raised when he has a fever or is confronted by other physiological stresses including infection, pregnancy and breast feeding.

Biologists believe that vitamin C acts as an antioxidant and thus as a protector of delicate enzyme systems. Recently it has been found that people who smoke cigarettes have less vitamin C reserves in their bodies than do non-smokers which indicates that the vitamin may interact with the oxidants in tobacco smoke and become inert. Similarly we have found that petunias exposed to ozone, a major constituent of Los Angeles smog and a strong oxidizing agent, have lower concentrations of ascorbic acid than do unexposed plants. Both sensitive and tolerant varieties were treated with 0.4 parts per million (ppm) ozone for 2.5 hours (this dosage is normally exceeded many times each year in the Los Angeles area). The plants showed no visible symptoms upon removal from the ozone chamber and were tested immediately for their vitamin C content. The treated petunia leaves had 10% less ascorbic acid than did the control leaves indicating that the fumigation either prevented vitamin C synthesis or destroyed the existing vitamin or both.

AN EXCELLENT correlation exists between ascorbic acid concentration and the response of petunia leaves to ozone fumigation. As can be seen from Table I, the smaller and younger leaves contain much more vitamin per unit size than do the larger and older leaves. The 1.5-2.0 centimeter leaves contain twice as much vitamin C per square centimeter of leaf surface as do leaves in the 4.0-4.5 cm. class. Likewise the younger leaves are more tolerant of ozone than are the older leaves. The largest leaves on the plants were not tested. The 4.0-4.5 cm. class represents leaves that were approaching maturity rather than fully mature leaves. It will be noted that the tolerant varieties of each class have a higher score (are more tolerant) than do the sensitive varieties and that this same varietal relationship exists when comparisons are made of ascorbic acid concentrations. The 1.5-2.0 cm. leaves of variety 'Gypsy' have approximately the same concentration of ascorbic acid as do the 2.0-2.5 leaves of varieties 'Coral Satin' and 'Pink Satin.' However, leaves as large as 2.5-3.0 cm. in variety 'Sundance' have nearly this concentration. Within the range of experimental error all these leaves show similar amounts of damage when fumigated with ozone, indicating that higher ascorbic acid concentration may be responsible for ozone tolerance in petunias.

Studies are continuing to investigate this relationship. Crosses have been made in all possible combinations between the four F_1 hybrid varieties listed in Table I. The seeds obtained have been planted and the resulting seedlings will soon be ready to test. If the above correlation is maintained in the segregating petunia progenies, the relationship will seem fairly well established for multiflora petunias.

OTHER PLANT SPECIES that have varietal differences in smog susceptibility or in vitamin C concentrations are being collected and analyzed to ascertain if a similar ozone-tolerance/ascorbic-acid-concentration relationship obtains. Although it is commonly believed that white petunias are more sensitive to smog, we have not found flower color important in this regard. The misconception is probably due to the relative sensitivity of the 'White Cascade' variety when compared to other varieties popular in the trade.

It is important to note that ascorbic acid has previously been proposed as an agent for the protection of plants.[2] When this substance is dusted or sprayed onto foliage the treated leaves are indeed made smog tolerant; however, leaves that develop after treatment are as sensitive as the untreated foliage and readily succumb to the air-borne poison. If naturally occurring ascorbic acid can be shown to determine smog resistance in other species, the plant breeder has a new tool. He can then select tolerant varieties of plants without having to depend upon natural smog or an expensive smog generating and testing device.

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[1] Geneticist, Research Assistant, and Plant Research Aid respectively, at the Los Angeles State and County Arboretum, Arcadia, Calif.

[2] Freebairn, H. T. and O. C. Taylor. "Prevention of plant damage from air-borne oxidizing agents." Proc. Am. Soc. Hort. Sci. 76:693-699. 1960.

Table I. Comparison of ozone tolerance and ascorbic acid concentration for different sized leaves of ozone-sensitive and ozone-tolerant petunia varieties.

	Variety							
	Tolerant				Sensitive			
Leaf	Sundance		Pink Satin		Coral Satin		Gypsy	
Length (cm)	Ozone Score*	A. A. Conc.**	Ozone Score	A. A. Conc.	Ozone Score	A. A. Conc.	Ozone Score	A. A. Conc.
1.0 - 1.5	2.40		2.36		2.30		2.23	
1.5 - 2.0	2.25	*** 2.29	2.12	1.77	1.91	1.75	1.78	1.63
2.0 - 2.5	1.95	2.00	1.72	1.58	1.49	1.63	1.35	1.43
2.5 - 3.0	1.73	1.51	1.46	1.43	1.36	1.19	1.15	1.31
3.0 - 3.5	1.25	1.27	1.28	1.21	1.24	1.13	0.97	1.16
3.5 - 4.0	1.07	1.04	1.11	1.01	1.18	0.94	0.89	0.94
4.0 - 4.5	1.00	1.01	1.12	0.89	1.06	0.88	0.87	0.92

*Average of more than 60 leaves in each size class where each leaf is given a rating of 2.4, 1.8, 1.2, or 0.6 depending on whether it was undamaged, stippled, spotted, or wilted respectively from an ozone treatment of 0.9 parts per million for 24 hours.

**Ascorbic acid concentration in milligrams per 100 square centimeters of upper leaf surface.

***About 1/4 pound of these leaves if eaten would satisfy the minimum adult daily requirement for this vitamin.

NOTE: This research was supported in part by a grant from The National Institutes of Health administered by The California Arboretum Foundation, Inc. Seed stocks for this study were contributed by Bodger Seeds, Inc., Chino, Calif.

Kiwi—A Potential New Crop for California

By Robert L. Smith[1]

AT A RECENT U.S. Department of Agriculture fruit exhibit a housewife picked up a Chinese gooseberry, or Kiwi berry (*Actinidia chinensis* Planch.), and asked, "Where did you get these fuzzy potatoes?" Another exhibit visitor wryly commented, "I don't know whether to eat it or step on it."

Such remarks are not too uncommon when people get their first look at a Kiwi berry.

The fruit, which has also been described as being 'beautifully ugly,' is about the size and shape of a hen's egg, brownish in color, and covered with short, stiff hairs. Those who have sampled Kiwi, however, know that its lack of beauty is only skin deep. When peeled or sliced for eating it reveals rows of small, dark, edible seeds, and an attractive green flesh that shades off to almost cream color in the center.

The flavor of Kiwi is literally "something else." It has been compared with everything from the common gooseberry (to which it is not related) to the watermelon. The consensus of opinion, however, seems to favor a combination flavor of strawberries, rhubarb, and pineapple guava.

In addition to flavor, Kiwis are noted for having more Vitamin C than citrus, and an enzyme that dissolves protein. A fresh berry sliced in two and rubbed on a steak is an effective tenderizer. This same enzyme, however, can also produce off-flavors in certain food combinations. For example, when fresh Kiwis were used to make ice cream and sherbet the product was rendered inedible.

In addition to fresh use, the fruit is excellent in jams, jellies, pies, preserves, as a canned product, and (when cooked) in ice cream.

In spite of its appearance many visitors to the U.S. Plant Introduction Station, Chico, California, where the deciduous, woody vines are being test-grown, become enthusiastic Kiwi growers. Scattered plantings in California range from a few vines in the garden to small commercial test acreages.

The Kiwi was recognized as a potential new crop when it was introduced from China (its native home) and New Zealand by the U.S. Department of Agriculture in the early 1900's.

Although it seemed climatically adapted to the south and western United States and widely distributed in those areas, it was not readily accepted by the public.

Most of the vines that were established were not replaced when they grew older, and with the passing generation Kiwi all but disappeared from American gardens. One of the few remaining plants from the early distribution is being grown at the U.S. Plant Introduction Station at Chico and is about 40 years of age.

DURING THIS SAME period a Kiwi industry was being developed in New Zealand. Although still a minor crop in that country it has expanded in recent years and New Zealanders now produce about 1,600 tons of fruit per season for local consumption and export. There are an estimated 600 acres in production.

Kiwi fruit, imported from New Zealand and sold on the West Coast and larger markets in the east, has been one of the factors that stimulated new interest in this plant as a potential crop for the western United States.

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Another factor was the successful marketing, for the past several years, of domestically produced Kiwi from a small test plot in northern California. Test plantings in other parts of the state, although not yet in production, appear to be developing normally and give every indication that they will be successful. This is especially true of plantings in the central valley of California.

Although vines are also being tested in southern California, it is too early to comment on their general adaptability. It is of interest, however, that Kiwi vines growing in the Asian section of the Arboretum for the last ten years show reasonably good adaptation.

Kiwi seedling about six months of age ready for planting to nursery row. At Chico, seedlings usually require two growing seasons to reach budding size.

The culture of Kiwi plants is not dissimilar to that of grapevines. The rank growing, woody canes require the support of a fence or trellis, and need to be pruned at least once in winter while dormant. Some New Zealand growers also prune in summer to reduce the vigorous growth and resulting entanglements.

Because the vines are capable of producing 6 to 8 feet or more of new growth each season, they are spaced in commercial plantings in rows about 15 feet apart, with plants 24 to 30 feet apart in the row.

The flowers of Kiwi are produced on the current season's growth and at Chico usually reach full bloom in early May. They are about 2 inches in diameter and have a single row of white petals that fade to buff color as the flower ages. The male and female flowers are produced on separate plants. In the center of the female flower is a cluster of stigmas that resemble small fingers. Surrounding the stigmas is a ring of anthers

Fruit ready for harvest, such as those shown here, give no indication of maturity other than a slight softening of the flesh.

that are non-functional in the female flower. In the male flower, which produces pollen but no fruit, the anthers are functional but the stigmas do not develop.

The sex of plants cannot be distinguished unless in flower or fruit.

For adequate pollination (which is effected by insects) one male is planted for every four to six females. When pollinated, the fruit develops rapidly in size but does not ripen at Chico until about the last week of November or early December. It can be stored for several months at 40°F, and longer under commercial storage conditions.

Although yields of 10 tons per acre, from 8 to 10 year old plants, have been reported by New Zealand growers, the average production would be considerably less. The Chico vine has produced 700 pounds but the average is closer to 400. These heavy yields, however, are from an exceptionally large specimen plant, and it is doubtful that it would produce as much if it were pruned back heavily and grown under commercial conditions.

To support the excessive growth and heavy yields, California vines will need abundant irrigation.

KIWI IS NOT DIFFICULT to grow once it becomes established. Seed and germination literature is available, free-of-charge, at the Plant Introduction Station at Chico; also, limited amounts of scion wood to bud or graft seedling rootstocks to male and female varieties.

Kiwi can also be rooted from cuttings although this method of propagation is not always reliable. Improved techniques are being developed, however, and in the future when there are enough Kiwi plantings to make cuttings readily available, this method will probably be used to produce plants commercially, as it now is in New Zealand.

At Chico there are only two pests of Kiwi that are important, and both are soil-borne organisms that attack the roots. One is root-knot nematode to which the plants seem at least partially resistant; the other is oak root fungus which is usually fatal.

Failure of the Kiwi to become established when first introduced years ago may have been partly due to its unknown cultural requirements. Now, however, culture of the vines is better understood, as a result of experimental work conducted at the Chico Station, and the experience of New Zealand growers and agricultural scientists.

Armed with this information and the marketing experience of imported and domestically grown fruit, growers feel that the risk is worth the investment and are in dead earnest about making Kiwi one of California's newest and most unusual crops.

Author stands alongside a 40-year-old Kiwi plant growing at the U.S. Plant Introduction Station, Chico, California. The vine is noted for its vigor and each season the canes put on from six to eight feet or more of new growth.

In winter, the Kiwi sheds its foliage as shown by this four-year-old vine. The fast growing canes tend to become tangled unless the vines are pruned when dormant.

Volunteer Seedlings in the Arboretum

Ross Goodrich

THE APPEARANCE OF seedlings on the surface of the earth must surely have been a cause for wonder to early man. Before he learned that their more or less regular reappearance had something to do with his survival he couldn't help but puzzle over these new plants that were not there before.

This fascination is still with many of us. The quick change from an object that is often dried up looking to a growing plant is almost magical. If the seed is planted by man it is usually watched intently for the first sign of life. If it is planted by nature's apparently casual system it seems to show up all at once — here is a growing plant, and this is the stage at which it is first noticed.

Then come the questions: What is it? Is it really a seedling, a root sucker, or could it have grown from a broken-off twig. Is it something new or a variation of a known plant? And where did it come from?

Through the years it has been interesting to watch the appearance of seedlings in an area of the Arboretum that is only about one-twelfth its total acreage, and to keep notes on these volunteer plants. No great conclusions have been reached, but some interesting things have shown up. These comments are offered on those that have appeared so far.

Years ago when the upper lake was relocated to channel floodwaters from neighboring areas into the main lake, several storm drains were put in, the largest being forty-eight inches in diameter. Its outlet was at the very head of the channel and during a storm it was nothing less than spectacular to see its discharge spouting ten to twelve feet into the air as it struck the deposits already there. The quick settling of its silt formed a large horseshoe shaped island. After the Michillinda Boulevard storm drain project was finished this little lake had no more great inrushes of water and seedlings soon covered the island. In the mixture that grew were the natives such as palm, dogwood, grape and willow. Among the exotics was one lone *Acacia baileyana*. Here, in what one would assume to be the most unlikely place for this plant to survive, let alone flourish, it grew to maturity and bloomed well for a number of years before it was blown over during a storm.

THE SHOWING UP OF new plants of *Lampranthus amoenus* was one of the more unusual seedling appearances. This is one of the plants we call ice plant. Amoenus means pleasing and pleasing it is; in recent years its brilliant colors cover a good part of Baldwin Avenue each spring. Here, in the original planting that was grown from seed brought back from South Africa by Dr. Samuel Ayres, no volunteers had ever appeared. When the question was asked as to why there were none an apparently knowledgeable person said that since it was from Africa perhaps it took an elephant to walk over them to crush the seeds or to push them into the ground. This seemed like a good joke until someone backed a truck with dual wheels into the bed for a distance of five or six feet. Later, in the exact area of the tire outline, and in no other place, the seedlings showed up in great numbers.

Another surprising appearance of seedlings was in a planting of about two dozen cistus. They were in groups of from two to three of each species. When a controlled test was set up to learn their resistance to fire for their possible use in replanting burned-over mountain areas, plants in some of these groups were selected to be literally put to the torch. In the entire planting no seedlings had ever been found. After the test they appeared around the burned plants and around those plants only. They came up in such great numbers that it looked as if they would choke each other out.

When one of the *Grevillea robusta* or silk oak trees was in its childhood, that is to say when it was ten or twelve feet tall, a sparrow hawk chose it as its favorite observation perch. The bird always sat as near to the top of the tree as possible to give it the better view needed to spot a grasshopper, cricket or other food in the meadow nearby. Whether this bird was the lone tenant of the tree is not known (but it was the observed one); in any case, beneath this tree in an area of a foot or so from the base on each side, these seedlings were found: *Berberis, Vitis, Cornus, Prunus caroliniana, Rhamnus californica, Viburnum tinus, Ochna serrulata, Ilex, Pittosporum tobira, Schinus terebinthifolius, Quercus agrifolia* and Washingtonia palms. Some of these seeds may not have been on this hawk's diet, but it is a reasonable assumption that most of these plants grew from seeds he brought in. The others could have been brought there by bluejays, squirrels, possums or peafowl.

FOR THE MOST PART, only the seedlings of trees and shrubs were noted, but one exception could be mentioned here. On Golden West Avenue, outside the fence that encloses this area, a solitary petunia came up in the seam between the macadam pavement and the concrete apron at a storm drain. Here, where car traffic is quite heavy but foot traffic is mainly youngsters going to school, this plant grew, thrived and bloomed well. When one thinks of the trouble some of us have in growing petunias this is an admirable performance. It would be nice to report that its end was due to natural causes but the plant was chopped out by a street crew that must have thought it was aiding and abetting the bermuda grass that was also growing in the cracks of the pavement.

From all the genera, species or varieties in this ten-acre section, only about seventy different seedlings have been found. This is a small number when one considers the fact that the area is under cultivation and is watered more or less regularly, both important factors in the sprouting of seeds. There are no seedlings of some genera one would expect to be present, but a number showed up from genera not expected.

The finding of many seedlings under a parent plant might make one think that most seedlings show up near the parent. However, only ten of the seventy did this: the rest of them came from some distance. The greatest number of varieties of seedlings here almost had to be carried in by birds.

To the true scientist the few real statistics presented here would not be valid because there is no way to check them in a controlled experiment to determine which plants produced seedlings where. Yet there are questions raised by these observations that may be of value.

The one that first comes to mind is: What would happen to the mixture of plants if an area such as this was abandoned to the native climate? If it was left unwatered except for the natural rains, given no pruning or fertilizing, which plants would take over, and which would live more or less peaceably with their neighbors?

The winner of a struggle is not always the one who can move the fastest, but the one that can endure. Would plants brought in from distant lands that have apparently found a happy home here take over from our natives, or would the natives stand firm and refuse to be taken over. In the eastern part of the

United States abandoned property usually soon reverts to a native forest. Here, where there was no natural forest to begin with, but only scrub growth and isolated patches of native oaks, one wonders if any of the imports would fill in the barren patches and create a new flora for the area.

LIST OF SEEDLINGS FOUND

Acacia baileyana, 1
Acer davidii, many
Acer oblongum, many
Acer palmatum V. Eupalmatum, 6 or 7
Alnus rhombifolia, 1
Barleria cristata, many
Berberis, various species, 25-30
Broussonetia papyrifera, many
Buddleia species, probably mostly B. Davidii, 50
Camptotheca acuminata, 7
Celtis species, probably Australis, many
Celtis species, probably Yunnanensis, 25-30
Cinnamomum camphora, many
Clematis species, probably C. paniculata, 25-30
Cornus stolonifera (Californica), many
Cotinus coggygria (Rhus cotinus), 100
Cotoneaster zabelli, 1
Cotoneaster frigida, 10 or 12
Cupaniopsis anacardioides, 45-50
Eriobotrya japonica, 1
Eucalyptus globulus, many
Eucalyptus pulverulenta, 2
Fatsia japonica, 3 or 4
Fraxinus uhdei, many
Grevillea robusta, 35
Hardenbergia species, probably H. comptoniana, 10-12
Hedera canariensis variegata, 6
Heteromeles arbutifolia, 100 or more
Homolanthus populifolius, 2
Ilex species, seemingly hybrids of I. cornuta, 50-60
Juglans nigra, many
Koelreuteria apiculata, 3
Koelreuteria bipinnata, many
Koelreuteria integrifolia, many
Lampranthus amoenus, many
Lantana montevidensis, 6 or 7
Ligustrum japonicum (texanum), many
Ligustrum sinensis, 3
Lonicera maackii, 5
Mallotus japonica, many
Ochna serrulata, 25
Olea europaea, many
Persea indica, many
Pinus halepensis, 3 or 4
Pittosporum tobira, many
Prunus caroliniana, many
Prunus munsoniana, 25-30
Prunus species (peach varieties), 25-30
Ptelea trifoliata, 1
Pterocarya stenoptera, many
Quercus agrifolia, many
Quercus alba, many
Quercus englemannii, 4 or 5
Rhamnus californica, many
Rosa species, 2 or 3
Rynchosia pyramidalis, many
Salix species, many
Sarcococca hookeriana, 25-30
Schinus terebinthifolius, 35-40
Securinega suffruticosa, many
Solanum pseudocapsicum, 25-30
Sophora japonica, many
Ulmus parvifolia, 1
Viburnum odoratissimum, 15
Viburnum odoratissimum awabukii, many
Viburnum rigidum, 5 or 6
Viburnum tinus, many
Vitex species, 3
Vitis californica, 25
Washingtonia species palms, several hundred

Coming May 3:

BALDWIN BONANZA

Mark your calendar!

What a Gardener Should Know About Fertilizers

by Myron S. Anderson[1]

FERTILIZER IS A TERM that is not easy to define in such a way as to include all the materials sometimes added to soil for the improvement of plant growth. In the general trade, fertilizers for soil improvement fall into three groups, primary, secondary and minor constituents. The primary group includes constituents carrying the chemical elements nitrogen, phosphorus and potassium. Nitrogen is stated on the bag as the element N and is added to promote green plant growth. Phosphorus, stated as the oxide (P_2O_5), aids the health of plants, improves growth of roots and to a moderate extent hastens crop maturity. Potassium, also stated as the oxide (K_2O), helps the plant to make better use of sunlight and also improves root growth.

The secondary constituents include compounds carrying the chemical elements calcium, magnesium and sulfur. Calcium and sulfur are frequently included as a part of the compounds carrying the primary constituents. Thus some of the nitrogen may be in the form of ammonium sulfate that contains a substantial percentage of sulfur. Furthermore, a chemical compound may also have calcium and sulfur in its composition.

In some areas soils are deficient in one or more minor elements such as iron, boron, copper, zinc, manganese or occasionally a few others. This lack of adequacy of certain elements in the soil may sometimes be detected by characteristic abnormalities in the appearance of plant leaves. Lowered crop yield as measured by both quantity and quality often results. Misshaped apples due to boron deficiency is a well-known example of the latter. These minor elements are so-called because the quantities present and needed are normally very small. Such constituents as compounds of copper and zinc, for instance, are usually stated as a few parts per million in a fertilizer mixture rather than by percentage as is the case with primary constituents.

A GARDENER SHOULD learn to recognize the chemical composition of a mixed fertilizer by the symbols on the bag or box. One of the very commonly used fertilizers of relatively low analysis is designated as 5-10-5. This means that five percent of the weight of the material in the bag is nitrogen. This nitrogen is present as a constituent of one or more chemical compounds in the mixture. The middle number, in this case 10, designates the percentage of the mixture that is phosphorus expressed as the oxide, P_2O_5. This is not, however, the chemical form in which the phosphorus actually exists. The third number, 5, represents the potassium of the mixture. The five percent is actually the amount of potassium stated as the oxide.

In a 5-10-5 fertilizer, the total quantity of primary plant nutrients thus adds up to 20 percent. The remaining 80 percent is made up of several items. The plant nutrients are in chemical combination with secondary elements or with other materials of non-fertilizing nature. A high-grade fertilizer material such as ammonium nitrate contains about 40 percent of nitrogen available to plants when placed in the soil. The remainder is a chemical carrier, not plant nutrients. A fertilizer such as 5-10-5 also contains materials known as conditioners. These are added to improve the physical condition of the mixed goods, especially to restrain caking. Inert material of low cast, called filler, is added to adjust the mixture to the total percentage stated on the bag.

Methods of fertilizer application vary somewhat with soil character, moisture present and kind of crop grown. In many places it is well to apply about 10 to 15 pounds of a mixed fertilizer such as 10-10-10 to one thousand square feet of area. This is plowed or spaded in and the soil properly conditioned for planting. When seeds are planted or small plants transplanted a small handful of perhaps 5-10-5 fertilizer per linear yard is placed in a shallow trench about four inches to one side of the plant row at a depth of four inches. When a second crop is grown without preliminary plowing the rate of application of fertilizer may be somewhat less than that used for the first planting.

Fertilizers of different grades are usually carried in garden stores. For best results a gardener frequently uses fertilizers of two or more grades. The 5-10-5 material has long been on the market and is widely used for growing many kinds of flowers and vegetables. The 10-6-4 grade is often recommended for use on lawns, while root crops usually respond well to 5-10-10. The 10-10-10 grade serves well to build up garden soil productivity.

CARE SHOULD BE TAKEN to use proper amounts of fertilizer for the area involved. The method of application should be suitable. Commercial fertilizers *improperly* used may burn plants and cause poor germination of seeds.

Longevity of the usefulness of fertilizers added to soil depends upon the rate and quantity of water added by rainfall or by irrigation, upon the character of the soil, upon fertilizer constituents dominant in the mixture and upon the quantity of fertilizing materials absorbed by growing plants.

In many areas fertilizers may be purchased that are supplied with minor element compounds in adequate yet safe quantities. In the case of tree-crops the appearance of young leaves sometimes give a clue to the likelihood of a deficiency of a certain element. Sometimes a minor element can be better supplied by sprays than in fertilizer applications to the soil. Absorption of a minor element through leaves is often adequate for a current season.

The fertilizer needs *vary widely from place to place*. A gardener should get as much reliable information as practical regarding the need of various constituents for different crops in the area of his garden. Some branch of a state university is usually in position to inform a gardener as to areas where minor element deficiencies are likely to occur and where other specific deficiencies may be expected. Sometimes this agency is in connection with the agricultural extension service, especially in the office of the county agricultural agent. The minor elements of fertilizers in a local garden supply store may provide some hint as to the likelihood of local deficiencies. One should read the chemical analysis on the fertilizer bag and buy the grade of goods that best suits the local garden situation.

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[1] Dr. Anderson is a retired soil scientist with 40 years' experience, much of it with the U.S. Dept. of Agriculture, as researcher and author.

The Santa Anita Depot

Patricia Armstrong Warren

THE HISTORICAL section of the Los Angeles State and County Arboretum will soon be enriched by one of the more nostalgic souvenirs of our country's past. This spring will see the reopening of the historic Santa Anita Depot in its new location south of the Hugo Reid adobe.

The original depot was built by the Santa Fe Railroad on Rancho Santa Anita property. The year was 1890. E. J. Baldwin had given the railroad the right-of-way on the condition that trains would always stop for him or for any of his rancheros who wanted to board. His condition was granted and for the next fifty years the depot served the residents of the area. On May 10, 1940, the depot was closed but not forgotten by the citizens of Arcadia and the San Gabriel Valley who sadly watched the brick Gothic Revival building slowly deteriorate. To many it was typical of the English country railroad station which frequently achieved an air of cozy whimsicality.

In the early 1960's it was announced that a freeway would be built paralleling Colorado Boulevard and the depot would be torn down to make room for progress. The Arcadia Historical Society at once decided they would not allow it to be torn down but would find a new home for it. Mrs. Edna Lenz, president of the Arcadia Historical Society, went out into the community and gained the support of the Arcadia Chamber of Commerce.

A group known as "Save the Depot," headed by James A. Harvey, raised more than $30,000 through a community-wide campaign with contributions from a dollar to thousands of dollars. He was assisted by a committee which included Ray Rogers, George Forman, Jerry Bernstein, Sherrell Watson, Don Camphouse, Dale Turner, F. Harold Roach, Edna Lenz, Mrs. S. D. Platford, Dr. William Stewart, Ward Helman, and Ward Kimball.

February 19, 1969 marked the groundbreaking ceremonies, in which Los Angeles County Supervisor Frank G. Bonelli and Arcadia Mayor Donald Hage participated. Raymond M. Rogers served as Chairman of the Construction Committee assisted by special consultant Dale Turner. Architect Ward Helman was in charge of design and Leonard Fullmer was the general contractor on the project. Owen H. Peters, landscape architect, was in charge of site development and will handle final landscaping.

THE DEPOT HAS six rooms, four downstairs and two rooms and a porch upstairs. The baggage and freight room is the largest and will be appropriately furnished with trunks, milk cans and crates.

When E. J. Baldwin used the depot, agricultural products were being shipped from his ranch in great quantity. They were used in part to supply his three hotels: the Baldwin in San Francisco, the Oakwood in Arcadia, and Tallac House at Lake Tahoe. The Baldwin Hotel was built on the corner of Powell and Market Streets. It contained a fine theatre and a $25,000 clock from Tiffany's that not only told the hours, minutes, and seconds, but the turn of the tides as well. The hotel cost three million dollars to build and the carpets were $30 a yard.

Baldwin grew produce on his 8,000-acre ranch to feed his hotel guests. He had 500 acres in oranges, large groves of lemons, and 3,000 English walnuts, besides acres of soft-shell almonds, pears, peaches, apricots, prunes, figs and persimmons. His grape crop produced

This photo was taken in 1890, the year the depot was built. The "cab" at the left served the residents of the area.

In 1900, the year of this photo, there were six trains a day stopping at Santa Anita en route to Los Angeles.

In 1923 skirts were long and photography sometimes a little murky.

Views of the Santa Anita Depot from 1890 to 1969, showing its various transformations during its colorful history as the private railroad depot of E. J. 'Lucky' Baldwin, the public depot for the town of Santa Anita, and, finally, a soon-to-be dedicated state historic monument on the grounds of the Los Angeles State and County Arboretum.

This is the way the depot looked in May, 1940, when it was closed for the last time.

100,000 gallons of wine and 30,000 gallons of brandy yearly, both produced on the ranch. One of the specialties of the Baldwin Hotel was orange champagne made from oranges from his Rancho Santa Anita.

In 1904, six trains a day stopped at the depot. The agent's office was a busy place. The agent not only handled the freight and passenger traffic but ran the post office as well. In its reconstruction, this office will be furnished as it was in 1897, with a roll top desk, wall telephone, telegraph key, large floor safe, a big clock with a pendulum, and railroad equipment. The big two-burner potbellied stove will be located here also.

The waiting room, a kind of town hall for local citizens taking the train on its 45-minute run into Los Angeles, will be furnished with benches, chairs and a fireplace.

The agent's room was part of the three room living quarters of the station agent. It will contain some railroad supplies, as well as the kitchen and utility room. Oilcloth on the floor, ice box and stove will bring this room to life as it was in 1897. The agent's room and the waiting room will become part of the regular tour of the many visitors and thousands of school groups each year.

Upstairs will be furnished as the bedroom and parlor of the depot. In the 1897 period, a young woman, Nora Higginson, was station mistress. An effort will be made to furnish these quarters as they were when she lived there. One of her relatives, Hilda Redman, has given Miss

The depot in 1969, transplanted and in the process of being rebuilt in its new location south of the historical area.

Higginson's dropleaf desk, which will be an important attraction in the parlor. The upstairs will be open to small groups of five or six persons at a time on special occasions.

The Interior Furnishings Committee includes Mrs. John Mage, Mrs. Edna Lenz, Mr. and Mrs. Ralph Cornell, Mr. and Mrs. Ward Kimball, Mr. Bruce Wetmore, Mr. Russell Belous, Mrs. Frank Ziol, Mrs. Peter Douglas, Mrs. Herbert Hescher and Mrs. William Warren. They have been receiving small items and trunks as donations but they need large items such as a roll top desk, brass bed, oak dresser, sideboard, and a bin kitchen table.

The Santa Anita Depot will be an attractive addition to the historical section of the Los Angeles State and County Arboretum. It will be seen by thousands of people using Baldwin Avenue, and, unquestionably, will prove a magnet for railroad buffs of all ages.

CALENDAR 1970

March - May

FLOWER SHOWS

Arboretum — **Arcadia**

March 13, 14 and 15
Southland Orchid Show

March 28, 29
Aril Show

April 18, 19
Iris Show

April 25, 26
Amaryllis Show

May 3
Baldwin Bonanza Treasure Sale

May 9, 10
Geranium Show

May 17
Epiphyllum Show

May 29, 30, 31
Santa Anita Bonsai

June 6, 7
Bromeliad Show

June 20, 21
Gladiolus Show

Descanso Gardens — **La Canada**

February 28, March 1
Camellia Show

Month of March
Exhibit of Botanical Paintings — Miss Ethelynde Smith
Hospitality House

March 14, 15
Daffodil Show

Month of April
Art Exhibit—The Newcomers Art Club
Hospitality House

Month of May
Art Exhibit — Ruby Anderson
Hospitality House

South Coast Botanic Gardens — **Palos Verdes Peninsula**

March 21, 22
Los Angeles Bay Harbor District of Garden Clubs

April 18
Silver Spur Garden Club

May 19
Las Colinas Garden Club

LECTURES

At Arboretum

March 20 — 8:00 p.m.
"California Succulents and their Uses"
Mrs. Joyce L. Tate, Chairman
Uses Research Committee
Cactus and Succulent Society of America

At Descanso Gardens

April 8 — 8:00 p.m.
Robert P. Hays
Professor of Botany, Retired
Pasadena City College
"Wildflowers, Here and There"

BOOKSHELF

DESIGN CHARACTERISTICS OF PLANT MATERIALS by Gary Robinette, c1967; College Printing and Typing Co., 244 pg. Illustrated.

Sub-titled Plant Form Studies, this collection of scale drawings illustrates "The summer and winter silhouettes of many of the landscape plants of the temperate regions of the world." Intended for use as a guide for the landscape architect, these form studies should facilitate the process of visualizing the height, spread, branching, character and silhouette of the plants he wishes to combine.

THEODORE PARKER LUKENS: FATHER OF FORESTRY by Shirley Sargent, c1969, Dawson's Book Shop, 91 pg. Photographs and illustrations.

Those of us who find the early history of the San Gabriel Valley of interest, and that of the Arboretum of great interest, will be richly rewarded by a reading of this fine biography. Mr. Lukens, from his early years as a nurseryman in Illinois, through his many years in Pasadena (beginning in 1880) as nurseryman, real estate agent, forester, businessman and conservationist, was a man in tune with the community and its natural wonders. He envisioned a public Arboretum in Arcadia where it stands today and, until his death in 1918, labored to protect the forests he had planted in order to assure that the trees would "grow great and do good centuries after we are all gone."

RHODODENDRONS AND AZALEAS by Philip Edinger, c1969, A Sunset Book, 80 pg. Color photographs.

This is the latest in the excellent series of Sunset garden books, which deal with the culture of ornamental plants. Special features in this volume include Pruning Azaleas, Azaleas as Bonsai, Transplanting a Rhododendron and Azalea Flower Forms. Well-illustrated with both black and white and color photographs.

THE PHYSIOLOGICAL ASPECTS OF PHOTOSYNTHESIS by O. V. S. Heath, c1969, Heinemann Educational Books, 310 pg. Illustrated.

Mr. Heath intends this work to be of assistance to advanced botany students, and postgraduate research students, research workers in botany and related fields. He feels that recent advances in the chemical aspects may have led to neglect, both in teaching and research, of emphasis on photosynthesis by leaves of higher plants. Since the latter is a matter of prime importance for man's survival, an area of more urgent awareness these days, this text is worthy of attention.

THE ART OF ARRANGING FLOWERS. A Complete guide to Japanese Ikebana, by Shozo Sato; Harry N. Abrams, Inc. (bound and printed in Japan), 366 pg. Color photographs.

A magnificent burst of color and classic style nearly overwhelms the reader of this illustrated history and study course, a recent gift to Lasca Library. Mr. Sato has divided his work into six main parts, "Ikebana in Japanese History," "Ikebana Styles through the Centuries," "Equipment," "Techniques and Imagination in the Use of Materials," "A Basic Course in the Moribana Style" and "Advanced Ikebana." Impressive and comprehensive in its instructive sections, it is easy to read, understand and enjoy. Above all, however, the magnificence of the photographs are sheer delight!

Margaret P. Smith

Of Special Interest

FLOWERING PLANTS ORIGIN AND DISPERSAL by Armen Takhtojan, c1969, Oliver & Boyd, Edinburgh, 310 pg. Illustrated.

EASY PLANTS FOR DIFFICULT PLACES by Geoffrey D. Smith, c1967, W. H. & L. Collingbridge Ltd., 208 pg. Photographs.

TREES FOR ARCHITECTURE AND LANDSCAPE by Robert L. Zion, c1968, Reinhold Book Corp., 284 pg. Photographs.

MOLECULAR APPROACHES TO ECOLOGY by Marcel Florkin, c1969, Academic Press, 203 pg.

NATIVE PLANTS FOR CALIFORNIA GARDENS by Dara Emery, c1969, Santa Barbara Botanic Gardens, 34 p. Illustrated.

ARRANGEMENT OF BRITISH PLANTS, 4 vols., by William Withering, c1796, M. Swinney Co., Birmingham. Illustrated.

All available at Lasca Library.

Speaking for the Foundation

IT WAS MY pleasure to be part of the Arbor Day program at the Arboretum on March 7. It was a perfect day; the rains had ceased and everything was washed clean. The air was clear and warm. As I sat on the speaker's stand and looked over hundreds of San Gabriel Valley school children, I realized how important it was to instill in *them* the love of horticulture which our Foundation members cherish. In the few moments which I had to speak, I stressed that they develop a love of the Arboretum. I said they should consider the Arboretum as theirs, now, and in the years ahead. The tree being planted should be considered as theirs. They should come to watch it grow and bring their friends. Those of us in the Foundation should never overlook the opportunity to instill in our young generation the love of all growing plants, for they will carry on our job.

The membership committee of the Foundation now has a slide program to be used by members in speaking before garden, horticultural, civic and other groups to tell of the Arboretum and the Foundation. Our membership is close to 1,000. I would like to see us pass that figure this year. I ask all of you to do what you can by individual contact.

The Horticultural Hall planning is coming along well. The preliminary plan has been accepted by the committee. The brochure to tell of the Horticultural Hall and the need will be printed soon. Then we shall all have to work together to start raising funds for its construction. More will be said about this in the next issue of LASCA LEAVES.

Projects are the life blood of any service organization. Without them, there are no goals. Happily, the Foundation and the Arboretum are young compared to most other Arboretums. Although enormous progress has been made in the last 20 years, much is yet to be done. We need a flower show building as I have mentioned. There are many activities to be sponsored by the Foundation, far in excess of those at present. We need to build our membership; it is up to all of us to work together to achieve these goals. If you are an officer or a member of the Foundation tell people you belong and get them to join also. Our brochure will help you tell the story. Be sure you have some with you at all times.

Ernest Hetherington
President

Lasca Leaves

The official publication of the California Arboretum Foundation, Inc.

Sponsors of

LOS ANGELES STATE AND COUNTY ARBORETUM

301 North Baldwin Avenue—Arcadia, California 91006

Los Angeles County Department

of

Arboreta and Botanic Gardens

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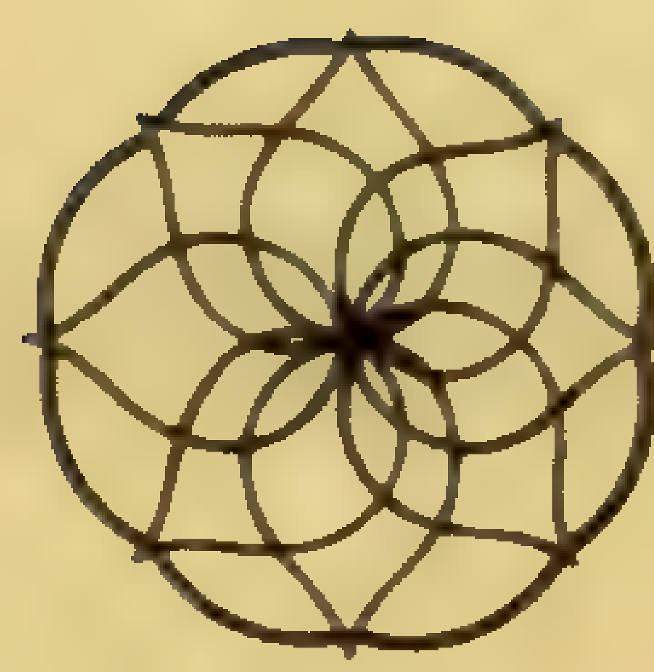
Arboretum Office — 446-8251



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The Cover

Arthrostylidium longifolium,
a graceful bamboo from Mexico
reaching a height of about 20 feet,
was introduced to the nursery trade
by the Arboretum in 1967. It is a good
container subject up to 3-4 feet.

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone (213) 447-8207

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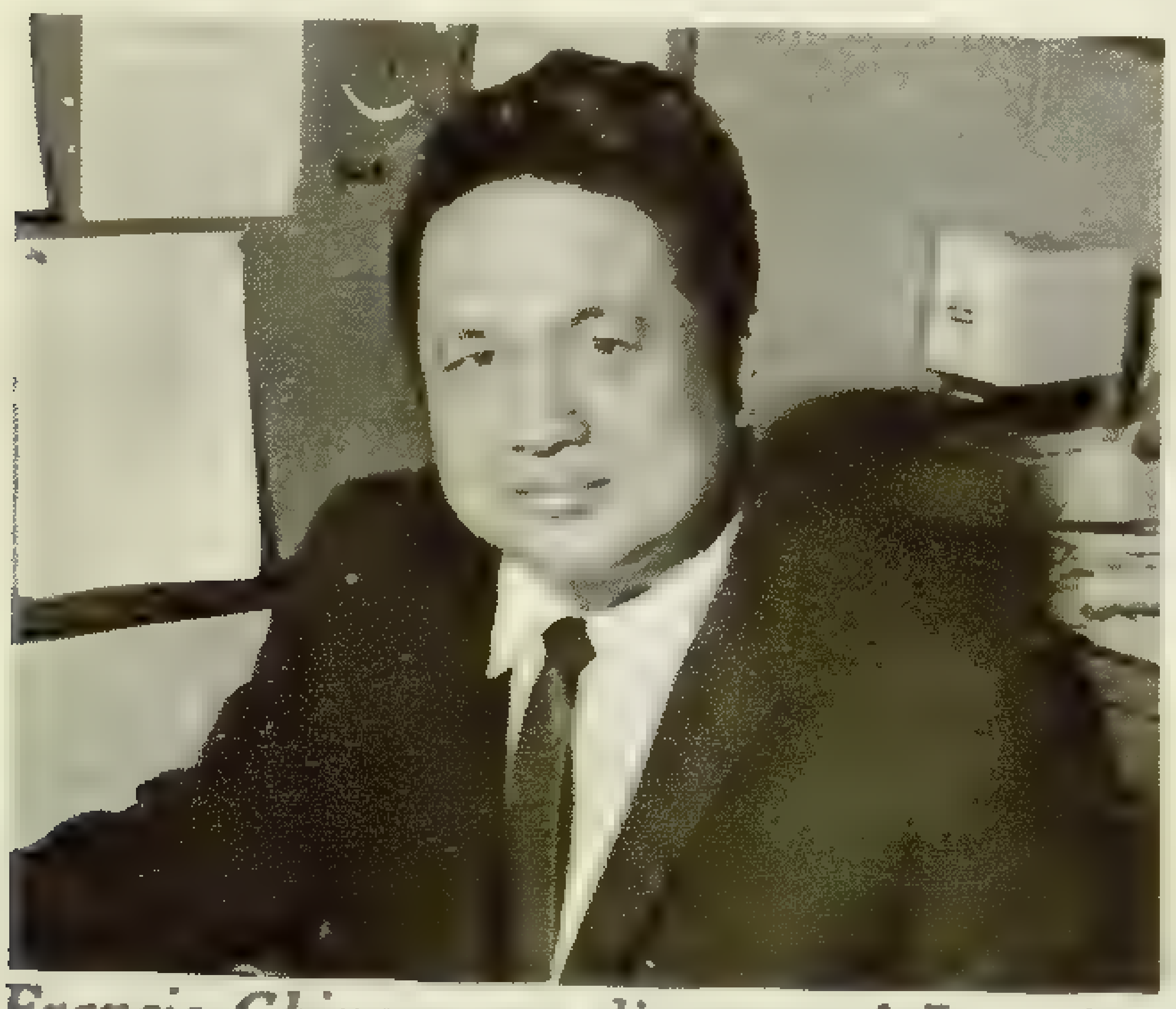
Arboretum notes

Director Appointed

ON MAY 5, the twenty-five member Board of Governors of the County Department of Arboreta and Botanic Gardens exercised its appointive powers for the second time in its seventeen-year history by elevating Arboretum superintendent Francis Ching to the office of director. The next day, the Board of Supervisors confirmed the appointment in a fifteen-second statement, thereby ending months of speculation and campaigning by supporters of the candidates.

In appointing Mr. Ching, the governors reaffirmed a county employment principle of promoting from within the ranks, and gained distinction by making him the first Chinese-American department head in Los Angeles County. For our new director the appointment culminates a rise from the bottom to the top rung of the organizational ladder in a period of fourteen years.



Francis Ching, new director of Los Angeles County Department of Arboreta and Botanic Gardens. MILTON BELL

It was in 1956 that Francis Ching signed on at the Arboretum as a grounds maintenance man, his first job in his chosen field after receiving first a B.S. and then an M.S. degree from Michigan State University. In the following years he put his academic knowledge at the service of the horticultural needs of the Arboretum, summing up at least part of his work in articles on gibberellic acid, air layering, fire-retardant plants, soil analysis, propagation of eucalyptus, and ground covers, written for this publication.

In recent years he has been especially interested in environmental problems and, during his term as superintendent, was able to implement this interest by limiting or prohibiting the use of certain highly toxic pesticides and herbicides. As director, he plans to broaden the department's work in the field of ecology through research projects and horticultural experiments and practices.

For the 130 men and women who staff the Arboretum, Descanso Gardens, and South Coast Botanic Garden, the new director is a man whom they have known for a long time on an informal, workaday basis, a relationship they can expect to continue.

CAF Election

THE ANNUAL membership meeting of the California Arboretum Foundation was held on June 4th in the Home Demonstration Gardens this year and got off to a particularly good start with a buffet luncheon that put everyone in a relaxed mood for the business to follow. One hundred and eighty members gave a warm welcome to former county supervisor John Anson Ford who is remembered as one of the key figures instrumental in establishing the Arboretum and the Foundation in the late forties.

Donald Camphouse, chairman of the nominating committee, presented the recommended slate of trustees for approval by the membership. Voted to the Board of Trustees for a three-year term were Harrison Chandler, Mrs. John Grivich, and Mrs. Chester Williams of Arcadia, and Dr. Jack Fowlie of La Canada. Reelected to the Board for second three-year terms were Mrs. Jerome Doolan of Los Angeles, Mrs. John Fehrer of Altadena, Judge Joseph Sprankle, Jr., of Pasadena, and Ernest Hetherington of Arcadia.

Dolores Hubbell, executive secretary of the Foundation, reported on the numerous activities of the past year and commended Las Voluntarias for their dedicated service to the Foundation and the Arboretum.

At the end of the meeting members went up to the new Research Laboratory Building to attend the dedication ceremonies and the open house that followed. Those who hadn't seen the damage resulting from last December's fire or the now landscaped Meyberg Waterfall, first took a special tram tour of the grounds that ended at the research building.

Later, everyone returned to pick up this year's plant distribution consisting of *Harpullia arborea,* an ornamental evergreen from Malaya, India and the Philippines that was introduced to the nursery trade by the Arboretum in 1968, *Osteospermum fruticosum,* the 'Burgundy Mound' South African Trailing Daisy introduced last year, and *Markhamia lutea,* an ornamental shrub or small tree native to Upper Guiana, Africa. This plant is being offered for testing and the Foundation would appreciate a report on growing results at the 1971 membership meeting.

Bonanza Report

THOUGH IT COULD not claim to have lived up to its name, that sometimes hectic, sometimes dubious, fundraising enterprise presented last May 2nd and 3rd under the title, Baldwin Bonanza, nevertheless proved an overall suc-

Auctions at the Baldwin Bonanza were conducted by Carlota Busch Flanigan and Fred Giersch. PETER DOUGLAS

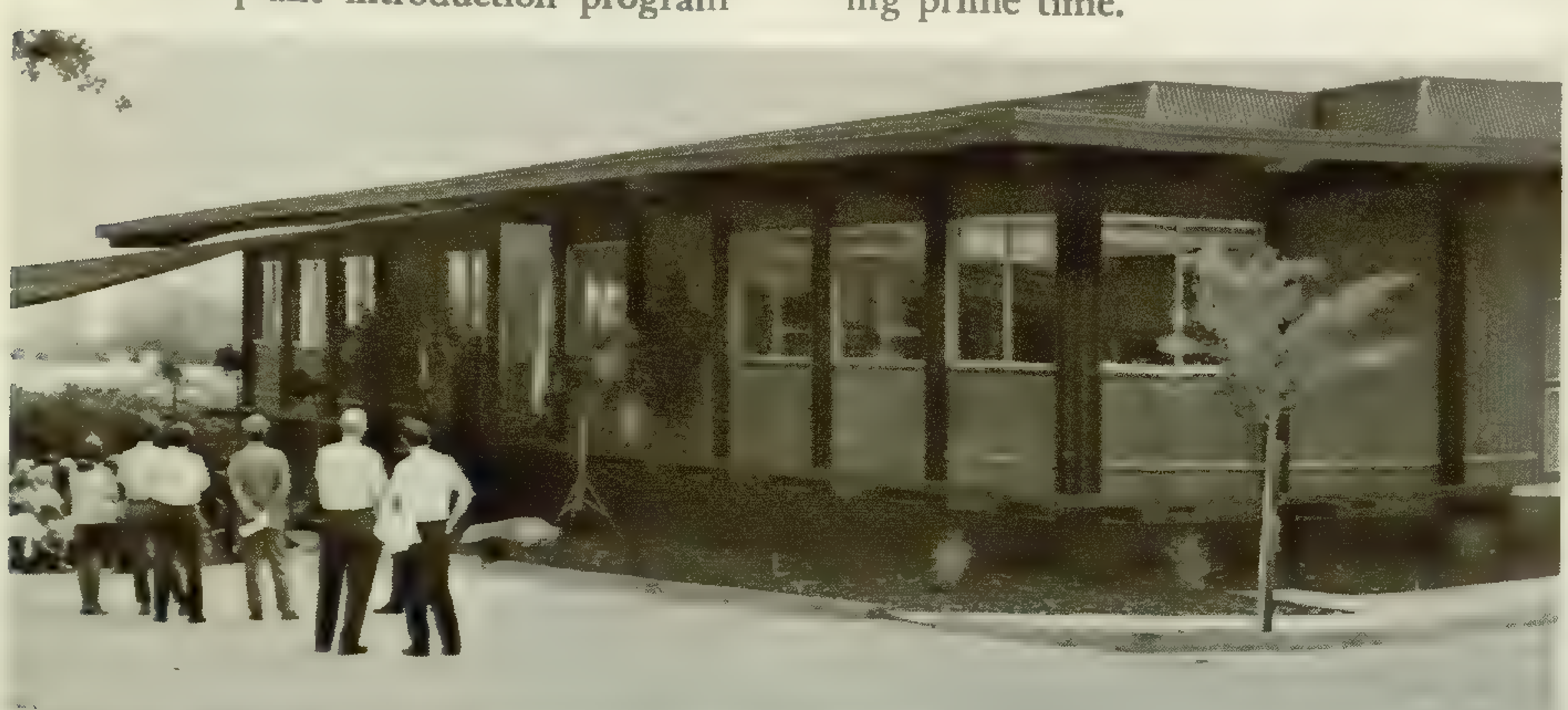
cess. There were some surprises when it came to toting up the results, a process still not complete. During the periodic auctions, many items went for less than their true value. In the language of the market, antiques and handcrafted items held firm, plants were bullish. Perhaps the most rewarding aspect of the project was the teamwork and spirit of close cooperation demonstrated from start to finish between Las Voluntarias, the California Arboretum Foundation, and members of the staff. Alice Douglas, Las Voluntarias secretary and co-chairman with her husband, Peter, of the event, summed it all up when she said: "Everyone did more than his job. I particularly want to thank all the chairmen; they worked long hours and manned their posts beautifully. A repeat performance? Why not. I think we all have ideas of how to do it better next time."

Research Lab Dedication

ON JUNE 4 at 2 p.m. before an audience of about 250 dedicated Arboretum supporters, F. Harold Roach, newly-elected president of the Board of Governors, opened the dedication ceremonies for the Research Laboratory Building with the customary pledge of allegiance. He then introduced our new director, Francis Ching, who, after a few remarks on the history of the building project and the aims of the research division, introduced Supervisor Frank Bonelli, who formally presented the building to the Department of Arboreta and Botanic Gardens. Mr. Roach then accepted the building on behalf of the department, and the ritual now having been completed with appropriate expressions of thanks and recognition along the way, everyone entered the building to see what architects, labor, and tax dollars had accomplished.

What they saw, in addition to some impressive-looking equipment in rather noisily air-conditioned laboratories, were a number of interesting and understandable displays set up by the research staff and volunteer aids illustrating different facets of current work activity — the plant pathology studies of research chief, Dr. Paul Cheo, involving oak root-rot fungus and various virus and bacteria; smog research studies of Dr. George Hanson; the long-term turf research of Dr. Hamilton Williams; rooting problems-and-technics of woody plants of Dr. Robert Gonderman; and fire-retardant plant studies along with the ecology of the different species of chaparral of Ken Montgomery. To many visitors unaware of the Arboretum's connections throughout the world, the displays of Dr. Leonid Enari were an eye-opener. One of the most important aspects of Arboretum work is its plant introduction program and the seed exchange program that goes with it. Dr. Enari had copies of his Index Seminum listing 318 species of plant seed available from the Arboretum, and reciprocal indexes from some of the 500 botanic gardens throughout the world with which the exchange program is currently active. The fruits of this program could be seen in photographs and descriptions of the trees, shrubs, and ground covers introduced to southern California in the Arboretum's brief 17-year history. Particularly fascinating to home gardeners touring the building were the insect displays of Dr. Harry Walker, separated in some cases into the good guys — ladybugs, bees, praying mantis; and the bad guys — mostly aphids of all kinds.

The open house continued through the following day to allow more visitors and, particularly, students to see the displays that had taken considerable time and effort to put together. Senior tour guide Bob Copper alertly re-routed trams to permit stops at the building and an invitation to riders to get off and go in and look around. The day before the dedication, CBS TV-reporter Ruth Ashton Taylor came out with her photographer-husband for a preview of some of the displays plus some general views (including one of a peacock) of the grounds. Her work was aired the following evening at 6:30 p.m., a good four minutes of first-rate reportage from the Arboretum during prime time.



Camptotheca Footnote

READERS WHO HAVE followed the story of *Camptotheca acuminata* in these pages — the donation of an Arboretum specimen, the search for and identification of other specimens, articles on the medical promise and the propagation of trees at Chico — will be interested in the following abbreviated version of a recent news release from the National Cancer Institute:

"A new drug called camptothecin that may be useful against advanced cancer of the intestine and rectum was described today by scientists of the NIH National Cancer Institute at the 61st annual meeting or the American Association for Cancer Research in Philadelphia, Pennsylvania.

"The findings, although preliminary, are especially important because cancers of the intestine and rectum strike 75,000 Americans each year and cause more deaths than any type of cancer except lung cancer.

"Drs. Jeffrey A. Gottlieb, Anthony M. Guarino, Vincent T. Oliverio and Jerome B. Block reported on results of administering camptothecin to 17 adults with various types of far advanced cancer treated at the National Cancer Institute's Baltimore Cancer Research Center. In each case the new drug, developed in government-sponsored studies from extracts obtained from a Chinese tree, was given because the patients no longer responded to conventional treatment.

"Dr. Gottlieb reported that the 17 patients, 9 of whom had advanced cancer of the intestine and rectum, were treated in a phase I or dose-establishing study in which the drug was given intravenously in a saline solution, in dosages from one-half to 10 milligrams per kilogram of body weight, usually at intervals of 2 weeks or more.

"Of the 9 patients with advanced cancer of the intestine and rectum, 4 patients achieved tumor reduction greater than 50 percent; in 4 others tumor masses decreased 25 to 50 percent. One patient of the 9 with gastrointestinal cancer did not derive benefit.

"In addition to the responses by patients with intestinal and rectal cancer, one patient with melanoma experienced greater than 50 percent reduction in tumor nodules; one adult with lung cancer and another with acute myelocytic leukemia had from 25 to 50 percent decrease in tumor mass or manifested other objective evidence of tumor regression.

"Durations of response were brief. Half were under 2 months, half longer than 2 months. The longest lasted 5 months.

"Four patients died 7 to 17 days following drug administration from kidney and lung complications but their deaths did not appear to be directly drug-related. Toxic side effects of camptothecin were varied and generally manageable. For instance, the major limiting toxicity was bone marrow depression which, in some cases, necessitated transfusions of blood platelets. Hair loss and weight loss were frequent but were reversible upon cessation of therapy. Hemorrhagic inflammation of the bladder occurred in some patients but appears to be preventable by maintaining high urine flow through administration of large quantities of water and other fluids.

"Cooperation between the Department of Health, Education, and Welfare and the Department of Agriculture in planting thousands of *Camptotheca acuminata* seedling trees in Chico, California is providing sufficient amounts of camptothecin for use by the research team at the NCI Baltimore Cancer Research Center. However, the drug continues to be in short supply.

"The most promising approach to obtaining large quantities of drug now, according to Dr. Saul Schepartz, Associate Scientific Director for Chemotherapy, National Cancer Institute, is to synthesize camptothecin chemically. Attempts are being made to produce a synthetic camptothecin product in several NCI-supported laboratory studies."

The Tanbark Oak

Ross Goodrich

A TREE THAT COULD be used more often in southern California landscaping is the tanbark oak, *Lithocarpus densiflora.* It is a good shade or street tree and is attractive as a shrub in its earlier years.

Pasadena has some very good tanbark oak trees and also Rancho Santa Ana Botanic Garden in Claremont where they can be seen in various stages of growth. The arboretum in Arcadia has a handsome young tree that is illustrated here.

The arboretum's tanbark oak is in the Bertholet Glade just west of the Meyberg Waterfall where it is probably most often seen by visitors as a large shrub. It is a little over fifteen feet tall, ten feet in width at the ground and evenly branched to the top in the shape of a Christmas tree. It is a light green color through most of the year and this is only changed in the spring when the appearance of the new growth puts pale yellowish tips on all the branches, or when the chestnut-like flower spikes show up at this same time.

The leaves are from two to five inches long, mostly elliptic in shape and very often, but not always, sharply toothed at the margin. Although the tree does not get its most common name from this particular quality, its leaves are very leathery and stay on the tree from three to four years.

The arboretum specimen is a beautiful young tree, but it is not offered as a prime example of what the tanbark oak can do in this area. Its growth was slow at first, possibly from the judgment that because a plant has grey-green leaves it can go dry for a long time, or the fact that it was in a difficult spot to water. When one of the arboretum gardeners said he thought the tree was being kept too dry, the watering was increased and it soon began to grow faster. Other tanbark oaks in the local area bear this out, especially where they are used as street trees and get water from the adjoining lawns.

It is a bit puzzling as to why this tree has not been planted more often in southern California where it seems to find a reasonably acceptable environment. It is available in only a few nurseries because most cannot afford to carry a slow-selling item for long.

KNOWING THAT the tree could possibly get to be one hundred and fifty feet tall could surely be against planting it, but in our area unless it is crowded among other tall-growing trees, there seems to be little chance of its getting to over fifty feet in a person's lifetime. From sixty to seventy and occasionally up to ninety feet tall in its native area is quite an accomplishment. There seems to be a strong need in many people always to want a plant from some distant land. If it is a native they just won't have it. Often a search for something different or better can be admirable and it has led to some important discoveries, but it can also suggest a need for something new just for newness' sake when it ignores a quality plant that is close at hand.

Though it is a native Californian, *Lithocarpus densiflora* is not found native in the southern third of the state. Its home area starts just above the outskirts of Santa Barbara and extends northward through the coastal ranges to southern Oregon. Inland it grows in the Sierra Nevada from just about Yosemite north.

It gets to its greatest height in the redwood forests where it successfully meets the competition of these and other tall-growing trees. Here it loses its lower branches up a good part of the trunk and has a cone-shaped head like the conifers. This is rare for a broad-leafed evergreen tree. According to one reference the age of these trees can be quite impressive — up to five hundred years, which would give them plenty of time to reach these great heights.

In more open areas and towards the southern limits of its range it is broader and more round-headed. This could reasonably be assumed to result from climatic and environmental factors because the more mature local trees in general follow this pattern.

Tanbark oak in Arboretum, dwarfed by coast redwood in background.

THE COMMON NAMES for this tree are most interesting. In addition to the tanbark name, it is also called the tan oak, burr oak, chestnut oak, sovereign and squaw oak. This is quite a number considering it is not really an oak at all, but a close relative. The derivation of the name chestnut oak is easy to understand. The flowers do look like chestnut flower spikes. The sovereign oak name comes from the ability of the tree to hold its head up and stand above its surrounding competitors for space in a crowded forest. In Humboldt and Mendocino counties where the natives used the acorns for bread-making the name was squaw oak. It is an amusing thought that except for man's determined effort to keep the female of his species as a second class citizen the tree could possibly have been called Indian oak.

Commercially the tree was widely harvested for tanning leather. The Indians used it first, but the white man went at it in a big way. In the first decade of this century as many as one hundred thousand trees were cut in one year for their tannin content. After the bark was taken off, the tree was cut up for firewood, although being a hard, fine-grained wood it could have been used to make furniture or other items. Luckily, other sources of tannin showed up and this great cutting stopped. The trees were too inaccessible to bring out just for lumber as long as other woods were available, so for a long time now the possible extermination of the tanbark oak is hopefully past.

PASADENA HAS USED this *Lithocarpus* as a street tree in limited numbers. On Euclid Avenue between California Boulevard and Cordova there are fifteen trees that vary in height from twelve to about forty feet. Almost all of these have a broad cone shape, except the younger ones which are more narrow. The tallest tree on this street has a trunk eighteen inches thick and the smallest a third of that. All of them are evenly branched.

On Atchison Street in the four and five hundred blocks east of Los Robles there are half a dozen varying from twenty-five to forty feet tall and from fifteen to thirty feet across. In the block west of Los Robles on the same street there are four of about the same size. Some of these could be taken for holly oaks at first glance, except for their distinct shape, and are planted here and there between cinnamomums and other trees. However, two of the largest are quite rounded and called for a closer inspection to see if they had been pruned to that form, but there was no sign of it. On Los Robles below Atchison there are a few more, one about forty feet but the rest smaller.

Near the Raymond and Holly Street corner of Memorial Park is a good specimen of some thirty-five feet in height and almost the same width. It is in the lawn just west of the Pasadena Senior Center, and while it maintains the same general shape of the trees on Atchison and Los Robles, it is slightly more informal in the outline of its branches. Just north of the Center building is another of about twenty feet in height.

Leaves of tanbark oak are leathery, serrated, and covered with a light wool. Male flowers are small and white.

AT THE RANCHO Santa Ana Botanic Garden, always a beautiful and interesting place to visit, there are fifty tanbark oaks.

They constitute an impressive collection easily found in two main areas: the Demonstration Garden and Administration Building area, and the plant community section in the northern part of the garden.

Two trees are just south of the Administration Building and five are nearby to the northeast. There are four south of the Demonstration Garden and four to the north, three of which are planted so closely together they look like one tree. Just to the east along the nature trail is the garden's tallest specimen, a tree about fifteen feet wide and a little over thirty feet tall. This is slightly on the narrow side for a tree of its eighteen years or so of age, but this could be accounted for by its location among other trees that are similar in height.

In the plant community section there are more than thirty trees, some in the evergreen forest but most in the northern oak woodland. The trees here are shorter, with shapes suggesting their use as a shrub for landscaping, or even for tub planting.

All in all, the trees mentioned should be enough to give one a reasonably good idea of how *Lithocarpus densiflora* does here in southern California. From the standpoint of maintenance, it is quite insect free and gives every evidence of surviving in our climate with minimum care. As for its esthetic values, most people seem to think it is beautiful. These are all admirable qualities; enough, it is hoped, for more people to give it a trial.

NOTICE

The Holly Society of America and the International Registration Authority for cultivated *Ilex* (holly) wish to announce a change in the place of the registration authority *from* the College of Agriculture and Environmental Science, Rutgers, the State University, New Brunswick, New Jersey with Dr. E. R. Orton, Jr., as registrar, *to* the U.S. National Arboretum, Washington, D.C. 20002, with Mr. G. K. Eisenbeiss as registrar.

A Partial Pollution Solution: Plant Trees!

by George P. Hanson and Linda Thorne[1]

RECENT STUDIES at the Los Angeles State and County Arboretum show that plant leaves have the capacity to trap significant quantities of smog. Species of plants differ considerably in this capacity. Over a short period of time, extremely smog resistant plants absorb very little, whereas extremely sensitive plants absorb considerable quantities. However, an extremely sensitive plant will be quickly killed and consequently will cease functioning as a smog trap. With these factors established, a major study has begun to identify those plants capable of absorbing significant quantities of smog while maintaining relatively normal life processes.

A few years ago Stewart and Wilken[2] reported that the smog level was significantly reduced beneath a tree canopy. They compared the concentration of the smog a few inches above a tree with the concentration a few inches below the tree leaves and attributed the difference to shade. We know that the hydrocarbon and nitrogen oxides pollutants emitted by the automobile combine to yield the noxious vapors ozone and PAN (peroxyacyl nitrate) which are the major components of smog in the Los Angeles area. PAN is an important contributor to eye irritation from smog while both PAN and ozone produce characteristic symptoms on plant leaves. The synthesis of PAN and ozone in the atmosphere requires oxygen as a reactant and sunlight as an energy source. If any of the reactants (hydrocarbons, nitrogen oxide, or oxygen) are absent or if sunlight is lacking, the reaction cannot occur and smog will not be formed. Stewart and Wilken reasoned that the tree leaves effectively screened out sufficient sunlight to prevent or retard the rate of smog synthesis beneath the canopy.

In the absence of air currents this is probably true. But breezes are seldom completely lacking, even under trees. With this in mind, we decided to test the ability of a plant to absorb or trap smog. We inserted a petunia plant into a piece of equipment we had constructed to measure the effect of ozone on transpiration. But instead of measuring the impact of ozone on water loss by the plant we compared the concentration of ozone injected into the plant chamber with the concentration which left the chamber after flowing over the plant leaves. We were impressed with the quantities of ozone which the petunia plant could absorb without showing visible symptoms of damage and subsequently began testing other plants. Our preliminary data indicate that petunias are very efficient ozone absorbers while camellias absorb very small quantities of the pollutant. Bougainvillea is intermediate in behavior.

DURING THE TIME the plants were being exposed to ozone in our test chamber, we were also recording the status of the plant's stomates. A stomate is a tiny pore in the surface of a leaf which can be opened or closed by the plant as a response to its environment. A pair of cells surround this pore and guard it. These guard cells regulate the size of the stomatal opening in response to stimuli they receive from the environment. The function of stomates is to allow gas exchange between the leaf interior and the outside environment. Carbon dioxide molecules are combined with water molecules within the cells of the leaf, utilizing light energy from the sun (another photochemical reaction). Sugar is produced which the plant may translocate to another portion of the plant for storage or growth. A byproduct of this reaction is oxygen which is a waste gas as far as the photosynthesizing leaf is concerned and must be removed. During the night this same leaf requires oxygen to conduct its normal life processes (respiration). A plant obtains the necessary water for this reaction from its roots. In order for a leaf to function properly as a photosynthetic organ, its inner cells must be moist. Because of this moisture, much of that water extracted from the roots evaporates from these cells and escapes through the stomates if they are open. During a hot, dry day, however, a tree is incapable of pumping enough water from its roots to its leaves to allow all this water loss. As a consequence, the guard cells close the stomates.

It is through these stomates that air pollutants are able to enter and damage the leaf. An ozone-resistant variety of onion has been found which is resistant precisely because its guard cells are sensitive to ozone and quickly close the stomates, thereby preventing leaf damage. Our experiments with several plants showed that if we exposed plants to high concentrations of ozone which will quickly damage the tissues, the guard cells also close and no further ozone is absorbed. However, if the ozone concentrations are kept relatively low (around the school alert level) most of the stomates remain open and ozone is trapped. If we want to trap smog we must provide an environment that will cause the plant's stomates to remain open.

We propose and are testing the following idea for protection of homes, playgrounds, picnic areas, and the like: First, the area must be enclosed by tall trees which lightly shade the space to be protected; second, the protected region must have reduced wind currents (to prevent smog from moving into a relatively free area) therefore shrubs should enclose the lower portion around the tree trunks. The trees and shrubs so far recommended must be fairly smog tolerant since they will be exposed to whatever has been produced in the city. Since these plants must be smog tolerant, they will remove some but probably not large quantities of smog from the area. Within the protected area we should next plant trees, shrubs, and vines that are intermediate in smog tolerance. These plants should absorb large quantities of the pollutants allowing the remaining area to be landscaped with shade-loving plants which will absorb more of the smog and bring it down to a level which is relatively harmless to the people within the area.

Plantings done in this way will offer several advantages. They will add beauty, they will serve in some degree as a hedge against noise pollution, the protected area will be cooler than the outside, unprotected area, humidity will be a little higher making for a generally more comfortable atmosphere, and, if our hypothesis is correct, the smog level will be considerably reduced.

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[1] Geneticist and Research Assistant respectively at the Los Angeles State and County Arboretum, Arcadia, Calif.

[2] Stewart, W. S., and D. H. Wilken. 1966. "A report on the effect of shade trees on smog." Lasca Leaves, Vol. XVI, No. 4, pgs. 84-85.

INQUIRY

A few years ago the CAF presented to its members as part of its annual distribution, plants of the Prairie Gentian (Eustoma Russellianum). The Arboretum would like to know what success members had in growing this attractive plant. Did it grow in sun or semi-shade? Did it hold over easily through the winter or reseed itself? Any information on the luck or lack of same in growing this plant will be appreciated. Please address replies to the Foundation with the words Prairie Gentian on the outside of the envelope to facilitate the tabulating of information.

Mulching vs. Lawns at the Arboretum

Francis Ching

FOR MANY YEARS mulching practices at the Arboretum were carried on only to a limited extent. One reason was that since the Arboretum is adjacent to the Santa Anita Race Track, a great number of residents in the immediate area have always been conscious of flies and have related any kind of mulching and composting with fly infestation. Many times in the past, the Arboretum has been able to obtain manure as well as bedding material from race tracks, yet, despite thorough inspections by the County Health Department, the fly problem has been erroneously blamed on the Arboretum.

Another reason why mulching practices have been resisted is that it was thought the general public would not appreciate large mulched areas as compared to a well-manicured lawn.

Further, there was the question of salts and possible damage to plants from an accumulation of salts from manures. In the final analysis, it was determined that if manure were properly used as a mulch, salts, if present in even damaging proportions, would be leached away before being able to cause any damage.

A fear that slopes heavily mulched would be subject to severe erosion from heavy rains or irrigation practices was thoroughly discounted by a timely demonstration.

Although mulching to any extent had not been practiced since the Arboretum was started in 1949, and plants apparently grew "all right," serious consideration was given in 1964 to a review of its advantages. It was well known that in the early days of development, whatever topsoil there was, was scooped up, pushed around and eventually lost. Not only were there hardpans present in many areas but surface layers were also compacted due to heavy equipment causing poor aeration and an intolerable condition for adequate infiltration and percolation of moisture. It was glaringly noticeable following heavy winds in 1962, 1963, and 1964 that many trees were lost due to uprooting. All of these uprooted trees possessed a very shallow root system which made them prime candidates for "pushovers." In addition, during digging and moving operations of large trees, many of the plants also had a very shallow root system which made moving operations quite difficult.

Realizing the poor soil conditions, checks were made on actual moisture penetration. Even after a relatively heavy rainstorm of two inches in twenty-four hours, moisture penetration amounted to as little as two inches in some areas. Checks made after leaving rainbirds on for seven hours showed that moisture penetration was less than four inches.

POOR ROOT SYSTEMS coupled with poor soil moisture penetration brought the sudden realization that irrigation practices were insufficient. This situation was worsened by the fact that it had always been more important to irrigate according to the needs of the lawn, taking it for granted that the trees and shrubs were receiving adequate amounts of moisture.

Maintenance of a lawn in a heavily planted area poses many problems besides watering. Having to mow regularly between plants subjects plants to possible damage. On the other hand, if lawns are not adequately mowed, the area takes on an unkempt appearance. In order to keep all lawn areas mowed during the spring, summer, and fall months, six men were assigned to the task. This did not include the great amount of time necessary for servicing and repairing the equipment.

Besides mowing, it was also necessary to spend endless hours in hand trimming grass away from the base of trees and shrubs. When this is not done regularly during the summer months, Bermuda grass has a tendency to climb up into the low branches of shrubs and up the sides of tree trunks.

(This is the first part of a two-part article.)

Ideas from One Man's Garden

Mr. and Mrs. Harrison Chandler live in an area of Arcadia that Spanish settlers called Los Robles de Santa Anita after the oak groves they found there. Like the rest of the city, it was part of famed Rancho Santa Anita.

The Chandler house was built thirty-five years ago by Mr. Chandler's brother, Norman, and even then the framework of the surrounding garden had been established by long standing oaks and other woody perennials. Its character today reflects the taste and interests of Mr. Chandler who ten years ago gave up the pursuit of bogeys and birdies on the fairways in favor of the endless challenges of horticulture.

Curiosity, of course, is one of the main occupational syndromes of gardening, and is inspiration enough for over-the-fence views of any garden that looks as if it might be interesting. By reason of its size — four acres — its unstudied diversity, and the ideas it suggests to even the most casual home landscaper, the garden of the Harrison Chandlers deserves closer inspection.

Magnificent 175-year-old Pasadena oak (Q. engelmannii) guards entrance (upper left); Brazilian trumpet vine (Clytostoma callistegioides) covers eaves in front; mondo grass and kumquat in painted beer-keg sections line brick walk.

Architectural beauty of this Engelmann (Pasadena) oak speaks eloquently for conservation. Mr. Chandler sprays his oaks twice a year and feeds about once a month in growing season at drip line through holes in patio. In lower left of picture, ears of "Pedro Conejo," English ivy on a wire frame, stick up above hedge of rounded Japanese box. Evergreen pear (Pyrus kawakamii) is espaliered on wall (right) of house.

In patio beneath oak, Sloop (left above), a basset hound who enjoys run of grounds, drinks from dog fountain filled from bamboo pipe connected to standpipe. Selaginella grows over moist rocks alongside, together with English primrose, mondo grass, clivias, and begonias. Above, hanging baskets of Boston and asparagus ferns, bromeliads, and ivy, interspersed with mica tinklers, ships' bells and other odds-and-ends collected in travels and at Merryvale's in San Francisco, give interest to otherwise routine California patio setting. Left, a close view of "Pedro Conejo" and walk to patio, bordered (on left, under oak branch) by hedge of creeping fig (Ficus pumila).

This well-planned pool and adjoining patio in which Mr. and Mrs. Chandler can entertain several hundred guests at one time, is landscaped with a great variety of plants located so as not to cause litter in or around the pool. Commanding the scene is a tall, fifty-year-old liquidambar. At bottom of steps in front of windmill palm are containers of crape myrtles (Lagerstroemia indica). East end of pool is protected by hedge of natal plum (Carissa). A fifteen-foot section of the east wall of the patio is covered with espaliered Eureka lemon. The south side of the pool (not seen) is lined with a row of hibiscus, a red-flowered shrub from China we have not been able to identify, and a low, brick wall covered with pots of verbenum.

The picture above is of the area just to the right of the entrance to the patio. In the foreground, a circular, wrought iron stand of pots contains Mexican marigolds (Tagetes), behind them a large planter of Jade plant (Crassula argentea), and beyond that, a philodendron (P. selloum). The two carved wooden figures between were picked up by Mr. Chandler in Hawaii. To the left of the marigolds is a container of yellow-flowered South African bush daisy.

Planters for patios are an invitation to invention. Not difficult to duplicate are those shown upper left: tree cactus (Cereus peruvianus), brownbean sedum (S. rubrotinctum), and haworthia, a succulent of the lily family; and below: a piece of feather rock with cavities filled with succulents. A bit more difficult (lower left) is the cutleaf Japanese maple (Acer palmatum) in container with feather rock and baby's tears (Soleirolia soleirolii) with iris in container overhead. In the cutting garden (upper right) a Mexican pot (foreground) contains ever-bearing strawberries at a nice height for picking and, beyond, saraband roses, colorful lobelia, iberis or candytuft, Transvall daisies (Gerbera jamesonii), and kalanchoe. Below, Dr. Enari (left) of Arboretum staff, and Mr. Chandler survey plot of South African trailing daisy through which runs a circulating stream. Structure in background is painting studio of Mrs. Chandler.

Mr. Chandler, who keeps a notebook of feeding and other schedules in a lath-house adjoining an orchid house and what he calls his "gardener's kitchen"-compost heap, potting soils and the like — avoids use of chemical pesticides wherever possible. Upper left photo shows egg sac of praying mantis which feeds on aphis and mealy bugs. He uses these particularly in his citrus orchard. Directly below, he and Dr. Enari stand in front of chrysanthemums (kept healthy by ten pounds of lady bugs) that Mr. Chandler is growing for his own flower show. Concord and Thompson grapes are growing in trellis in background. Cinquefoil (Potentilla fruticosa) in right of picture (bottom left) is popular in the East and in Europe, but not very common here. To the left of the yellow-flowered cinquefoil is Veronica langifolia, somewhat uncommon in Southern California. Other flowers are double-flowered daisies, a Chrysanthemum maximum hybrid. The photo top above shows the inner yard through the unleafed branches of a flowering coral tree. The grass is St. Augustine, as is all the lawn area. And finally, the questioning look of Skiff — ball player, fruit picker, and photographer's friend.

D.D.

Lasca Leaves

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Sponsors of

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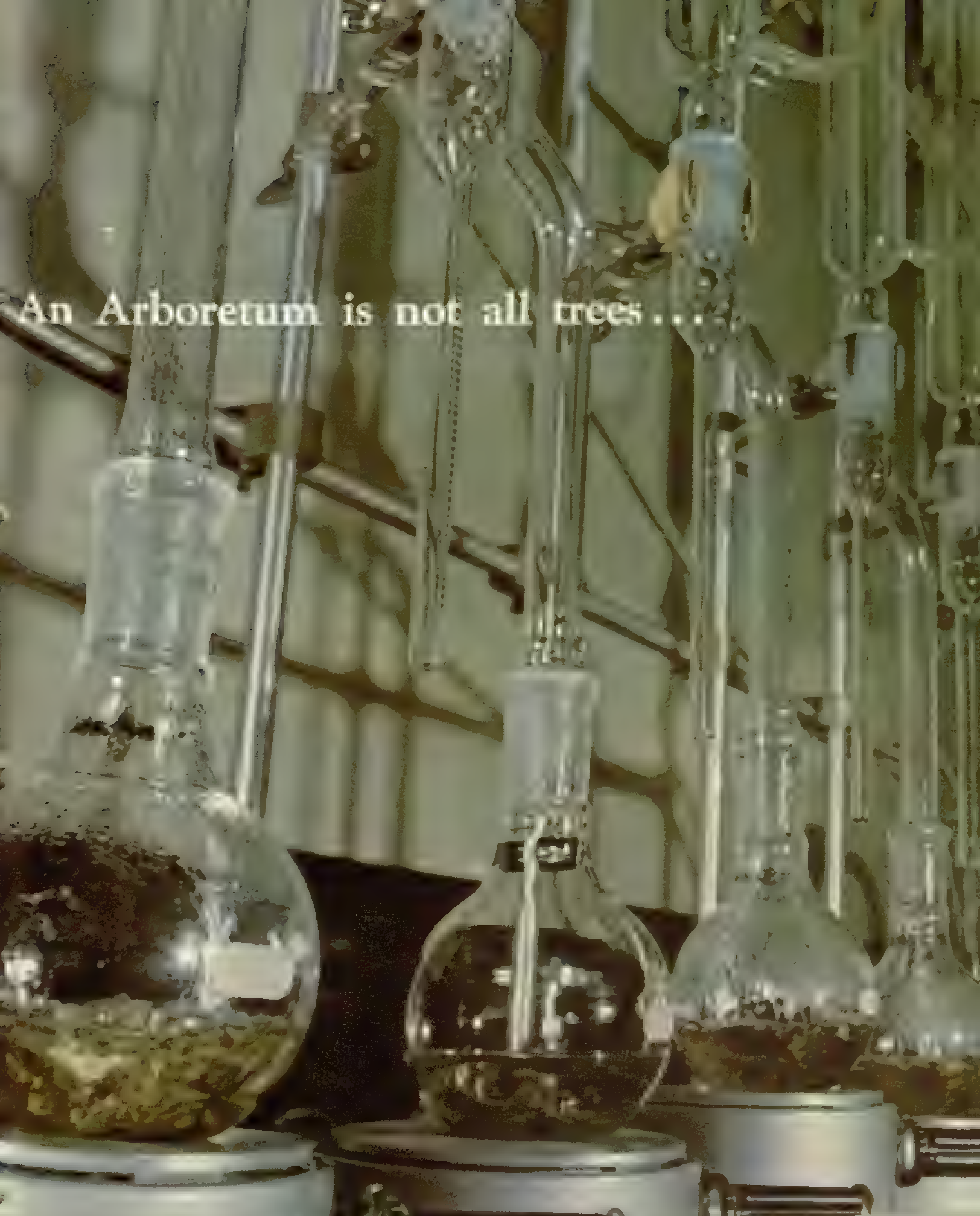
An Arboretum is not all trees . . .

BOOKSHELF

FLOWERING VINES OF THE WORLD by Edwin A. Menninger. Hearthside Press, Inc., New York. 1970. 410 pg. Illustrated in black and white and color.

The author is well known for his books on plants of the warmer regions of the world. In this, his latest effort, he has had the active collaboration of 50 plant scientists in all parts of the world. The result is a solid book of permanent value for a well-rounded library on ornamental plants. Since authorities are given for the Latin binomials, this book will also be of interest to botanists. It is truly international in scope. Although the main emphasis is on flowering vines, those which have foliage or other values are included. Some are even denounced as dangerous pests. Espaliers of shrubs and trees are discussed, and also the various modes by which plants attach themselves for climbing.

The descriptions are extensive and give many distinguishing characters. Together with the excellent illustrations in black and white and color, they should assist in identification of species, although there are no keys.

The author believes that ornamental vines are somewhat neglected but have many potential uses. Their values include attractive foliage, color, fragrance and occasionally fruits or other economic products. The author points out many interesting facts regarding vines. For instance, the bulk of the vines are found in less than a dozen families. The tropical regions are the areas in which most of the species are found and they are much less common in temperate zone forests. Vine growth is sometimes so heavy in tropical forests that it creates difficulties in felling trees, which then have to be handled in a group. Numerous instances are cited in which the plant habit changes drastically in different stages of growth.

The book is so attractive in printing and in illustration that it would be an ideal gift book. Books of this type often do not remain in print over a long period and should be added to a collection while easily available.

V. T. Stoutemyer

USING WAYSIDE PLANTS by Nelson Coon. Hearthside Press, Inc., New York. 4th revised edition. 1969. Line drawings.

This pleasant guide to the quiet pleasures and simple uses of plants collected along the wayside, seems remote from the crowded speed of southern California highways.

Mr. Coon, a former nurseryman, must have spent many hours of happy roaming over the northeastern United States before producing his book in 1962. In this expanded 1969 edition he notes that many of the plants included cover a wider range of growth. He points out that true conservation lies in intelligent use of plant life rather than in total preservation. He then recounts the products of many wild plants found about the house, and provides recipes for food and drink obtainable from edible ones. He urges imaginative use of plants as ornament, both the living plant transferable to cultivation and the careful cutting from other native species adaptable to decorative use because of beauty, fragrance and graceful form. He makes numerous suggestions for plant craft, and includes ideas for teaching and amusing the children who take part in the outdoor explorations. A chapter on dyeing gives specific information on process and colors. There is detailed instruction for the popular potpourri. Plant medicinal properties are discussed, with an interesting variety of homely remedies suitable for immediate use in roadside emergency.

Mr. Coon's love of his subject appears in the make-up of the book, with the pleasing black and white line drawings from nature patterns, and the appropriately chosen literary quotations prefacing each chapter.

Section Two describes one hundred plants, identified in line drawings, with general habitat located in a small map drawing, and bits of lore and fanciful legend enlivening the factual text. This section divides into trees, shrubs, herbaceous plants, water plants, lichens and fungi, and plants which are poisonous. The botanic and common names are given, and the information is simply stated for the non-scientific reader.

This is a handbook for the nature lover who likes to do his own exploring and planting, for the camper, the boy and girl scout, the unhurried wayside traveler. An alphabetic index aids in quick reference, and a varied bibliography leads to further knowledge. Once delved into, the miscellany of botanical information enthusiastically assembled in this little book, keeps the pages turning to the end.

Beatrice Boore

Of Special Interest

THE ODYSSEY BOOK OF AMERICAN WILDFLOWERS by H. W. Rickett, Odyssey Press, c1964, 252 p. Color photographs.

FLORE DU SENÉGAL by Jean Berhaut, Editions Clairafrique, Dakar, c1967, 485 p. Color photographs and black and white illustrations.

FLORA VON MITTEL-EUROPA, 7 vols. Dr. Gustav Hegi, J. F. Lehmann, Munich, c1906. Color and black and white photographs.

THE FLOWERING WORLD OF "CHINESE" WILSON by Daniel J. Foley, Macmillan, c1969, 334 p. Photographs.

WEST AMERICAN OAKS by Albert Kellogg, James MacDonald, c1889, 84 p. Illustrated.

MEDICINAL PLANTS OF JAPAN by Jisuke Takatori, Hirokawa Publ. Co., Tokyo, c1966. Color illustrations.

FLORA OF MANILLA by E. D. Merrill, J. Cramer, Lehre, reprint of 1912 edition, 490 p.

THE GARDENER'S DICTIONARY by Philip Miller, Sixth and Eighth editions (1752 and 1768), London. Illustrated.

THE ART OF GARDEN DESIGN IN ITALY by H. Inigo Triggs, Longmans, Green & Co., London, c1906, 135 p. Photographs.

JARDINS D'ESPAGNE, 2 vols., by George Gromort, A. Vincent, Paris, c1926. Photographs and illustrations.

THE PHYSIOLOGICAL ASPECTS OF PHOTOSYNTHESIS by O. V. S. Heath, Heinemann Educational Books, London, c1969, 1310 p. Illustrated.

GARDEN TREES AND SHRUBS IN AUSTRALIA by Harold Sargeant, Macmillan of Australia, c1968, 216 p. Color photographs.

YOUR FLORIDA GARDEN by John V. Watkins and Herbert S. Wolfe, Univ. of Florida Press, c1968, 382 p. Photographs.

CALENDAR 1970

July-August-September

FLOWER SHOWS

Arboretum — Arcadia

July 3, 4 and 5
Cactus and Succulent Show

July 11 and 12
San Gabriel Valley Begonia Show

Descanso Gardens — La Canada

July (date to be announced)
Musical Entertainment

September 26 and 27
Annual Bonsai Show

South Coast Botanic Gardens — Palos Verdes Peninsula

July 17, 18 and 19
Annual Flower Show
"Fiesta Las Flores"

SPECIAL EVENTS

Museum of Science and Industry — Exposition Park — Los Angeles

June through July 12
Science Fair Projects by Roderick R. Young

June through July 26
Ceramics, crafts and furniture exhibits

June through August 23
Works by student and instructors of photography

County Museum of Art — Wilshire Boulevard — Los Angeles

June through July 19
"Old Master Drawings from Chatsworth" from the collection of the Duke and Duchess of Devonshire

Old Globe Theater — Balboa Park — San Diego

June through September 13
Shakespeare Festival

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The Cover

Harpullia arborea was introduced to the nursery trade by the Arboretum in 1968. Native to India, this evergreen tree grows to 35 feet and features ornamental bright red fruit in clusters.

Arboretum notes

Promotions

TWO STAFFERS with 31 years of service to the department between them have changed work sites and positions as a result of earning top grades in competitive examinations and the endorsement of Director Francis Ching.

Frank Simerly, assistant superintendent at Descanso Gardens for the past ten years and at the Arboretum for the previous eight in several capacities, has returned to the Arboretum as superintendent. George Lewis, recently senior gardener at the Arboretum where he started as a maintenance helper in 1957, has moved over to Descanso to fill the vacated post of assistant superintendent.

Garden Work Center

TWO GREENHOUSES with separate environmental controls, a lath house, and a potting shed, make up the new garden work center now being completed as an extension of the Home Demonstration Gardens.

The purpose of the center is to provide facilities for public demonstrations of various horticultural practices. The first demonstration, scheduled for mid-October, will be concerned with the growing of bulbs, particularly in containers.

Art Preview

MORE THAN 500 art lovers attended the evening preview (Sept. 18) of the Foothill Arts Society weekend show at the Arboretum. A reception for participating artists and their guests was given afterwards in the Home Demonstration Gardens by the cosponsoring California Arboretum Foundation.

George Lewis *Francis Ching* *Frank Simerly*

Photo: Milton Bell

The Study of Fire-Retardance in Plants

P. C. Cheo and Kenneth R. Montgomery

IN THE PAST twenty years, a steady increase in population in Southern California has necessitated the expansion of residential development into the nearby brush-covered foothills. These areas are constantly threatened by fires during the dry season of summer and early fall. Wildfires in the shrubby vegetation (called chaparral) cause great loss of property and have aroused considerable public concern and alarm. Even worse, perhaps, are the floods and mud slides following fire, exemplified tragically by the 1969 disaster in Glendora and the Hollywood Hills area. The management of wildfires in connection with watershed protection and erosion control is an important regional problem in need of investigation and recommendation.

The Los Angeles State and County Arboretum became interested in some phases of this problem in the early 1950's (2, 3, 5, 8). The study of fire-retardant plants was established to test the burning characteristics of plant species which were adapted to the climate of Southern California in the hope that such information would be useful in wildland management and to foothill homeowners in landscaping their property to minimize the brush fire hazard.

The preliminary testing procedure for determining relative fire retardance among plant species involves burning plant material in a muffle furnace. Test material is inserted into the furnace chamber (4 x 3½ x 9 inches in size) which has been preheated to a designated temperature, usually within the range of 1000° F. to 1600° F. The time in seconds required to ignite the plant material is recorded, as well as other observable burning characteristics. Controlled muffle furnace burning tests of a selected group of species at 1400° F. with their ignition times recorded are presented in Table 1. All samples for the muffle furnace tests were pre-dried until a constant weight was reached to eliminate the influence of free moisture. Leaves were cut to a uniform size (1 cm. x 3 cm.), and their thickness and weight were measured and recorded. Ten replications for each species were used. As can be seen in Table 1, appreciable differences in ignition time exist among the species tested.

The concept of fire retardance in plants and its practicability have not been fully elucidated. The term 'fire-resistant plant' was originally adopted to indicate a relative difference in plant flammability. It specifies a degree of difference in flammability in the same sense as the degree of difference in drought resistance or disease resistance in plants. The term resistance is conditional; in the case of fire resistance it is dependent on fire (or furnace) temperature. Therefore, a comprehensive temperature range must be defined in order to give meaning to the concept of fire-resistance in plants, or, as we now prefer to call it, fire-retardance. Fresh leaves of saltbush (*Atriplex lentiformis*), for example, will not burn with a flame when tested at a muffle furnace temperature of 1200° F. Instead, they glow red, blacken, and char into white ash. This charring reaction is considered to be a fire retardant property, as compared with native chaparral species which burst into flame at the same temperature. However, when tested at 1400° F. *A. lentiformis* leaves do not char but burst into flame, although considerably more time for ignition is required than for the highly flammable species. If we further increase the muffle furnace temperature to 2000° F. the burning behavior of all species is so accelerated that any differences in flammability between two samples are masked and unnoticed by visual observation. On the other hand, if we lower the muffle furnace temperature to 1000° F. more species show the charring characteristic instead of flaming. Furthermore, at a particular furnace temperature, the same species may char when its moisture content is high, but will flame when its moisture content is low.

FOR THE SPECIES we have tested, fresh plant material at field moisture content levels or samples pre-saturated to their water holding capacity can be classified into three groups based on differences in ignition time at 1200° F. The first group, including species of *Sedum* and other succulent plants, is the most retardant. The second group, represented by *Atriplex lentiformis, Cistus ladaniferus* (gum rock rose), and *Eriodictyon trichocalyx* (hairy yerba santa), demonstrates moderate retardance. The third group, represented by chaparral shrubs such as *Salvia mellifera* (black sage) and *Quercus dumosa* (scrub oak), is not retardant. To illustrate the magnitude of these differences, the average ignition time for *Sedum* is about 50 seconds; for *Cistus,* it is around 18.2 seconds; and for *Salvia,* it is 8.5 seconds.

When plant samples are heat-dried to remove free moisture prior to testing in the muffle furnace, relative ignition times at 1200° F. can be classified into two groups. The first group, represented by *Cistus, Eriodictyon,* and *Sedum* is relatively retardant. The second group, represented by *Salvia, Quercus* and *Atriplex* is not. For example, it takes an average of 3.8 seconds to ignite a dried *Cistus* sample and it takes an average of only 1.9 seconds to ignite a dried *Salvia* sample.

BEFORE DISCUSSING what these results would mean in a practical sense, some of the plant characteristics which may have produced these differences should be mentioned.

Atriplex lentiformis is one of the species which has been recommended as a fire-retardant plant. Tests in our laboratory have demonstrated that the slow-burning qualities of *Atriplex* are due mainly to its higher moisture content in all seasons of the year, particularly in the dry season of high fire danger, as compared to *Salvia, Quercus* and others (9). Furthermore, it is able to resist rapid water loss under a drying stress. Under dry field conditions, *Atriplex* was found to have a moisture content of 62.3% by fresh weight while *Salvia* had a moisture content of 38.6%, *Quercus* of 31.6% and *Cistus* of 37.6%. If we subject similar samples from these species to a mechanical drying treatment under a heat lamp at 210° F. on a moisture determination balance and record their moisture loss at different time intervals, we can demonstrate a somewhat higher moisture holding ability in *Atriplex*. Under such a drying condition, *Salvia* lost 53.2% of its original moisture by fresh weight, and *Quercus* lost 55.9%, while *Atriplex* lost only 32% within the first five minute drying interval. Under all field conditions including Santa Ana winds, *Atriplex* could be expected to have a higher moisture content than the chaparral species. The observation that heat-dried *Atriplex* material completely loses its muffle furnace burning advantage further supports the conclusion that an innate high moisture content is responsible for its fire retardance in muffle furnace tests. When test samples of *Atriplex, Salvia* and *Quercus* are all heat-dried to eliminate free moisture, there are no significant differences in their ignition time (2.2 seconds, 1.9 seconds and 2.5 seconds, respectively at 1200° F.). Similarly, the high degree of fire retardance in succulent species is due mainly to their high water content and their ability to retain water under drying conditions.

Some other fire-retardant plants worthy of mentioning are *Cistus ladaniferus* and *Eriodictyon trichocalyx*. Both of them have no moisture advantage over the highly flammable chaparral species, yet they demonstrate a degree of fire retardance. Using the heat-drying treatment before burning in the muffle furnace to eliminate the effect of moisture, both *Cistus* and *Eriodictyon* continue to demonstrate slow burning characteristics as compared with other species (Table 1). There apparently is something besides moisture that produces these results.

Further investigation has shown that *Cistus ladaniferus* and *Eriodictyon* have thicker leaves than most other species tested (10). The greater the leaf thickness, the longer the time in seconds required for ignition at 1400° F. *Cistus ladaniferus* and *Eriodictyon trichocalyx,* therefore, are slow to burn apparently because of their physical nature.

THUS, MOISTURE and, to a lesser extent, physical properties are two factors we have found so far that are responsible for the burning behavior of some fire-retardant plants. Juhren (5) reported that the essential oil (terpene) content of plants also may be correlated to plant flammability. In studies with corn plants, Broido and Nelsen (1) further indicated an effect of ash (mineral) content on combustion. These and other factors that could contribute to fire retardance remain to be studied.

The muffle furnace test is primarily a measurement of the ignitability of plant material. Therefore, it alone cannot furnish complete information on flammability. *Cistus ladaniferus,* for example, is classified by the muffle furnace test as a fire-retardant plant on the basis of an ignition time advantage over recognized highly flammable species. Its slow ignitability is due largely to its leaf thickness. However, the physical properties which are responsible for slow ignitability could function differently after ignition. Leaf thickness is not necessarily advantageous in combustion or sustaining the fire after ignition. This would mean that even though *Cistus* is comparatively retardant to ignition, when it does ignite, it might tend to favor continuous burning.

In addition, muffle furnace tests on leaf or branch samples do not represent full evaluation of the flammability of the plant as a whole (total fuel volume). The flammability of a plant is the sum total of the flammability of leaves, various size of branches and twigs as well as dead leaves and twigs on and beneath the plant. For instance, *Rhus ovata* (sugar bush) has a relatively thick leaf as does *Cistus ladaniferus,* and both require a relatively long time to ignite at 1400° F. in muffle furnace tests (Table 1). However, *Rhus ovata* may not be rated as high as *Cistus ladaniferus* in a total flammability evaluation because the former grows to a much larger size with more woody parts than the latter. In other words, even though the leaves of *Rhus ovata* and *Cistus* are both slow to ignite in muffle furnace burning tests, the overall flammability of *Rhus ovata* plants as a whole may be much different than *Cistus.*

CONSIDERATIONS such as the age and growth condition of a plant also have an important bearing on its flammability. In *Cistus ladaniferus,* for example, young seedlings (2-3 years old) full of leafy growth are quite slow burning. But when they reach eight years or older, the condition of the plant is entirely different. The bottom branches become woody and bared with dried leaves accumulated around the base of the plants. The proportion of dead branches and leaves increases as the plants age, and their retardance to burning decreases accordingly. A similar condition occurs in several species of *Atriplex,* including *A. lentiformis.* The rank, rapid growth of these plants can produce a tangle of vegetation in a few years. The living vegetation which is fire retardant eventually forms little more than a canopy over a highly flammable central mass of bared, woody material. These species of *Atriplex* after a few years of growth could hardly be considered useful as a fire-retardant plant.

Based on our muffle furnace studies, the foliage of several species has been shown to be comparatively fire retardant by the fact that more time is required for ignition than in chaparral shrubs of recognized high flammability. This property alone may be used to advantage. By planting these species along roadsides and around campsites in wildland area, the frequency of accidental fires could be reduced. A few seconds delay in ignition time could make a difference in preventing the establishment of a major brush fire. Another possible application could be that heavy stands of these species on firebreaks might attenuate or slow-down the progress of a fire and to a certain extent aid fire fighting efforts. This last point, however, has yet to be demonstrated. A well-planned outdoor burning test could give us some idea of the feasibility of this approach.

OF CRITICAL IMPORTANCE in the future is the need of establishing a more realistic attitude toward the wildland fire problem. Fire has been an important natural force in the course of evolution. Our chaparral is the result of thousands of years of evolution and is adapted to and stimulated by the fire cycles. What appears on the surface to be destruction as a result of a fire is in many ways a regenerative process. Efforts to prevent brush fires are actually against the nature of the chaparral and succeed only in delaying and worsening the inevitable. The longer a particular area is kept from burning, the hotter and more damaging will be the eventual fire.

Human activity, however, is progressively dominating the forces of nature. The long-standing philosophy of forest fire prevention for the protection of property, for example, undoubtedly has contributed greatly to the enormously destructive chaparral fires that have occurred in or adjacent to heavily populated regions of Southern California. Now that urbanization of high fire danger areas has become so widespread, we must continue to control and prevent these fires in order to protect the homes and properties of foothill residents.

Controlled burning now practiced in some areas of the world, may eventually be used as a tool in our remote mountain areas, but it is doubtful if such a method could be used safely anywhere near residential areas, unless such areas can be effectively protected from the spreading fire. Do fire-retardant plants represent a possible tool to serve this end? The answer could be in the affirmative if they could be integrated into a brush fire control program. Fire-retardant plants cannot be used effectively by themselves without consideration of the numerous other factors involved.

Table 1. Ignition times of dry leaf pieces of different plant species at 1400° F.

Species	Ignition time (sec.)
Cistus ladaniferus (gum rock rose)	2.71
Rhus ovata (sugar bush)	2.52
Heteromeles arbutifolia (toyon)	2.43
Cistus laurifolius (laurel rock rose)	2.26
Eriodictyon trichocalyx (hairy yorba santa)	2.05
Nerium oleander (common oleander)	1.93
Cistus villosus (rock rose)	1.84
Eucalyptus globulus (blue gum)	1.50
Cistus albidus (white rock rose)	1.49
Cistus monspeliensis (Montpelier rock rose)	1.43
Salvia mellifera (black sage)	1.36
Hypericum elatum (St. Johnswort)	1.32
Nicotiana glauca (tree tobacco)	1.18
Ibosa riparia	0.99
Euphorbia milii (crown-of-thorns)	0.84

All leaf samples listed in this table for ignition test were pre-dried to eliminate the effect of moisture. The muffle furnace temperature for these tests was set at 1400° F. The results demonstrate

clearly that without the influence of moisture there is further ignition time difference among species of plant. This difference can be related to leaf thickness and weight (10), and perhaps chemical constituent of the leaf.

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Fire-Retardant Plants for Brush Fire Prevention in Hillside Residential Areas

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IN THE PRECEDING paper we discussed the concept of fire retardance in plants in relation to a broad consideration of the chaparral brush fire problem in Southern California. Now we would like to focus on the application of this information for hillside residents who are faced with the direct threat to their homes and property from brush fires.

A homeowner can reduce the fire threat by removing all or most of the highly flammable native brush from around his home and then replanting with species that will not produce as much fuel for a fire and yet will be attractive and have the capacity to control soil erosion. To keep the fire hazard low, it is necessary also to water the plants according to their need and tolerance throughout the dry, fire season and to maintain them in as clean a condition as possible by periodically renovating and removing accumulated litter. These are the essential steps in the formation of a "green belt" between residential areas and the highly flammable brush.

Green belt plantings can achieve their greatest effectiveness in the prevention of brush fires if the plants used predominantly are of relatively low flammability, in other words, fire retardant. The moisture content of plants is probably the most important factor in fire retardance. As we pointed out in the first paper, species with high moisture do not burn as readily as those with low moisture. Although any plant has a higher moisture content when regularly watered than it would under dry conditions, some species are naturally able to hold more water in the tissue than others at the same soil moisture level. A good example is found in succulents. Plants of this type have thick, fleshy leaves and stems for storing water and for resisting water loss. Therefore, they are considered to be fire retardant. Some non-succulent plants also have the capacity for a relatively high water content and, to a lesser degree, are fire retardant.

ON THE BASIS of two criteria, we can make recommendations of species to use in hillside residential plantings for fire prevention. First, the plants must have a relatively high moisture capacity. Second, they must be low growing with a prostrate or creeping habit which would tend to limit the volume and accumulation of material available for burning (it could also make the plants more difficult to ignite because of the more compact spatial arrangement of the leaves and stems). Presented in Table 1 are 30 shrubs and herbaceous perennial species, primarily ground covers, listed according to these criteria. Although many other plants with similar moisture and growth characteristics also could have been listed, we selected these as examples largely because of their established horticultural value and ready availability through most nurseries. Several promising plants including two prostrate species of saltbush (*Atriplex*) and creeping sage (*Salvia sonomensis*) are being tested but are not at present available to the homeowner. Prostrate succulents are grouped by themselves in Category 1 with the highest degree of fire retardance. Prostrate species that are not distinctly succulent are subdivided into three categories depending on their leaf moisture content (% fresh weight) as determined for plants growing under normal garden conditions at the Arboretum. As the moisture content of the plants decreases from Category 2 to Category 4, fire retardance also decreases.

Drought tolerance in Table 1 is evaluated in terms of the ability of each species to survive without supplemental watering during the dry season. The water retaining mechanism within the plant tissue, both physiologically and morphologically, as well as the depth and efficiency of the root system all contribute to the total tolerance of the plant to drought. Even the most drought tolerant species must have some summer water, however, to keep the moisture content of the tissue as high as possible. At the same time, overwatering must be avoided.

The value of a plant in controlling soil erosion on hillsides depends to a certain degree on the steepness of the slope. Thus, we have evaluated each plant separately for gentle (0-30°), moderate (30-60°) and steep (above 60°) slopes. Within the recommended slope ranges, each plant was then graded as to whether it is good (++) or only fair (+) for erosion control (Table 1).

GENERAL MAINTENANCE requirements also are given in Table 1 to indicate the relative amount of care, exclusive of watering, that must be provided to keep a planting of each of the listed species in a relatively low fire hazard condition. Maintenance includes such operations as pruning, renovation, weed control and removal of litter. Without proper maintenance, almost any planting could become a fire hazard given enough time.

The information we have presented here is valuable for broad comparisons. However, since no two hillside landscaping situations are exactly the same, absolute answers on what and how to plant cannot be given. Further information on slope conditions, cultural requirements and other plants to use for specific purposes can be obtained from

(Continued on Page 67)

Table 1. Recommended Fire-Retardant Plants for Brush Fire Prevention in Hillside Residential Areas

SPECIES	HEIGHT AT MATURITY	DROUGHT TOLERANCE	COLD HARDINESS	EROSION CONTROL			MAINTENANCE
				0-30°	30-60°	60°+	
CATEGORY 1 — GREATEST FIRE RETARDANCE Succulents (moisture content 90-95%)							
Carpobrotus edulis (Hottentot Fig)	12-18″	good	to 20° F.	+			medium
Delosperma 'Alba' (White Trailing Ice Plant)	6-8″	very good	to 20° F.	++	+		medium-low
Drosanthemum hispidum (Rosea Ice Plant)	4-6″	good	to 20° F.	++			medium-low
Lampranthus spectabilis (Trailing Ice Plant)	6-12″	good	25-30° F.	++			medium-low
Malephora crocea (Croceum Ice Plant)	6-12″	good	to 20° F.	++	+		medium-low
Malephora luteola (Yellow Trailing Ice Plant)	6-12″	good	to 20° F.	+			medium-low
Portulacaria afra 'Variegata' (Elephant's Food)	12″	good	25-30° F.	+			medium
Sedum brevifolium (Green Stonecrop)	2-6″	very good	below 20° F.	+			medium-low
Sedum confusum	6-12″	very good	25-30° F.	+			medium-low
Sedum rubrotinctum (Brown Bean)	6-8″	very good	to 20° F.	+			medium-low
Senecio serpens	12″	good	to 20° F.	+			medium-low
CATEGORY 2 — Non-succulent plants, high leaf moisture content capacity (80-95%)							
Arctotheca calendula (Cape Weed)	12-15″	fair	20-30° F.	++	+		medium
Gazania uniflora (Trailing Gazania)	6-10″	good	to 20° F.	++	+		medium
Osteospermum fruticosum (Trailing South African Daisy)	12-18″	very good	to 20° F.	++	++	++	medium
Pelargonium peltatum (Ivy Geranium)	12″	fair	over 30° F.	++			medium-high
CATEGORY 3 — Plants with medium-high leaf moisture content capacity (70-80%)							
Ajuga crispa (Giant Ajuga)	6-9″	poor	below 20° F.	+			high
Atriplex semibaccata (Creeping Australian Saltbush)	12″	excellent	to 20° F.	++	++	++	medium
Cerastium tomentosum (Snow-in-Summer)	4-6″	very good	below 20° F.	++			medium-high
Myoporum parvifolium	6″	very good	to 20° F.	++	++	+	medium-low
Santolina chamaecyparissus (Gray Lavender Cotton)	18-24″	excellent	below 20° F.	++	++	++	high
Santolina virens (Green Lavender Cotton)	18-24″	excellent	below 20° F.	++	++	++	high
Vinca major (Periwinkle)	18-24″	fair	below 20° F.	++	++	++	medium-low
Vinca minor (Dwarf Running Myrtle)	6-12″	fair	below 20° F.	++	++	++	medium-low
CATEGORY 4 — LEAST FIRE RETARDANCE Plants with medium leaf moisture content capacity (60-70%)							
Baccharis pilularis var. *prostrata* (Dwarf Coyote Bush)	12-24″	excellent	below 20° F.	++	++	++	high
Hedera canariensis (Algerian Ivy)	12-15″	poor	25-30° F.	++	++	+	medium
Hedera helix (English Ivy)	12″	poor	below 20° F.	++	++	+	medium
Helianthemum nummularium (Sunrose)	6-8″	very good	20-30° F.	++			medium-low
Hypericum calycinum (Aaron's Beard)	12-15″	good	below 20° F.	++	+		medium-low
Teucrium chamaedrys (Germander)	8-12″	good	below 20° F.	++			medium-low
Verbena peruviana	4-6″	very good	below 20° F.	+			medium-low

Mulching vs. Lawns at the Arboretum—*Part II*

Francis Ching

ANY LARGE SCALE mulching program necessarily entails the use of large amounts of organic matter. The values to be derived from such a program are as follows:

Effects on the Physical Properties of Soil:

1. Improves soil structure and tilth
2. Increases water holding capacity
3. Increases aeration
4. Increases pore space — capillary and non-capillary
5. Aggregates heavy soil
6. Binds light and sandy soil
7. Increases intake of water and prevents run-off
8. Reduces erosion due to water absorption

Effects on the Chemical Properties of Soil:

1. Supplies colloids on which mineral ions are absorbed
2. Reduces leaching of nutrients
3. Increases availability of nutrient ions by producing carbonic and other acids
4. Acts as a buffer in chemical reactions
5. Reduces toxicity of certain substances due to buffering action
6. Adds trace and mineral elements to the soil
7. Furnishes carbohydrates for microbial action

MULCHING PROGRAM

MULCHING OPERATIONS were initiated in 1964. This was brought about in part by an offer to deliver to the Arboretum, free of charge, manure mixed with redwood shavings used as bedding material at a nearby riding stable. The initial mulching program encompassed only small areas around trees and shrubs. The mulching process was as follows:

1. The areas to be mulched were first treated with a suitable herbicide, usually dalapon as bermuda was the dominant grass.

Mulched area around palms eliminates need for mowers that could injure plants. Mulch holds moisture better than adjoining lawn.

2. The treated areas were then ripped to a depth of eighteen inches. Because of the type and compaction of the soil, ripping was accomplished with the use of a tractor.

3. The mixture of manure and redwood shavings was then applied to the ripped areas to a height of approximately six inches. Care was taken to keep the mulch away from the base of plants as the manure was applied fresh and hot.

4. The mulch was then watered in well and a suitable insecticide applied to control the breeding of flies.

The success of this mulching program was quickly evident. The small mulched areas were connected so as to make sizable mulched areas. One previously undeveloped area was mulched prior to planting with the result that mature plants were obtained in approximately one-half the time previously experienced. Besides creating optimum growing conditions there were other benefits: Irrigation became practical; sprinklers could be turned on from four to eight hours without experiencing the appreciable run-off that previously occurred in one to two hours of irrigation; moisture was able to percolate to a depth of four feet in a reasonable amount of time, a condition hitherto highly impracticable; the deeper penetration of the water led to infrequent periods of irrigation, thus saving a considerable amount of labor time during the summer months.

BECAUSE OF THE large mulched areas, mowers were not required to continually run in circles in order to mow around trees and shrubs; new plantings were less apt to be chopped up and there was less damage to trunks and low branches of trees and shrubs. As a result, the mowing staff was reduced by one-third, thus relieving these men for more important duties.

Weed control has been a relatively minor problem. Bermuda grass can be quite persistent, but equally persistent applications of dalapon will eventually rid a mulched area of bermuda. Contact herbicides as well as pre-emergence chemicals such as Treflan or Dymod have been very effective in the control of grasses and broadleafed weeds. To date, over 700,000 sq. ft. of what was once mostly lawn area has been mulched as a result of the program started in 1964 and still continuing. Although a manicured look is absent, these areas have taken on a more natural appearance which, in actuality, produces a blended environment. One last item in recognition of the success of this program is that in the windstorm of December 28, 1969, when gusts of wind were clocked at 95 mph, sixty-four trees were blown down but none from the mulched areas. I would give the mulching program some credit for this happening.

Tractor is ripping compacted lawn, at left, previously treated with a suitable herbicide. Manure pile, at right, will be spread following ripping.

Horticultural Photography

Ralph D. Cornell, F.A.S.L.A.

SUCCESSFUL PHOTOGRAPHY of plants and their details, particularly if done outdoors under natural conditions, calls for perspicacity, persistence and patience. It is impossible to control the natural elements which combine to provide ideal picture-taking circumstances and outdoor environment. As a result, many good photographs are accidental; the photographer just happened to be at the right spot at the right time and was able to realize the photographic potential of what he observed.

It is possible to pass by a good plant subject daily and not think of it as being particularly photogenic until, at a certain time and viewpoint, when all the controls are in proper juxtaposition, the observing person recognizes a combination of light and form that spells good composition. A shift of a few feet in the viewpoint, of a few minutes in the timing, of atmospheric clarity, or of the lighting as it strikes the subject, may spell the difference between a successful shot and just another one of those that failed.

Thus, a good photograph is what, when, and where you see its potential — and should be taken at that time. What is seen today will not exist tomorrow. Light and air conditions vary, skies change, so it is like gambling at the races or playing the stock market to anticipate good conditions at a future date. For these reasons one who tries to program his work schedules can do no more than play the averages and hope that he will find what he seeks.

ONE MUST KNOW something of the seasonal changes of the plant he seeks to record, its flowering time of year, its appearance in spring or fall or even winter. He then can plan to be on hand when the plant and its environment should perform at their best. But

Archontophoenix cunninghamiana

Fruits on this plant are a brilliant red: the small flower cluster at upper center is a lovely amethyst. To bring out detail of both flowers and fruit, a vermillion-red filter was used which also increases brightness of palm trunk.

Yucca brevifolia

The clouds make this picture which otherwise could have been flat and uninteresting. Without use of red filter, clouds would not have shown and sky would have been a monotonous tone of grey.

Yucca whipplei

Clear air and good light helped this photo. A red filter deepened the sky tones and created the contrasts. Note simplicity of composition with emphasis on the flowers, subordination of other details and background.

he cannot guarantee that they will be cooperative. I have sought good pictures of certain plants whose location I knew for as long as ten or fifteen years. During one of California's wildflower years, I drove between four and five thousand miles on weekends alone, moonlighting, so to speak, on my own time in the hope of good photographs. But the failure to find the pictures and record them on film does not mean a total loss for the photographer, for he is paid back manyfold in his experiences and observations in the wide open spaces.

Outdoor photography can make one richer in many ways. For one thing, it sharpens the senses and powers of observation, thus permitting one to see beauty and gain pleasures denied to those who having eyes see not. It helps attune one to nature and the tranquilizing effects of outdoor associations. It permits one to see and enjoy and tune in upon wholesome experiences. And to make it personal, I venture the comment that no one thing has enriched my life any more than an interest in taking pictures, with all the side benefits which are added as a bonus.

The mechanical aspects of photography have been greatly refined in an effort to eliminate the errors of human judgment and thinking and thus put the matters of focusing, timing, and printing — in other words picture-making — on a purely electronic or otherwise automated basis.

Modern invention has made it very easy for the amateur to take pictures which please him at the early stages of understanding within which he operates. But it does not eliminate the human operator as perhaps the most important link down the long chain of events which leads to good photography.

BASICALLY THERE are but four fundamental steps to good picture-taking. First, one must learn to recognize a potential picture when he sees it. Second, he must be able to compose the subject and frame it within the boundary of the film's surface. Third, he must be able to pull the entire composition into focus or into the type of focus which may accent certain details and subordinate others, as he may see fit. Fourth, he must be able to assure the exposure which will tell the story he seeks to tell. Beyond the ability to accomplish these four factors it is not too important what kind of camera is used, or how complicated or simple the gadgets may be. A computer can feed back only that which it has been instructed to record and hold in memory. Cameras, automatic or otherwise, can produce only that which the judgment of the "shutter-snapper" has made it possible to produce. In the last analysis, the intelligence and the experience of the operator who tends the machine becomes its ultimate control.

If one wishes to be a professional, expert photographer, one should study the subject as one would study any profession which may become a life work. The field is unlimited and there are as many different angles of approach and of subject matter as there are craters on the moon. The opinions expressed here are only the conclusions of an amateur who has tried for a lifetime to take passable photographs without benefit of highly complicated equipment. Such opinions probably would not interest the trained, technical man beyond the fact that he would consider them to be amateurish.

Horticultural photography is similar to any other type of photography excepting in the problems presented by the subject matter with which one works. Before color reproduction entered the field, all pictures were taken in black and white (b/w). This at the outset presented special problems because of the fact that all colors on a b/w print are reproduced in varying shades of gray, never as they appear to the human eye. Thus both red and yellow, which are rather brilliant and aggressive to the human eye, recede into a dull gray which reproduces at about the same value as average green foliage. Conversely, the intense blue of a brilliant and clear sky, seemingly dark to the eye, prints out on a photograph as a very light grey in exact contrast to its visual impact. White clouds, in a blue sky, seldom appear on a b/w print (unless a filter was used) because the blue of the sky and the white of the clouds have relatively the same effect on the photographic emulsions.

TO ILLUSTRATE, let's say that one desires to photograph a plant with green foliage, yellow flowers and red berries, all of which stand out sharply against a blue sky with fluffy, white clouds. If one shoots what he sees "blind" so to speak and without filters, the print comes out as a smudge of gray in which foliage, flowers and berries all fuse into an indistinguishable mass against a bright, cloudless sky, not at all resembling the lovely color composition which inspired the effort. Filters, of which there are many, will compensate for these problems. There is a filter for every color and some filters that will handle several colors at the same time, though possibly in only a partial way for each. A yellow filter should bring the yellows into visibility, a red filter should pull up the reds, a proper sky filter will bring out the clouds, not by changing them but by pulling the intense blue of the sky into a dark tone (on the print) which brings out the clouds by contrast. The photographer must decide what he is seeking and then shoot for that, bringing up the other values as best he can. The judgment of the camera operator is important and, without discounting the potentials of any of the gadgets, a good operator will get better pictures with simple equipment than will a poor operator loaded down with gauges and charts which he doesn't understand.

Ordinary photography (which does not include infra-red and other specialized types of film) merely records the reflection of light. Without light (artificial or natural) there is no picture, and it behooves the photographer to study the lighting of his subjects before he snaps the shutter. Flat lighting in b/w work tends to eliminate modelling of the form, to reduce contrasts and sharpness of detail, as is sometimes discovered when one attempts photography under the intense and flat light of a midday sun. The angle of lighting for any subject becomes very important. Sometimes a shift of but a few feet in the viewpoint from which the picture will be made determines whether or not the photo is successful. Most horticultural subjects photograph better in cross-lighting than in light either from directly overhead or from directly behind the camera. There are times when all rules can be broken but we are dealing in averages. Early morning and late afternoon often provide ideal lighting for trees and scenics. Usually, if the light seems good to an experienced eye, it will record well through a camera lens.

ALSO, IN ANY photograph, the operator always should remember what he is taking and why. Outdoor pictures should not be cluttered with poles, billboards, and other distracting details which relate in no way to the real subject of the picture. Specimen trees and shrubs should stand out in clear contrast to their background and surroundings. A foreground plant, against a background plant may disappear in the confusion of a design improperly conceived. A dark shadow or a clear sky, against which the subject may sparkle by contrast, may produce an excellent picture without competition of interest or the cacophony of confusion. These things all are learned by trial and error, by experience and by the human judgment that cannot be replaced by divining equipment aids. Simplicity of compositions and accent on a proper item of interest, with eliminations of extraneous and competitive details are well worth seeking.

Pinus jeffreyi on top of bald rock at about 9,000 feet elevation has been stunted and warped by storm and wind and winter snow. Tree trunk was cinnamon red, foliage dark green. A red filter brought them into contrast.

Populus tremuloides. Aspen foliage was bright yellow, background foliage dark green, aspen trunks white, sky blue, all brought into acceptable tones and contrast by a red filter.

Horticultural detail photography, of flower, fruit, foliage or whatnot, will follow all of the average rules that may be stated, but may become even simpler in some ways. It generally is easier to eliminate distractions, simplify backgrounds and control lighting for flower portraiture, unless one must shoot the flower or fruit in situ, on the plant. In any event the goal is to place emphasis where the photographer wants it and not to come out with anything that is confused or competitive with that which one wishes to tell. Again, cross-lighting usually is desirable (not always), filler light for shadows may be helpful and can be provided either by floodlight, flash, or reflectors. Focusing becomes more difficult because the lens is closer to the subject with resultant reduction in allowable focal depth. Filters should be used if it is necessary to separate flower color from foliage background.

The sophisticated improvements in color photography have been brought along with such rapidity and accomplishment that many would-be shutterbugs start with color instead of b/w, as did our ancestors. And while the color film still has many problems to overcome it is seemingly easier to do color work, in many instances, because it reproduces what the eye sees — within its own limits — rather than providing a grey monochrome of conventionally accepted tones which are untrue to visual impressions. Color is reproduced approximately as the eye sees it, without as obvious a need for corrections that are necessary to provide greater realism. Even poor color may seem to make a better statement to the uncritical eye than can be made in monochromatic tones. And since color photography can be done in either transparent or opaque form, it has its interest factors.

The same observations concerning framing, focusing, and exposure that apply to b/w photography apply also to color, except that the lighting for color photography calls for slightly different techniques. There is less need for lighting that will model the form of the subject as in b/w work, since the colors themselves provide definition, form, and differentiations of material. It all depends upon experience and judgment, but flatter lighting generally may be used in color work — may even be necessary.

MOST COLOR emulsions are less sensitive and more contrasty than is customary with b/w film, so that it is easier to lose detail in the shadows which might end up as black holes in an otherwise well-balanced film. Filler light is helpful since it is important that contrasts between light and shadow in the subject be reduced, in order that they both may register properly. Precise exposures become more critical since it is impossible to work with the films during their processing and thus make corrections occasioned by unsatisfactory exposures.

The exposure meter becomes an absolute necessity in any form of picture shooting. The human eye cannot register light intensity with sufficient accuracy to replace the electronic eye, particularly when one is shooting outdoors where conditions vary so radically from day to day and, often, from minute to minute if skies are overcast. The method of using a light meter also may determine success or failure of the picture. Again, one must be sure of what he is photographing and what he wants and must manipulate the meter so that it gives an accurate reading of the subject. If shooting something that stands out in silhouette against a bright sky, but which may be in relatively low key itself, it is important to get an accurate reading on the precise object and not to take a reading on the bright sky behind it. This again calls for experience and judgment.

Photography of any kind may provide very rewarding experiences which, also, may be expensive. But if one stays with the simple forms until he has mastered some of the main problems it can be quite worth the effort in many, many ways.

(Continued from Page 57)

the Arboretum or from the L.A. County Forester and Fire Warden, Forestry Division. In addition, the following references may be of value.

———. 1968. Sunset Western Garden Book. Lane Magazine and Book Co., Menlo Park (California).

———. 1968. Perry's Ground Cover Guide. Perry's Plants, Inc., La Puente (California).

Kimnack, Myron. 1966. Groundcover Succulents for California. Lasca Leaves XVI, No. 2 (31-48).

Maire, Richard G. and J. R. Goodin. 1967. Landscape for Fire Protection. University of California, Agriculture Extension Service Publication AXT — 254.

Brush fire prevention in hillside residential areas in Southern California and the role of fire-retardant plants in this problem can be summarized as follows:

1) Removal of all or most of the highly flammable native brush from at least 100 ft. around the home.

2) Replanting of cleared areas predominantly with low-growing plants that have a relatively high moisture capacity. Plants having these characteristics are considered to be fire retardant.

3) Proper watering throughout the dry, fire season to keep the moisture content of the plant tissue high. A permanent, fully automatic sprinkler system is most desirable.

4) Maintaining the planting to minimize the fuel volume and thereby keep the fire hazard low. Removal of litter and weed control is particularly important.

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[1] We would like to acknowledge the assistance of the L.A. Forestry Division in the preparation of this report. Also appreciated is the help given by Miss Nanette Kibler and Camille Mead in collecting moisture content data.

CALENDAR 1970

October-November-December

Arboretum — **Arcadia**

October 3 and 4
Akebono Bonsai Show

October 16 — 8:00 p.m.
Theodore Payne Foundation Lecture
"A Study of Iris"
Dr. Lee W. Lenz, Director of the
Rancho Santa Ana Botanic Garden

October 30, 31 and November 1
Fall Flower Show

Descanso Gardens — **La Canada**

October 31 and November 1
Chrysanthemum Show

November 18 — 8:00 p.m.
Theodore Payne Foundation Lecture
"Man and Nature Against the
San Gabriel Mountains"
Anselmo Lewis, District Ranger
Mount Baldy area
U.S. Forestry Service

December 5 through December 13
Descanso Guild Christmas
Decorations Show

All events admission free

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone (213) 447-8207

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Annual Contributing	25.00
Annual Business	100.00
Annual Sustaining	100.00
Annual Sponsor	250.00
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An Arboretum is not all trees...
PLANTS, LIKE HUMANS, suffer from
To find antidotes
laboratory study,
This rotating, high-vacuum type
at the Los Angeles State and County
SCE
Southern California Edison Company

Speaking for the Foundation

WE ARE ALL AWARE that our lives have become much more complex than a generation ago. Those of us who live in the Los Angeles area have so many demands pressing on us in our busy lives we must constantly answer the question: Where must I place my interests, efforts, and time? This is where our Arboretum fits into my commentary. Those of us who direct the Foundation realize that membership must be meaningful if it is to be maintained. The Foundation, in a pure sense, is the service organization of the Arboretum. Originally, it was established to create the Arboretum, which has now reached 22 years of age. Any organization, regardless of its purpose, must be dynamic and go forward or it slides back. Our Foundation must be aggressive in many areas, and must have projects and goals constantly, in design and progress. What are some of these goals and projects? Foremost in my mind is to raise the funds and see through to completion a beautiful flower show building. Unbelievable as it may sound, Southern California with its 10-million-plus population does not have a single place where proper flower shows can be held. The day of large spectacular shows, such as the Holly-Park International shall never return. The modern concept of flower shows is to have smaller specialty shows the year around. People of Southern California will come to say, "Arboretum — yes, that's where they have all those flower shows every year!" We should publicize the fact that one of our major functions is to sponsor research in horticulture through grants and various aids. George Spalding is going on a plant collecting trip to Australia. Our members have supported him nicely. We should work on youth education. The benefits from having our children horticulturally oriented are many.

The story of the Arboretum and the Foundation must be told many times over, each year and throughout the years. We must believe in it as the "Green horticultural heart of Southern California" — center of horticultural leadership. We must work to make Southern California the garden spot of America, where people will see more beautiful trees, flowers, gardens and greenery than any place in the world, and where the citizenry has been educated to appreciate and maintain all of this. If we believe in this and work toward these goals, we shall continue to have a dynamic frowing organization.

Ernest Hetherington

President

Lasca Leaves

The official publication of the California Arboretum Foundation, Inc.

Sponsors of

LOS ANGELES STATE AND COUNTY ARBORETUM

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Los Angeles County Department

of

Arboreta and Botanic Gardens

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Staff

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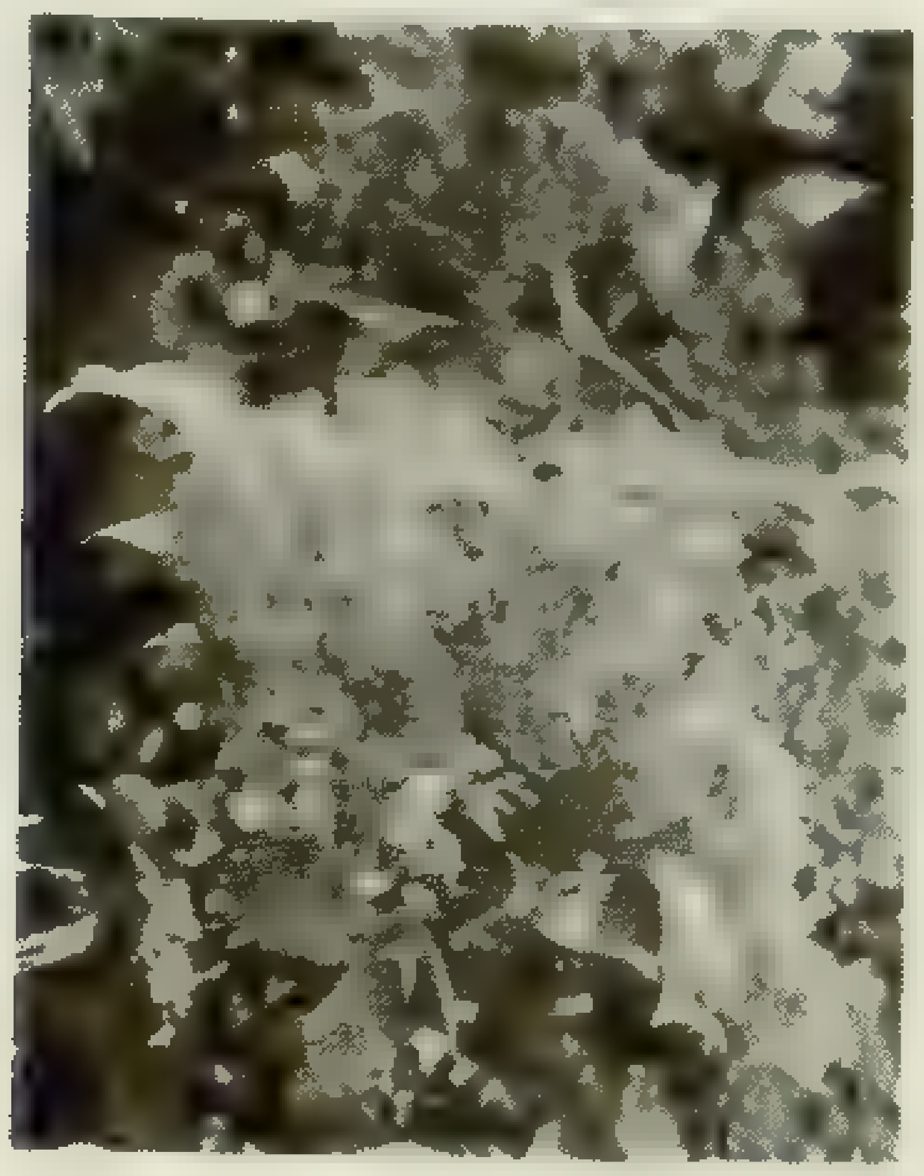

The Cover

Syringa vulgaris cv. Descanso Giant is one of the clones selected from the cross between two cultivars, Lavender Lady and Clarke's Giant. It was introduced to the nursery trade by Descanso Gardens in 1965 through cuttings and scions. It grows and flowers well in Southern California gardens.

Arboretum notes

Fire

ON THE EVENING of September 24th Kenneth Montgomery, Arboretum biologist, and Russell Stallings, deputy forester for the County Forester and Fire Warden, delivered a joint lecture before a sparse audience in the Arboretum's Lecture Hall. Their lecture, illustrated with slides, represented a summing-up of a long-term ecological study of the fire hazard presented by Southern California's chaparral-covered hillsides, a study conducted by the Arboretum's research division in cooperation with Forester and Fire Warden and other interested agencies. An important part of their talk had to do with a recommended list of fire-retardant plants and their relative moisture content, degree of drought tolerance, cold hardiness, capacity for erosion control, and maintenance requirements.

Up to the date of the lecture there had been no major hillside fires this year in any of the surrounding counties. This fact, coupled with the reasonable assumption that only those living in hillside areas would have a compelling motive to attend such a lecture, and also because traveling to the Arboretum would mean a fairly long trip for many, seemed a plausible explanation for the low attendance. The substance of the lecture had been printed in a brochure to be handed out to those attending the lecture and to anyone else asking for it. A thousand were run off.

The next morning at 10:31 a.m. a raging fire broke out in the Santa Monica Mountains rising above Malibu on the coast. At 10:50 a.m. another fire started about thirty miles to the northeast in a wind-blown pass in the San Gabriel Mountains near Newhall. In the next four days a siege of fires broke out in widely separated hillside areas, fires that were later to threaten residential communities in the flatlands located in the path of 60 to 70-mile-per-hour winds. In the following days fires were reported in San Diego County to the south and Santa Barbara County to the north.

Since the most immediate concern was for fire control and rescue operations, the Arboretum was hesitant about making a possibly untimely public announcement of its brochure which, after all, could be of no help to a man whose house was already on fire. But after the initial impact of the fires had passed and rescue operations had begun to have their effect, a copy of the brochure was sent to press, television, and radio editors in every affected area with the suggestion they inform their readers and listeners of its availability, free of charge, from the Arboretum. The response was immediate. The first requests came from agencies close to the scene, like the Fire Department, Flood Control, and Forestry. The communications media, stimulated to seek more information, asked for interviews with members of the research staff and with department director Francis Ching, who had initiated publication of the brochure. This prompted more requests. The one thousand copies were gone in a few days. The Board of Supervisors quickly authorized an emergency order for printing five thousand more. In the interim, the Arboretum managed to get another forty-five hundred printed but not assembled. Into this breach stepped members of the ever-ready Las Voluntarias who stapled from early morning to night to get the job done. Ultimately, close to fifteen thousand brochures were given out. A tabulation showed that 78% went to Los Angeles County, 22% to San Diego County, 7% to other counties, and 1% to Nevada.

Almost every request contained an explanatory line or two showing need and appreciation for the information contained in the brochure. Typical were such remarks as ". . . I will appreciate a copy so I can begin to regrow adequate ground cover for the burned areas I have lost . . ."; ". . . my home was lost in the Malibu fire and I plan to rebuild . . ."; ". . . thank you for your work along this line. . . ."

The contribution of the Department of Arboreta and Botanic Gardens to the battle against the fires was not confined to giving out its brochure on the subject. Numerous telephone calls were received asking for specific, fire-related information. One repeated inquiry on the advisability of watering trees in fire-devastated areas was answered by an announcement sent to radio and television stations for broadcast. (The answer: No, where water was extensively used to extinguish fires; otherwise, one good soaking until new growth appears, then water again if natural rains have not occurred.)

Neither the fires, nor the subsequent efforts to control them, nor the many heroic efforts to save lives and homes, nor the emergency aid stations set up by government agencies were anything new. The same scene has been portrayed often in the past with varying degrees of devastation. As always, there were differing opinions, some of them fanciful, about what could or should be done. Whatever else, it was generally agreed that brush fires in the wildland areas of Southern California's chaparral are, from an ecological standpoint, a natural and unavoidable phenomenon. The problem, it is clear, arises with the presence of man who, if he must live close to an environment dangerous to himself, can best adapt by taking certain sensible, easy-to-accomplish precautions and by making use of certain kinds of readily-available plants offering erosion control and fire-retardant properties plus some measure of esthetic satisfaction. That is the message of a modest, twelve-page brochure that became an overnight success.

Loss

THE FOUNDATION suffered the loss of two of its members this month with the passing of Mrs. Rudolph J. Richards and Mrs. Lee Wray Turner. Helen Richards served as a member and officer of the Board of Trustees for seventeen years. She also served as by-laws chairman and organized and chaired the first special events committee. She was appointed to the Board of Governors of the Department of Arboreta and Botanic Gardens in 1953. Lee Turner served as executive secretary of the Foundation from 1955 until her retirement in 1959. She also supervised movie and television locations at the Arboretum, continuing this phase of her work for several years after her retirement.

Both of these fine ladies gave unstintingly of their time and efforts in their dedication to the development of the Arboretum and the Foundation. They will long be remembered and missed.

Milestone

By January 1, 1971, the total Arboretum attendance since opening to the public on January 1, 1955 will top the 8 million mark, approximately the population of Los Angeles County.

A biennial attraction at Descanso Gardens in La Canada is the Christmas show presented in the Hospitality House by the Descanso Gardens Guild. The show features over a hundred displays of contemporary and traditional Christmas decorations and scenes.

With garden volunteers and city and county representatives taking part, public tram tours were inaugurated November 25th at South Coast Botanic Garden on Palos Verdes Peninsula, marking another forward step in the development of the department's youngest facility. The new service has been made possible by the generosity of the Los Angeles Camellia Council which presented the vehicle, formerly in use at Descanso Gardens, as a gift to the garden. The present schedule offers two tours daily, Tuesday through Friday, and three tours on Saturdays and Sundays.

Photo: Mike Eggers

Man and Air — Threats to Prairie Survival[1]

George P. Hanson

ALTHOUGH POLLUTION in all forms is increasing everywhere in the world, it is increasing most rapidly in highly industrialized countries where, ironically enough, a high standard of living has given the people a false sense of security, causing them to be wasteful of their natural resources. Fortunately, as man becomes more deeply aware of his environment he becomes more aware of pollution and its many-faceted threats to his existence.

Thus, in the prairie states there is a growing concern with air pollution because of its visible damage to crops. In Southern California, on the other hand, air pollution is something of an old story. It begins with the automobile, so important in an area lacking a rapid transit system, and goes on to include such variables as the high light intensities, low humidity, low rainfall, slight wind movement, and high temperatures, all of which contribute to the formation of dangerous concentrations of air pollutants during the summer and autumn months.

Starting in the morning when the commuters are on their way to work, and continuing throughout a typical day, a slight breeze blows in from the ocean over the seaside communities (our major industrial areas). It continues down the San Gabriel Valley and eastward through the Pomona-Walnut Valley on its way to Riverside and San Bernardino. Like most Los Angeles area cities, these are located in valleys surrounded by mountains. As the breeze blows inland it picks up the primary pollutants which are converted to even more toxic materials via photochemical reactions of the sun. By the time the pollutants have reached Pasadena, Azusa, and Pomona they have been concentrated somewhat and have had sufficient time to interact with each other. The result is eye-smarting, plant-damaging smog.

Although most of the reddish-brown pollution cloud continues eastward on through the valley, some of it enters mountain passes to the north and infiltrates the Angeles National Forest. The main cloud of pollutants proceeds eastward, increasing in concentration and toxicity from the accumulated pollutants of the cities through which it passes until it reaches the San Bernardino area. The pollution cloud up to this point has been riding close to the ground due to the formation of a temperature inversion layer. Now its eastward progress becomes partially blocked by mountains. The continued northeasterly breezes and the convection currents along the mountains on the north and east cause a mixing of the warm surface air with cooler upper air at the edge of the mountains. As a result the air pollution cloud filters over the mountains into the San Bernardino National Forest.

Sources of Air Pollution

The sources of air pollution are primarily industry and the internal combustion engine. The phosphate fertilizer industry emits fluoride and oxides of nitrogen (NO_x). Nitrogen fertilizer plants contribute nitric acid and NO_x. Petroleum refineries spew many toxic fumes including sulfur dioxide (SO_2), carbon monoxide (CO), NO_x and various hydrocarbons. Other chemical plants yield particles and gases including hydrochloric acid (HCl), hydrogen fluoride (HF),

[1] This paper is based on a presentation given by Dr. Hanson, senior biologist at the Arboretum, September 20, 1970 at the Second Midwest Prairie Conference sponsored by the University of Wisconsin Arboretum, Madison; the University of Wisconsin-Parkside Department of Life Sciences, Kenosha; and the Wisconsin Department of Natural Resources, Madison. It has been submitted for publication in the proceedings of the conference.

SO_2, and hydrogen sulfide (H_2S). Various smelting plants discharge SO_2 into the air. Lead mining and concentrating facilities produce lead containing air pollutants. The paper pulp industry yields H_2S and other sulfur compounds. Electric power plants and other stationery power sources utilizing fossil fuels expel SO_2 and NO_x as well as particulates. The internal combustion engine burning the standard fuels belches lead, CO, NO_x, and hydrocarbons including fuel, aldehydes, and ethylene.

MANY OF THESE pollutants act on living material directly upon contact. Others such as NO_x and hydrocarbons, toxic in themselves, become even more hazardous when allowed to interact in the presence of oxygen and sunlight. The reaction products include nitrogen dioxide (NO_2), ozone (O_3), and peroxyacyl nitrates.

How Air Pollutants Damage Plants

Air pollutants may damage plants in several ways. Certain pollutants fall on the vegetation in aerosol form or are condensed with dew. Several pollutants, such as HCl and SO_2 which may combine with water to yield sulfuric acid, produce an acid lesion on the leaf. Most pollutants enter the leaf through tiny pores in the leaf surfaces and cause internal leaf damage. These tiny pores or stomates are the passages through which gas exchanges take place during photosynthesis and respiration. Thus, when a leaf is actively photosynthesizing, its stomates are open and susceptible to pollutant gases.

Each stomate is surrounded by a pair of guard cells which control the tiny entrances to the leaves. Guard cell action is determined at least in part by the water concentration in the leaf cells and in the outside air immediately adjacent to the stomate. Under humid conditions stomates have a larger aperture than in dry air. At a given pollutant level, other things being equal, a plant growing under conditions of high humidity will take in more pollutant and become more severely damaged than a plant growing under arid conditions. Thus, levels of pollutant damaging plants in the Los Angeles area would be even more toxic in the Chicago area.

Symptoms of Plant Damage

Once the pollutants have entered the leaf each has its own characteristic type of interaction with the plant tissues. In most instances the exact cellular target site of pollutant activity is unknown. Most pollutants differ in their effect on plants although it is not always easy to distinguish between pollution damage and symptoms due to other causes. They also vary considerably in the concentrations necessary to induce formation of symptoms. For instance, lead at concentrations presently found in nature is not toxic to plants. Plants do, however, take up lead through their roots and concentrate it. The result may be fatal to herbivorous animals which eat the lead-containing plant. Lead is known to be an accumulative poison and animals feeding along busy highways might well ingest sufficient lead to be detrimental to them. Recent studies with pigeons[1] illustrate quite well the fact that animals living in polluted city areas acquire several times the lead concentrations in their tissues as do animals living in relatively clean country air. Tansy and Roth suggest that the major portion of the concentrated lead is absorbed via the bird's respiratory system. Thus, small animals living along a busy highway could accumulate lead by consuming lead-containing herbage or breathing lead laden air.

Fluoride air pollutants damaging to plants are hydrogen fluoride and silicon tetrafluoride. These substances are taken into the plant leaves through the stomata where they are absorbed by the mesophyll tissue. From the mesophyll the fluoride moves toward the leaf tips and margins where it accumulates. The characteristic symptom of fluoride damage is necrosis on leaf tips and margins where the fluoride has been concentrated. Animals feeding on plants which have accumulated fluoride in leaves may receive toxic dosages.

ETHYLENE IS considered to be a plant-growth hormone and as such exists in low concentrations wherever there are growing plants. It causes a general reduction in growth, decreases apical dominance, and stimulates lateral development. Symptoms often appear on older tissues first and result in early leaf abscission. In orchids the characteristic symptom is necrosis of the sepals.

Peroxyacetyl nitrate (PAN) is the most prevalent component of the peroxyacyl nitrates and is probably responsible for most of the symptoms caused by them. PAN enters the leaf through the stomates where it attacks the cells of the spongy mesophyll. These cells collapse and give the leaf a glazed appearance. Since PAN preferentially attacks the spongy mesophyll and usually leaves the cells of the palisade intact, most sensitive dicotyledonous plants show symptoms only on the lower leaf surface while grasses show symptoms on both surfaces. PAN attacks leaf tissue of a very specific physiological age. Thus, many plant species exhibit a characteristic banded appearance after several successive days of exposure to PAN. After 24-48 hours the glazed appearance may turn bronze or silver. If high concentrations were received by the tissue, it may become chlorotic. Subsequent growth of the damaged leaf may result in an indented or pinched area surrounding the injured tissue.

Ozone (O_3), in addition to forming characteristic symptoms on plant leaves, causes reduced growth. Ozone enters through the stomates and attacks the palisade tissue. Thus, the symptoms are usually expressed only on the upper leaf surface. Many species develop pigmentation at the affected area and show a dark stippled upper leaf surface. Other species may exhibit a loss of chlorophyll by the affected cells resulting in a chlorotic or necrotic flecking. Grasses exhibit the symptoms on both surfaces. Under more extreme exposure to ozone large chlorotic or necrotic areas may develop. In contrast to PAN, young leaves are more resistant than older leaves to ozone damage. Nitrogen dioxide (NO_2) causes growth reduction and defoliation at concentrations often present in polluted areas. Acute symptoms such as chlorotic or necrotic areas occur only with high dosages. The levels of this pollutant in city atmospheres is increasing, however, due to changes in the character of automobile emissions.

SULFUR DIOXIDE (SO_2) enters the leaf through the stomates and reacts with water on the moist cell surfaces to form sulfite which is in turn slowly oxidized to sulfate. Chronic exposure to SO_2 may result in toxicity symptoms due to accumulated sulfate. Acute exposure, on the other hand, will yield symptoms of sulfite toxicity. Chronic symptoms include a general chlorosis while acute symptoms are marginal or interveinal spots.

Since the natural air pollutants emanating from most midwestern cities consist of a mixture of all of these contaminants, the syndrome presented by the plant will be complicated. Different species will respond to the air pollution differently due to their differing relative sensitivities to the different pollutants. An excellent review of symptoms developed by various plant species as well as their relative sensitivities to the pollutants has been recently published by the Air Pollution Control Association.[2]

Ecological Effects of Pollution

Air pollution is having a detrimental economic effect on agriculture in the nation. Truck crops such as beans, lettuce, and spinach cannot be grown in polluted areas near cities. Orchid growers and other producers of cut flowers must establish their nurseries farther and farther away from large cities. Citrus growers in California and Florida are suffering from air pollution. Many farmers have been forced to move away from pollution sources. Alfalfa and many other farm crops in the midwest are very sensitive to air pollutants and farmers are experiencing damage.

Air pollution is also altering the ecological relationships of plants and animals. Many native midwestern plants such as legumes and grasses are very sensitive. California and other states with pines as part of their native vegetation have noted that they are among the most sensitive of trees to photochemical air pollution. Within the pines there is much variation between species. Ponderosa pine and eastern white pine are among the most sensitive. Ponderosa pine is a dominant in much of California's forested lands and is one of the most valuable timber trees. Up to 85% of our ponderosas in the Los Angeles area forests are damaged. Most of these trees may soon die. They appear to be quite sensitive to ozone which impairs the photosynthetic process and other enzymatic reactions. Ozone also causes premature leaf abscission. Normally leaves are retained on these trees for 3-5 years. Often a damaged ponderosa will have only the current year's needles remaining. Thus, the plant is able to make and store less food than normal. This results in less resin production. Since resin seems to function as a protectant against bark beetles and certain other diseases, a smog-affected tree is more susceptible to attack by other organisms. The result is premature death. Unless something is done quickly, the ponderosa pine in California may be doomed.

Research to Develop Tolerant Plants

FORTUNATELY, most species have a great wealth of genetic variation in sensitivity to air pollutants. While many ponderosas are dying, others right beside are quite healthy. We must select and propagate the pollution-tolerant specimens. With ponderosa pines this is difficult because they don't root readily and grafting is slow and expensive. The result is that more tolerant species are being planted by the forest service to replace the dying ponderosas. Such trees as sugar pines, firs, and incense cedar are apparently capable of withstanding current levels of pollution. At the Los Angeles Arboretum we are currently working on improved methods of vegetative propagation of ponderosa pines. We are attempting new ways of rooting cuttings using specialized rooting chambers and chemical treatments. We are also attempting tissue culture of these pines with the hope of rapidly propagating pollution-tolerant clonal plant material from which we can later obtain rooted plants.

The mechanism of plant tolerance to air pollutants is not known in most cases. Engle and Gabelman,[3] however, found that tolerance to ozone in onions is due to a single dominant gene. The tolerant plant has sensitive guard cells. When the air pollutant is detected, the stomates close and the plant is protected. Tomlinson and Rich[4] believe that lipids may be involved, at least in tobacco. They, and others, have found that ozone tolerance in most plants is due to two or more genes. Our studies with petunias implicate leaf thickness and ascorbic acid (Vitamin C) concentration being somehow involved with ozone tolerance. Plants with thicker leaves are more tolerant than plants with thin leaves. Also, the ascorbic acid concentration of the leaves appears to lend tolerance. Preliminary data from petunias indicate that two or more genes are involved and that sensitivity is partially dominant to tolerance in gene action. Breeding programs are presently under way with many plant species to develop smog tolerant varieties.

Conclusions

Hopefully, a great wealth of genetic variability in response to air pollutants also

(Continued on Page 92)

Buxus harlandii: A Versatile Garden Ornamental

Ross Goodrich

ONE OF THE LESSER known boxwoods that has a lot to recommend it is *Buxus harlandii.* It can be grown as a hedge, as an individual plant in landscaping, and as a tub or planter specimen. It is vase-shaped with a flat top and its leaves are a shiny light green that always look like new spring growth.

Used as a hedge its butch haircut should appeal to those who have ever had much hedge trimming to do. Its thinness at the bottom makes it helpful to folks who like to keep everything tidy with all the fallen leaves raked up. Its slowness of growth makes it useful as an individual plant in landscaping and as a planter or tub specimen where a reasonably predictable size or shape is wanted.

The Arboretum's most mature specimen is in the northwest corner of the Asiatic section where it is seen by few visitors. It wasn't planned that way and it is not exactly hidden, being right at the side of the service road that leads from the upper lake to the corner of Vaquero Road and Golden West Avenue. It's just that not too many people wander up that far, but those who do see it usually admire it. It is not of great size for all its eighteen years of age; it is just a little over four feet tall.

Off and on through the years this plant was pointed out as being somewhat special. Through most of this time it was in the shade of a large blue gum, a *Eucalyptus globulus,* and the response was almost always, "Well, if it wasn't in the shade of this tree it wouldn't do so well." When the eucalyptus blew over in one of our spring windstorms some years ago it kept right on growing, looking better than ever. Such is the way with preconceived notions as opposed to actual observations.

The flat top seems to be natural to the plant; it has been neither trimmed nor pruned. This characteristic was suspected to be an isolated incident, so a few cuttings were grown from it to see what they would do. The young plants are now about a foot and a half tall and are the same shape as the parent, so this feature must be typical. It has been easy to grow, with no special cultural demands as to soil, water or fertilizer, and has had no insect problems.

In addition to these features and considering its attractiveness, it is puzzling why it has never become as popular as some of the other boxwoods. But fashions in plants are sometimes like fashions in clothes and hair styles; it is almost heresy to suggest that they will change again. But change they do, and it is possible that some day someone will take enough notice of this plant to give it a whirl.

Buxus harlandii is still available in a few nurseries and it has been known, grown and sold for so long by this name that it is almost a shame to have to say that it is actually *Buxus microphylla sinica,* a native of the mainland of China.

The original Arboretum specimen came as a gift in 1952 from Clarence Hearn who for many years had a nursery at the corner of Las Flores and Santa Anita Avenues in Arcadia.

The Function of a Botanic Garden As a Bird Refuge

Robert and Elizabeth Copper

IN THESE TIMES of rapidly increasing urbanization of natural areas, botanic gardens constitute the only sizable acreage within cities capable of supporting large bird populations, either in residence or in migration. The reason is simply that botanic gardens, unlike parks, are extensively planted, thereby offering a varied habitat, and, most important of all, are sanctuaries where birds and other wildlife are actively protected.

At the Los Angeles State & County Arboretum, 168 native species of birds have been observed, including 16 species of ducks and geese during migration; 14 species of birds of prey, of which 8 are resident; 8 species of woodpeckers; 10 species of warblers; and 27 species of the family Fringillidae (grosbeaks, finches, sparrows). Among these 168 species are 14 rare or endangered species, which enjoy protection from predators and man that can seldom be enforced in the wild. Domestic predators (dogs, cats) are controlled, and strict wildlife protection rules are enforced. Occasional wild predators (foxes, coyotes, bobcats) are not destroyed because of their marginal populations in this area. Few wild predators remain on the grounds more than a few days, and few feed on anything but the domestic peacocks and chickens.

The relationship between plants and birds is one of the most complex and interesting of all biological relationships. To a bird, a tree is a home, a nursery, and a food depot. At the Arboretum, native birds have adapted to living with non-native vegetation, and it can be theorized that many non-native plants have been able to withstand our native insect pests because of birds. All songbirds eat insects at one time or another during the year. In the case of many birds, insects comprise their total diet, and most birds eating a large number of insects consume two to ten times their body weight daily, feeding most heavily in the hours after dawn and before sunset. The importance of insects in the diet of birds is largely underestimated. Hummingbirds, for example, are thought to feed primarily on nectar. In actuality, nearly half their diet is insects; during nesting, nearly three-fourths of their diet is insects, including nearly astronomical numbers of fruit flies and mosquitoes. The total number of insects killed by man by all means, including pesticides, equals a very small percentage of the number eaten by birds, and it becomes apparent that birds represent the world's

The American coot is a common, year-round resident of Arboretum ponds, often seen running across the water or feeding on lily pads.

most effective single method of insect control.

Many birds have acquired reputations for crop depredation, sometimes justly, but most often unfairly. Crows eat grain, but grain comprises only 30% of the total diet of crows in grain-producing states; waxwings eat berries, but these berries are usually considered inedible or undesirable by man. Sparrows eat seeds, but usually weed and grass seed. Woodpeckers drill holes in living trees, but drill primarily to extract wood-boring insects they hear beneath the bark. Mockingbirds seen on dichondra lawns are often blamed for lawn damage when they are actually pulling out the cutworms that are the real culprits. In short, what little damage is done by birds to plants is outweighed by their beneficial actions.

The relationship between birds and plants is clearly beneficial to both, but the relationship between waterbirds and the Arboretum ponds is not quite so obvious. Waterbirds feed primarily on algae, grass, crustaceans, fish, frogs — about anything that lives in or near a pond. Between 200 and 300 waterbirds are resident on the grounds, about half of which have been received as donations. The waterbird population is affected more by the easy availability of food than the amount. It has been noted that when a number of new birds are released, some will seek new feeding grounds, not because food is in short supply, but because food is not easily available in unlimited quantity. Hence the greater the number of birds introduced, the greater the number that will join wild populations, and this is a significant effect of introducing birds at a botanic garden, since all birds capable of flight will eventually join migrations. While these birds are at the Arboretum they assist in maintaining a proper ecological balance in the ponds by controlling pop-

The Ross' goose, one of the rarest of North American waterfowl, made a unique visit to the Arboretum in the winter of 1968.

The cackling goose is the smallest of the ten recognized sub-species of the Canada goose and is an introduced resident at the Arboretum.

ulations of algae and other aquatic organisms. The maximum waterbird population at the Arboretum in recent years was in the spring of 1968, when nearly 700 ducks, geese, swans and coots were present, and it is interesting to note that no extraordinary pressure was placed on the grounds by this population. The average spring population of waterbirds is about 350-400 birds, and the pre-migration fall population may be as low as 200 birds. It can be estimated that the Arboretum could support over 1,000 waterbirds without straining the natural resources or increasing the supplemental feeding already provided. With such a large population, however, a high percentage of the birds would seek feeding grounds elsewhere and leave in migration. Additionally, such a large population would cause a decline in the reproduction rate, since birds can and do naturally reduce their population when pressures for food increase. Incidentally, the Arboretum serves as a haven for rare waterbirds, such as the Ross' goose that arrived in October, 1968. The Ross' goose is one of the rarest of waterbirds, with a worldwide population of only 2,000. A few of these geese usually migrate south to the Salton Sea, and this particular bird was apparently blown off course by strong winds in the desert. Had this bird not come to the Arboretum, it would not have survived. As it was, it wintered here and rejoined the northward migration the next spring.

BOTANIC GARDENS also offer unique opportunities to study bird populations in a protected environment. Bird study has been an important area

The ruddy duck, the male shown in full courting display, is an excellent diver, feeding in deep water on bottom-growing organisms.

Along with other, more common birds of prey, the great horned owl helps check the rodent population at the Arboretum and in the surrounding area.

The only resident heron in the last twenty years is the green heron. A pair, including this immature bird, has made its home at the upper end of the upper pond.

Photo Credit: Great horned owl photo by Ralph D. Cornell; all others by authors.

of biological research, and birds can often be used to predict what may eventually happen to other animals. Examples are the use of canaries by miners to warn of lethal gas and the current study of the brown pelican indicating nearly total reproductive failure due to pesticide damage. Today there are few places where one can study birds, especially near urban centers, and botanic gardens offer the opportunity for study in all phases since they usually have as varied a collection of birds as they do plants. Also, the study of birds is easier and more natural in a botanic garden because of the research and conservation orientation of most gardens. At the Arboretum, bird populations have been studied for several years, the grounds are regularly covered by birdwatchers, and two pilot bird-banding projects are being organized. One proposed study would deal with cedar waxwings which are fall migrants. Very little data exists on cedar waxwings, not due to lack of interest, but rather to the inability to locate stable migratory populations. The Arboretum has a population that resides on the grounds for several months each year, only because of the presence of a large number of berried plants on which these birds feed. Hence, research dealing with birds is now or will soon be a part of each botanic garden, since observation areas are becoming fewer, and botanic gardens offer a habitat conducive to population stability.

Careful bird records are maintained at the Arboretum with the assistance of the Pasadena, Whittier, Los Angeles, and San Fernando Audubon Societies, and the Angeles Chapter of the Sierra Club. Total membership of these groups is about 25,000. The Arboretum is included in the Christmas bird count, Pasadena area, and is published in *Audubon Field Notes,* a field journal published by the National Audubon Society. In addition, rare birds on the grounds attract birdwatchers not only from California, but from neighboring states as well. In 1968, birdwatchers in number from San Diego, San Francisco, Arizona and British Columbia came to see two rare sparrows that have wintered on the grounds for two years now, returning to the same acre area each year. It has been estimated that about 35,000 of the Arboretum's annual 600,000 attendance are birdwatchers made up of students from ornithology classes, the public, and representatives from farm, agricultural, and other state and federal agencies. Through the years, the Arboretum has cooperated with birdwatchers and conservationists by maintaining a current bird list and preserving prime bird habitats on the grounds, such as the willow thicket in the upper pond and the small pond in the historical area.

Wildlife management is relatively new at the Arboretum, beginning in the winter of 1967 with the elimination of domestic ducks and chickens. In the summer, waterfowl are innoculated to prevent mortality from avian botulism (*Clostridium botulinum,* Type C), and a current, continuing pond ecology survey will prove of ultimate benefit to the birds. The Arboretum also serves as a release point for ducks and other wild birds brought in by the public. Most of these birds join migrations. It also serves as a clearinghouse for bird inquiries. Injured and juvenile birds have been accepted and cared for in numbers too numerous to remember by the authors who at times have cages in every room of their house containing species from hummingbirds to owls, and wood warblers to grebes and swans (in the bathtub).

VIEWING THE ARBORETUM and its relationship to birds, one sees an island in an urban area where birds congregate to rest during migration or to feed during the wintering period. The population changes frequently, as frequently as every few hours during peak migration. Of the birds present, only a handful can be said to be Arboretum birds. Most species use the Arboretum for only a short time each year, and really belong to the winds of the western flyway. Many come only to roost, as in the case of seven pintail ducks in 1969 that fed daily at Legg Lake and spent the night at the Arboretum.

As birds pass through, it is the Arboretum's responsibility to provide shelter and safety, not simply because all birds are protected by one or more federal or state wildlife laws, but because careless destruction here, through willful action or neglect, could sever migration tracks, quite possibly affecting the ecology of the birds' winter and summer homes, which might be, as in the case of the western tanager, Guatemala and British Columbia.

It has been estimated that as many as 2,000,000 individual birds visit the Arboretum annually, while the daily bird population ranges from about 5,000 to nearly 20,000 during migration peaks. Any actions taken that affect birds on the grounds will have a similar effect on the species' population and the ecology of all points on the migration path, especially the winter and summer grounds. As long as actions are taken to preserve and protect species, the effects will be beneficial, strengthening the species. If the actions are careless or do not take into account the fact that birds are part of many other ecosystems, the results could be disastrous.

Rose Wilt or Dieback—

A New Virus Disease Attacks Roses in California

by Paul Cheo[1]

CALIFORNIA ROSES are being threatened by a new virus disease. On March 16, 1970, the California Department of Agriculture, Bureau of Plant Pathology, officially reported the existence of a new virus disease in its circular, "Report of New or Unusual Plant Pathogen." The first report of the disease came from the town of Loomis, in Placer County, in September of 1968. It had been observed in one plant of *Rosa multiflora,* obtained originally as a cutting in February in 1965. The cutting was a sample of a commercial rootstock clone used in Oregon and had been planted in a home garden at Loomis to be maintained as a rootstock source plant. Symptoms of a similar kind were also found in 1969 on fifty-one hybrid tea tree roses in a commercial planting near Livermore in Alameda County.

In the same period, our famous rose garden in Descanso Gardens has also been having a wilt and dieback problem. In 1969, 150 roses in Descanso Gardens died and were removed. This year, close to 60 roses have already been removed due to this virus. At first, chemical injuries such as herbicides, fungicides, or over-fertilization were suspected. In consultation with Mr. Clive Loos, Agriculture Commission Plant Pathologist from Los Angeles, and Mr. Harold E. Williams, Plant Pathologist, Bureau of Plant Pathology, California Department of Agriculture at Sacramento, it was agreed that roses in Descanso Gardens are having the same virus problem as reported in Loomis. We are planning to do some transmission and purification work to substantiate the evidence of a virus nature.

Fig. 1

A typical symptom of this disease is the recurved appearance of the leaflets on young shoots (fig. 1). They crowd together and have a tendency to form a ball. These leaves drop off when touched or shaken by the wind. Also, the leaves sometimes turn pale green or yellowish before dropping. After the leaves fall, the young wood starts to die back. Eventually the whole plant dies. In advanced stages of this disease the heavy defoliation and terminal dieback (fig. 2) form a typical descriptive disease syndrome. At times temporary recovery may occur. Frank Simerly, assistant superintendent at Descanso Gardens, indicates that the disease advances more rapidly during the cool season from October to May. In the warm summer season, the disease seems to be arrested.

A VIRUS DISEASE, very similar in description, was prevalent in rose gardens in Victoria, Australia during 1908-1912. It was not regarded as serious by rose growers until 1915, when it reached damaging proportions. As a result, this rose wilt and dieback was restricted to New Zealand, Tasmania, and Australia, including Victoria, New South Wales and South Australia. After half a century it is now in California.

Virus disease is difficult to control. No chemical spray can be recommended, because virus is so intimately associated with the plant cell that chemical treatment sufficiently effective to destroy the virus would also injure the cell. Many plant virus diseases are transmitted by insect. In such cases, an insecticide spraying program can help to eliminate virus infection. Reducing sources of infection is also a helpful measure, requiring the removal and destruction of diseased plants. The use of resistant varieties provides the most effective control of virus diseases.

Fig. 2

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[1] Chief, Research Division, Los Angeles County Department of Arboreta and Botanic Gardens.

BOOKSHELF

Wild Flowers of the United States
Volume Four, The Southwestern States
H. W. Rickett, 1970
McGraw-Hill Book Company, New York

Wildflower books are a tradition and many volumes are in print ranging from small pocket-size handbooks for a single park to the magnificently illustrated volumes of this latest publication.

Volume four, The Southwestern States, covers the states of New Mexico, Arizona and southern California from the Mexican border to San Luis Obispo and Kern Counties. Approximately 2,000 wildflowers are shown in excellent colored photographs and some 250 line drawings are an additional aid in identification. It is the first time that we have had brought together in one volume descriptions and illustrations of the wildflowers of one of the richest botanical regions of the United States. It is an area diverse in habitats from below sea level to the high peaks of the southern Rocky Mountains, southern Great Basin ranges, and southern California. Because this is the largest of the four volumes published to date it is bound in three parts for convenience in using with the beautifully bound volumes boxed in a sturdy slip-case.

The volume is one of a planned set of six, now two-thirds complete. Volume one, appearing in 1966, described the wildflowers of the northeastern states; volume two, in 1967, the southeastern states; volume 3, in 1969, the wildflowers of Texas. Volume five will describe the wildflowers of the northwestern states and volume six those of the Rocky Mountain region. Volumes may be purchased individually but a complete set is recommended for anyone interested in wildflowers.

The remarkable history of this publication is of interest. In 1960 a National Committee for the Wildflowers of the United States was established by the New York Botanical Garden under the chairmanship of Mrs. David Rockefeller and with a membership composed of both botanists and laymen from all parts of the United States. The charge to the members of the Committee was to "promote the publication of a series of books which will eventually contain all the wildflowers of the United States, illustrated in color." Financial support for a publication of this magnitude and quality had to be assured. Professional staff had to be obtained. It was an awesome task faced by Dr. Rickett, the Senior Botanist who took charge of the program. Decisions had to be made on which flowers to illustrate and what kinds of descriptions to write; on the number of volumes and the geographical delimitations and format of each; illustrations, both in color and black and white, had to be secured. One of the first decisions, and perhaps the most important, was to make this a publication which could be used for the identification of wildflowers. All too often wildflower books have been pretty picture books, works of art rather than science, and so restricted in their scope that their use is limited.

Dr. Rickett, with a long experience in popularizing plant study as well as in technical scientific publications, was an ideal choice for editor of the new publication. He has succeeded notably in producing a series of volumes which are technically correct, can be used for wildflower identification, and at the same time are outstanding examples of fine printing and superb illustrations. Each new volume in the set surpasses the preceding in excellence.

The New York Botanical Garden and McGraw-Hill Book Company are to be congratulated on the continuing publication of volumes with such a high standard of scientific accuracy combined with a high quality of the publisher's art. They should serve not only in wildflower identification but as a constant reminder of a floral heritage we must make every effort to protect both for aesthetic enjoyment by future generations and because the flowers themselves are the colorful portions of the green plant essential for the maintenance of life on earth.

Mildred E. Mathias

BOOKS OF SPECIAL INTEREST

South African Aloes by Barbara Jeppe, c1969, Purnell, Capetown, 144 pg. Color plates.

Agricultural Botany by N. T. Gill and K. C. Gear, c1969, Gerald Duckworth and Co., Ltd., London, 637 pg. Illustrated.

The Chemistry and Biology of Viruses by H. Fraenkel, c1969, Academic Press, 294 pg. Illustrated.

Evolution and Phylogeny of Flowering Plants by J. Hutchinson, c1969, Academic Press, 717 pg. Illustrated.

New Pronouncing Dictionary of Plant Names by Amer. Nurseryman, Florists' Publishing Co., 1967 Rev. Ed. 63 pg.

ADULT EDUCATION — WINTER-SPRING 1971

County of Los Angeles — Department of Arboreta & Botanic Gardens

ARBORETUM

CLASS	DAY	HOURS	SESSIONS	FEE	DATES	INSTRUCTOR
Advanced Bonsai	Mon.	7:00-10:00 p.m.	18		Feb. 8-June 14	Mr. Suzuki
Agricultural Chemicals	Wed.	4:00- 7:00 p.m.	18		Feb. 10-June 16	Dr. Crummett
Beginning Bonsai	Mon.	7:00-10:00 p.m.	18		Feb. 8-June 14	Mr. Wydman
*Flower Arrangement	Tues.	9:00-12 Noon	8	$25.	Jan. 5-Mar. 30	Mrs. Brueckner
Home Gardening B	Tues.	9:00-12 Noon	18		Feb. 9-June 15	Mrs. Williams
Plant Identification	Wed.	7:00-10:00 p.m.	18		Feb. 10-June 16	Dr. Enari
Plant Propagation	Wed.	7:30-10:00 p.m.	18		Feb. 10-June 16	Dr. Gonderman
*Sketching & Painting	Thurs.	9:00-12 Noon	12	$25.	Feb. 18-May 13	Mrs. Oldfield

PASADENA HIGH SCHOOL

CLASS	DAY	HOURS	SESSIONS	FEE	DATES	INSTRUCTOR
**California Heritage	Tues.	7:00-10:00 p.m.	10	$50.	Jan. 5-Mar. 9	Mrs. Warren
Home Landscape Design	Wed.	7:00-10:00 p.m.	18		Feb. 10-June 16	Mr. Yocom
**Taxonomy of Flowering Plants	Thurs.	7:00-10:00 p.m.	10	$50.	April 1-June 10	Dr. Enari

ARCADIA METHODIST HOSPITAL

CLASS	DAY	HOURS	SESSIONS	FEE	DATES	INSTRUCTOR
**Poisonous and Medicinal Plants	Tues.	7:00-10:00 p.m.	10	$50.	Jan. 5-Mar. 9	Dr. Enari

**Cooperative with California Arboretum Foundation (Fee $5 less to members)*

***Cooperative with UCLA Extension*

All others cooperative with Pasadena City College with no fee.

DESCANSO GARDENS

CLASS	DAY	HOURS	SESSIONS	FEE	DATES	INSTRUCTOR
***Beginning Bonsai	1st Tues.	7:00-10:00 p.m.	Monthly	$25.	Feb. 2-June 1	Mr. Wydman
***Beginning Bonsai	3rd Tues.	7:00 10:00 p.m.	Monthly	$25.	Feb. 16-June 15	Mr. Wydman
***Flower Arrangement	Fri.	9:00-12 Noon		$25.		Mrs. Pulliam
Home Gardening B	Wed.	9:00-12 Noon	18		Feb. 10-June 16	Mrs. Williams
Home Horticulture	Mon.	7:00-10:00 p.m.	14		Feb. 8-May 17	Mr. Simerly
Home Landscape Design	Tues.	7:00-10:00 p.m.	14		Feb. 9-May 18	Mr. Wilson
Plant Identification	Mon.	9:00-12 Noon	18		Feb. 10-June 16	Dr. Enari
***Sketching & Painting	Thurs.	10:30-12:30 p.m.	17	$25.	Feb. 18 June 17	Mrs. De Groat

SOUTH COAST BOTANIC GARDEN

CLASS	DAY	HOURS	SESSIONS	FEE	DATES	INSTRUCTOR
*****Contemporary Flower Arrangement	Mon.	9:00-12 Noon	10	$10.	Mar. 1 May 10	Mrs. Stough
****Home Gardening	Thurs.	9:00 12 Noon	12	$12.	Jan. 7 Mar. 25	Mrs. Williams
****Plant Identification	Wed.	7:00 10:00 p.m	16	$16.	Feb. 3-May 26	Mr. Verity
****Shade Gardening	Thurs.	9:00-12 Noon	10	$10.	April 15-June 17	Mrs. Williams

*****Cooperative with Harbor College*

****Cooperative with Descanso Garden Guild (Fee $5 less to members)*

******Cooperative with South Coast Botanic Garden Foundation*

All others cooperative with Pasadena City College with no fee.

(Continued from Page 81)

exists within the native prairie flora and fauna. One would also expect considerable variation between species in smog sensitivity. Several participants at this conference have discussed the establishment or maintenance of relic prairies within a city. It will be interesting to see if some species are eliminated by the air pollution associated with these urban centers. Due to the relatively short generation times (compared to pines) the prairie natives may be better able to adapt to man-made air pollution, thus the changes in the ecosystem may not be as severe as we are experiencing in Southern California.

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3. Engle, R. L., and W. H. Gabelman 1966. Inheritance and mechanism for resistance to ozone damage in onion, *Allium cepa* L. *Proc. Amer. Soc. Hort. Sci.* 89: 423-430.
4. Tomlinson, H., and S. Rich 1968. Relation of lipid content to ozone resistance of tobacco leaves. *Phytopathology* 58: 1070. ——— 1969. Changes in sulfhydryl and lipid content of bean leaves exposed to ozone. *Phytopathology* 59: 1054. ——— 1969. Relating lipid content and fatty acid synthesis to ozone injury of tobacco leaves. *Phytopathology* 59: 1284.

CALENDAR 1971

January - February - March

ARBORETUM ARCADIA

January 15 — 8:00 p.m.
Theodore Payne Foundation Lecture
"Some of California's Native Shrubs"
Eugene Memmler, Natural Science Photographer

January 23 — 3:00-5:00 p.m.
24 — 9:30-4:30 p.m.
Southern California Iris Show

January 29, 30, 31 — 10:00-5:00 p.m.
Baikoen Bonsai Kenkyukai Show

February 13 — 1:00-5:00 p.m.
14 — 9:30-5:00 p.m.
Temple City Camellia Society Show

March 9 — 3:30-4:30 p.m.
Arbor Day Celebration

March 19 — 8:00 p.m.
Theodore Payne Foundation Lecture
"California Native Lilies"
Frank Ford, Photographer and Lecturer on World Flora

DESCANSO GARDENS LA CANADA

January 16 — 1:30 p.m.
Rose Pruning Demonstration

February, all month — 9:00-4:15 p.m.
Mid Valley Artist League Show

February 17 — 8:00 p.m.
Theodore Payne Foundation Lecture
"Flowering California Native Shrubs for our Gardens"
David Wood, Photographer

February 27 — 1:00-5:30 p.m.
28 — 8:00-5:30 p.m.
Camellia Show

March, all month — 9:00-4:15 p.m.
Eagle Rock Artist Association Exhibit

March 9 — 3:30-4:30 p.m.
Arbor Day Celebration

March 20, 21
Daffodil Show

All events admission free


An Arboretum is not all trees . . .
THE REPRODUCTIVE PROCESS of flowering plants is interrupted if the
pollen grains, which must transfer from the anthers (yellow) to the
stigmas (orange), fail to germinate before reaching the ovary where
the young ovules are fertilized and develop into seed. Studies have
shown that heavy concentrations of smog inhibit pollen germination.
Biologists at the Los Angeles State and County Arboretum are investi-
gating the possibility that natural selection for smog tolerance occurs
on the floral stigma. If true, the plant breeder may be able to develop
smog-tolerant varieties using the floral stigma as his selection site.
SCE
Southern California Edison Company

Speaking for the Foundation

IT IS AMAZING what has been done at our Arboretum in its short life span of a little over twenty years. We are indebted to those who had the foresight, drive, and love to provide the foundation for later accomplishments.

It is interesting to note that long before ecology became a vogue word, awareness of environmental relationships was a way of life for those who loved nature. Pure air, clean water, horticulture, conservation, wild flowers — these are words long familiar to members of the Arboretum Foundation. Those of us who have been active as nature lovers all our lives have been active in the same cause now being advanced under the name of ecology. But under any name, we want the Arboretum to progress as the leader in showing how Southern California can be a better, more beautiful place in which to live. I choose to call the Arboretum the "greenheart" of Southern California, for it pumps life, inspiration, and love of horticulture throughout our Southland.

Soon it will be spring. In Southern California our seasons are more gentle, without the dramatic differences between fall, winter, spring and summer. Recent arrivals do not understand when we say that spring comes with the first rains in the fall. At that time the grass on the fields, hills and mountains starts to grow. By mid-winter Southern California is fresh and clean and green.

For the new year I would like to see all of our members assign to themselves the responsibility of bringing new members into the Foundation. Our goal of 1,000 members has yet to be reached. With a half million people living in the western San Gabriel Valley and seven million in all of Los Angeles County, there are many times 1,000 persons who are surely genuine prospects having a desire to work with us toward achieving our horticultural and environmental objectives.

It is my sincere hope that 1971 will be a year of accomplishment for our Foundation. I hope we can move to another stage in the planning of the horticultural display building that is so badly needed. Either by separate mailing or through the pages of *Lasca Leaves* you will be receiving a report on the activities of the Foundation with a statement of objectives for the years ahead.

Ernest Hetherington

President

CALIFORNIA ARBORETUM FOUNDATION, INC.

Foundation Office — Telephone (213) 447-8207

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Lasca Leaves

The official publication of the California Arboretum Foundation, Inc.

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of

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Box 688

Arcadia, California 91006

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Staff

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Lasca Leaves

DEPARTMENT OF ARBORETA AND BOTANIC GARDENS, COUNTY OF LOS ANGELES

Arcadia, California 91006 • Telephone (213) 681-5277

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LOS ANGELES STATE & COUNTY ARBORETUM | DESCANSO GARDENS | SOUTH COAST BOTANIC GARDEN

The Cover

The white jacaranda was introduced by the Arboretum in 1961. Bud wood had been received at the Arboretum from Lima, Peru, ten years earlier. All white jacarandas now in Southern California have been grown from this original tree which, when it blooms well, is outstanding. Flowering appears to be involved with temperature. It has been noted that alternately cooling and warming periods cause buds to burst open. Botanically, the white jacaranda is a form, or selection, of *Jacaranda acutifolia.*

Editor
Donald S. Dimond

Photo Credits
Cover by Jack McCaskill

department notes

Change

REGULAR readers of Lasca Leaves will note some changes on the title page and elsewhere reflecting the magazine's new status as a publication representing the entire Department of Arboreta and Botanic Gardens, instead of the Los Angeles State and County Arboretum alone. The decision to expand was reached at a board meeting of the California Arboretum Foundation early this year, with the further decision that the Foundation would continue as publisher.

The change has the endorsement of Department Director Francis Ching who sees it as a further step in the unification of the Department's facilities which, located in various major climatic environments in Los Angeles County, have the common objective of serving surrounding communities through information, education, research, horticultural, and plant introduction programs.

The Department's three principal facilities are, of course, already well known. The Arboretum, established in 1948, had the benefit of a hundred and fifty preceding years of colorful history, a good part wrapped up in the person of E. J. Baldwin, whose "rancho" encompassed the present site. Descanso Gardens also has a long history. Its one hundred and sixty-five acres were acquired in 1958 and just as the Arboretum is still known to many as "Lucky Baldwin's old Rancho Santa Anita," so is Descanso Gardens known as the onetime home of Manchester Boddy, publisher of a liberal Los Angeles newspaper of the thirties and forties. South Coast Botanic Garden, located not far from the ocean on Palos Verdes Peninsula forty-one miles south of Department headquarters in Arcadia, was established in 1960. It too has a Spanish pedigree, but its popular fame rests more on the unique character of its eighty-seven acres, once the site of a county dump that in turn filled an abandoned diatomaceous earth mine.

Each of these gardens represents a different botanical and topographical environment. At the Arboretum and at South Coast the soil is generally poor, but for different reasons. South Coast Botanic Garden is planted on three feet of soil covering seventy-five to one hundred feet of trash, resulting, among other things, in subsidence and heat from decomposing waste. At the Arboretum, soil conditions vary from one part of its one hundred twenty-seven acres to another. Boggy around the ponds and some adjoining areas because the water table is high from underground springs, the soil elsewhere has a high clay content, full of nutrients, but unyielding and requiring a great deal of conditioning. So far as soil quality is concerned, Descanso Gardens is better endowed. Its longstanding forest of California live oaks provide the humus and the mantle for the equally famous camellia plants growing in profusion underneath. Its rose gardens, like most of the grounds, were planted and cultivated by Mr. Boddy, an enthusiastic horticulturist. A further horticultural bonus is provided by a copious supply of pure water piped down from a two-hundred-and-fifty-acre watershed in the San Gabriel Mountains just a few miles to the north. This is in contrast to the water of the Colorado River, major irrigation source at the Arboretum, which has a debilitating effect on plants because of its high salt content. Plants at the

Arboretum invariably perk up and look better in the fall after heavy rains have leached accumulated salts to below root level.

Two other parcels of land belonging to the Department, both in still different environments, are marked for future development. One is the High Desert Arboretum in Lancaster. If you were to head due north from the Arboretum for approximately twenty-six miles, tunneling in a slight rise through the San Gabriel Mountains, and then head ten miles east, you would reach the eighteen-acre site at Avenue J and 175th Street. The rise would have taken you from the Arboretum's mean elevation of four hundred and fifty feet to three thousand feet which is the posted elevation of the Joshua Tree State Park just across the street from the High Desert Arboretum.

The climate here is typical of the area: low humidity, precipitation four to six inches annually, very cold and windy in the winter, and very hot and windy in the summer. An analysis of the soil by the U.S. Department of Agriculture in cooperation with the University of California Agricultural Experiment Station describes "the surface layer in a typical profile (as) light yellowish-brown, loamy fine sand about 6 inches thick. The subsoil is . . . light clay loam, sandy clay loam, and gravelly light sandy clay loam about 23 inches thick. Hard granitic rock is at a depth of about 29 inches. These

Site of High Desert Arboretum. Photo, taken in March, shows desert wildflowers and shrubs with buttes in the background.

Photo: Glenn Hiatt

soils have a moderately slow permeability. Available water-holding capacity is 4 to 6 inches. Fertility is low."

The entire area is expected to become a vast metropolis by 1980, centered around the projected, controversial Palmdale Intercontinental Airport. Ecological considerations aside, the area is already laid out in a grid of streets and avenues reminiscent of New York City's boroughs of Manhattan or Queens. The avenues encompass the alphabet, running east and west. The streets run north and south, reaching easterly to 260th Street, the dividing line between Los Angeles and San Bernardino Counties. By the time the predictions of urban planners come true, the Department hopes the High Desert Arboretum will be ready to help thousands of new home owners learn about plants for their gardens.

The other parcel of land is the Lux Arboretum, located in the foothills of Monrovia about ten miles northeast of the Arboretum. It was willed to the California Arboretum Foundation in 1955, and subsequently turned over to the Department, by Dr. George P. Lux, a dental doctor whose avocation was horticulture. Dr. Lux imported many plants from Mexico, where he had large holdings, in the 1900s, and was among the first to introduce avocados to the United States. The property consists of one hundred and fifty-four acres at elevations of nine hundred to thirteen hundred and fifty feet. The terrain is mountainous yet offers frost-free areas for tender plants by reason of the air drainage or circulation through the canyons and slopes that eliminates frost pockets. An all-year water supply for the Lux Arboretum and three residences in the area is provided from stream beds. The site constitutes one of the very few remaining natural canyons in the foothills and, aside from its value as a place for growing tender plants, offers a superb setting for use as a nature study area.

CAF Election

THREE NEW OFFICERS were elected by the Board of Trustees of the California Arboretum Foundation, Inc., all to serve a one-year term. They are Mr. Donald Camphouse, President; Mrs. Peter L. Douglas, First Vice-President; and Mr. Harrison Chandler, Second Vice-President. Mr. Camphouse previously served as secretary-treasurer to the Board and also has served as the mayor of Arcadia, president of the Arcadia Chamber of Commerce and president of the Arcadia Rotary Club.

Appointed for one-year terms as secretary and treasurer were Mrs. Chester L. Williams and Mr. William E. Eilau. Four Board of Trustee members reelected to three-year terms were Mrs. John N. Fehrer, Mrs. Jerome K. Doolan, Judge Joseph A. Sprankle, Jr., and Mr. Ernest E. Hetherington. Appointed as an honorary trustee was Mr. Charles Crum, an Arcadia resident who is president of the California Nurserymen's Association and general manager of Rosedale's Nursery in Monrovia.

Expressions of appreciation for ten years of dedicated service to the Foundation were tendered outgoing CAF president Ernest Hetherington. In addition to his work on numerous committees, Mr. Hetherington served as secretary to the Foundation before becoming president in 1970.

Canoe, Anyone?

A SOMEWHAT cryptic telephone call from Alice (Mrs. Peter L.) Douglas, CAF vice president, brought this message: anyone having, or having access to a canoe is asked to get in touch with her, and all CAF and Las Voluntarias members should look forward to an upcoming "party to end all parties." A canoe party?

Camellia Culture for Southern California

Mark J. Anthony

YES, IT IS TRUE, you may have camellias blooming in your garden nine months of the year if you select the correct varieties.

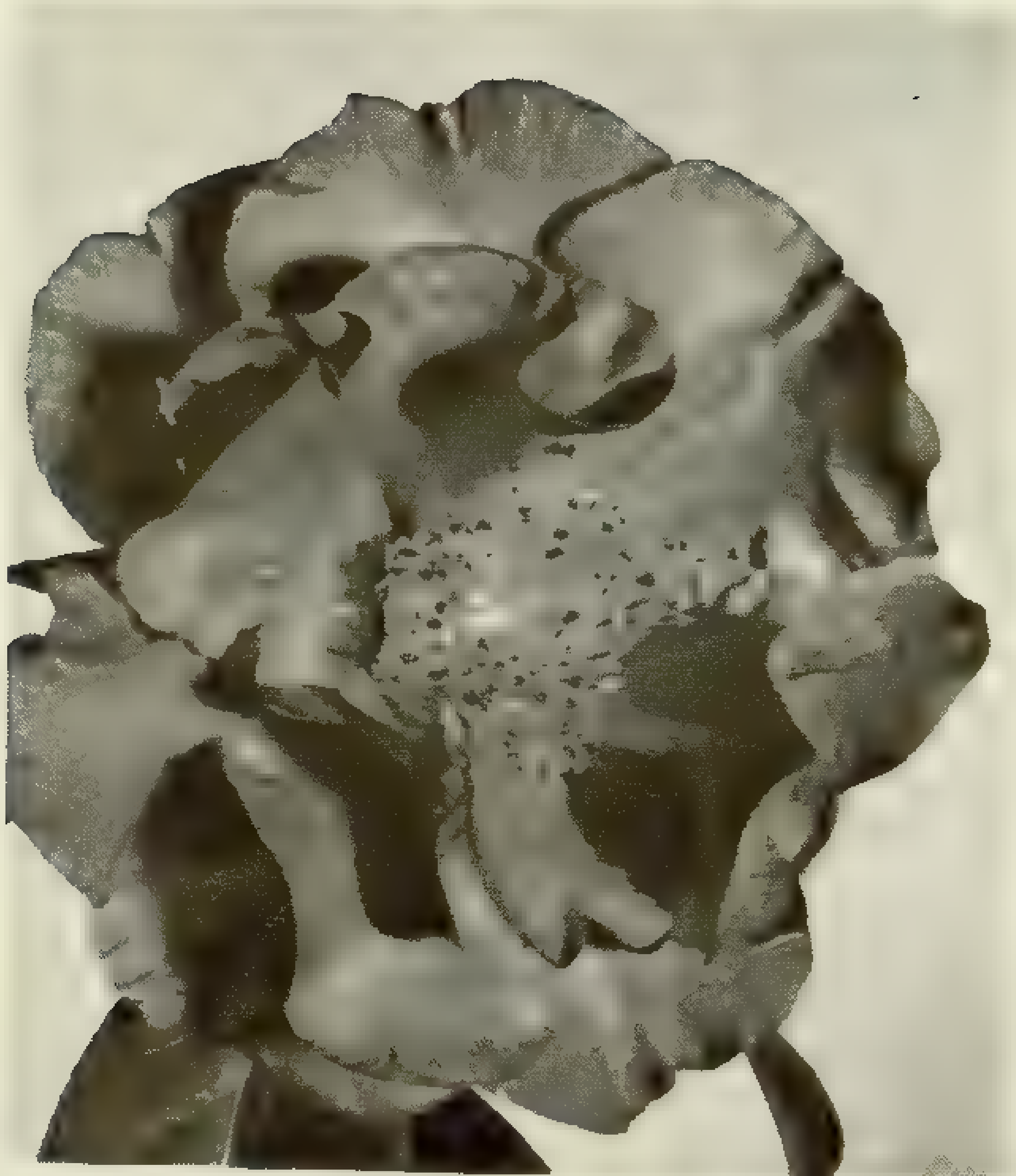
Starting in September, the beautiful, wild, roselike *Camellia sasanqua* with the willow-like branches starts bursting into bloom. Some of the finest members of this species include 'Jean May,' a compact grower with glossy, dark green foliage. It has large, shell pink, double blossoms, with better than average keeping qualities. 'Narumi-Gata' is a very large, fragrant, single, white variety, quite upright in its growth habits and excellent for covering a fence or arbor. 'Rosy Mist,' with its large, single, delicate, soft pink flowers, is extremely prolific in its flowering. 'Showa-No-Sakae' is a low-spreading sasanqua that is fine to use as a ground cover. The semidouble to peony flowers of soft pink are admired by everyone. Sasanqua camellias can stand more sun than most other species of camellias and so can be used in more locations in the home garden.

A few of the *Camellia japonica* will start coming into bloom in September. 'Yohei Haku,' sometimes called 'September Morn,' is a white peony form with the early flowers showing a slight pink cast. Plant in full shade so the early flowers won't burn. 'Are-Jishi,' a dark salmon-rose, full peony form, will also start coming into bloom in mid-September.

In October and November more sasanqua and japonica species will start blooming. Of the japonicas, the Daikagura family of red, pink sport 'High Hat,' variegated and white sport 'Joshua Youtz,' will start blooming nicely at this time. 'Daitairin,' the large, light rose pink single with the mass of petaloids in the center, will also bloom in November. The best formal white of all time is also an early bloomer. This is 'Alba Plena.' It will start blooming in November and continue all winter until the end of March. A relatively new camellia, 'Mrs. Goodwin Knight,' is also extremely early. Petals of a lovely, deep orchid-pink, form a large, loose peony flower. In a fairly sunny spot plant 'Debutante' for good pink peony-shaped flowers at this season.

In December more and more good flowers begin to show throughout Descanso Gardens. 'Lucy Hester,' 'Laura Walker,' 'Richard Nixon,' 'Berenice Boddy,' 'C. M. Wilson,' 'Dr. John D. Bell' and 'Gigantea' are among the best.

At the early camellia shows in December you can see camellias of all kinds blooming out of their normal season. These are



Camellia reticulata *'Captain Rawes' — imported from China in the early 1700s. The reticulata species produce some of the largest and most showy flowers in the camellia family.* Photo: Charles Kassler

flowers that have been treated with gibberellic acid to induce them to bloom as much as three months early. After the growth bud, next to a flower bud, has been removed, a drop of the acid solution is placed on the growth bud scar. Within thirty to forty-five days later the flower bud will burst into bloom; sometimes twice as large as normal.

In January and February hundreds of varieties of camellias burst into bloom at one time, and we say that late February is the height of the camellia season. 'Pink Clouds,' 'Sunset Glory,' 'Kick Off,' 'Grand Slam,' 'Cardinal's Cap,' 'Betty Sheffield' and 'Herme' are good ones to plant for bloom at this season.

The *Camellia reticulata* adds to the array of flowers in March and April. These giants of the camellia world range from the beautiful, cherry red of 'William Hertrich' through many rose and pink varieties to the striking variegation of 'Lion Head.' For bushy plants and lots of large perfect flowers, plant reticulatas where they will have about one-half day of sun and lots of light.

Camellias will still be blooming in your yard in April if you have such plants as 'Te Deum,' 'Purity' and 'Blood of China.' In May when I see Descanso Gardens' 'Elena Nobile' camellia plants in bloom I know that once more a camellia season has ended.

IN ORDER TO HAVE these flowers for nine months of the year a few thoughts about their care might be in order. Plant high in such a manner that they can grow high the rest of their lives. By this is meant that no peat moss or leaf mold should be under the plants that later can decay and allow them to settle. Set the ball of roots from the container about one-half inch high on good, solid ground and then fill in around the plant with a mixture of one-fourth leaf mold, one-fourth peat moss and one-half good soil. Planting high also provides the good drainage that is necessary for success. After the plant has been watered, a mulch of pine needles, bean straw or peat moss put around the plant helps to keep the roots cool. The sunnier the location, the heavier the mulch should be.

Camellias should be kept damp at all times; never allow them to become dry, winter or summer. Plants that are dry in the summer will drop flower buds in the fall and winter. If the buds do not drop from dry plants the flowers will be smaller than they ordinarily would be. In watering a plant that is in direct sunlight, care should be taken that water is never applied to the leaves when the temperature is over 92°. Large brown spots in the center of camellia leaves can be attributed to watering the foliage in direct sunlight. When the temperature is not over 92° always wash the leaves off after the plant has been watered at its base, as clean leaves make for healthy plants.

Winter is the best season of the year to transplant camellias but transplanting can also be accomplished successfully in June and July. After the first flush of new growth is over and the plant has hardened off, carefully shape a solid ball of soil around the plant's roots, wrap the soil in burlap and move it to its new location. Be sure to replant it no lower than it was before. Water at once with a little Vitamin B-1 added to the water. If the plant seems to wilt, cut a few inches off the terminal branches.

All camellia plants should have their first feeding about March 15th, or at the first sign of growth. The second is due May 15th and the last about August 15th. Use any good organic camellia fertilizer that is on the market. Spread under the plants at the rate of one heaping tablespoonful to each foot of camellia height. Follow with a very thorough watering. Be sure the material you use is of the organic type as it is less likely to burn. If your plants are large and growing profusely, one fertilizing may suffice.

Before applying a new mulch around camellias the old one should be removed. This accomplishes two things; first it gets rid of old flowers and petals that may be hiding in the mulch. This is very important as the camellia flower-blight lives over from year to year on decayed flower parts and the only way to eradicate this dreaded fungus disease is to keep your garden free from old flowers on the ground. The second thing accomplished is you keep the depth of the mulch from increasing around the plant. Camellia plants hate having a deep mulch around them as it cuts the air off from the roots and also keeps the trunk of the plant damp at all times thus inducing rot to set in. A one-to-two-inch dressing of pine needles, oak leaves, peat moss or bean straw makes a very satisfactory mulch.

At this same time you might check the depth of your camellias. If the large roots are not within one-half inch of the surface of the ground, your plant is too deep. Remove all excess soil from under the plant until you come to the roots; then put a light mulch over the roots. Plants that are much too deep can be raised during the winter.

Some trimming of camellias can still be done if you have not already finished this job. The best time to trim is in March or April before the new growth appears. This way you do not disturb the next year's crop of flowers. Always cut the branch back to a live bud or to the axil of another branch. Slant all large cuts away from you so the cut won't be seen by those viewing the plant. Paint all cuts larger than one-half inch with a good tree paint. Dead wood can be removed any time of the year. When the plant is spindly, but you do not wish to trim it very much, breaking off of the terminal growth buds will quite often force dormant buds to start growing.

CAMELLIAS GROWING in pots or tubs should be checked during the winter to make sure they have good drainage. Lay the plant on its side and reopen the drainage holes in the bottom of the container. Container plants need only half the amount of fertilizer as those grown in the ground. If the plants have been in the same tubs for three or four years, this would be a good time to replant them in a size larger container. Those of you who are striving for large, extra fine flowers that will win a silver trophy at the camellia shows should start thinking of disbudding your plants in August. When thinning the buds take some of the large buds as well as some of the small ones. In this way you will spread the blooming season of the plant over a much longer time.

In July, seed pods start forming on some camellia plants. Ten or twelve pods will not harm the plant but if great numbers develop they should be removed as they can sap the strength of the plant or keep it from setting flower buds the following year. The pods that remain will be ripe in September and as they break open they should be planted in the ground immediately.

There are two methods of growing camellias from seed that work equally well. In both, the secret is to plant fresh seeds; that is, as soon after picking from the bush as possible.

The first method is to plant 8 or 10 seeds in a 6-inch flower pot of good garden soil that has about one-third leaf mold or peat moss added to it. If many seeds are planted, use an 8-inch deep box that has many drainage holes in the bottom and fill with the above soil mix. The seeds are placed an inch apart and covered with one-fourth inch of soil and leaf mold. After the plants are a year old, they can be taken up bare root and planted in the ground or in 6-inch pots or gallon cans.

The second method is to thoroughly wash with boiling water a pint or quart jar that has a large mouth. Next, boil enough peat moss in an old kettle to fill the jar. Squeeze out the extra water and after the seeds have been mixed with the peat, fill the jar with this mixture of seeds and peat.

Place somewhere that is warm in the kitchen and the heat will quickly cause the seeds to germinate. When the seed has sprouted and there is a white root about three-fourths inch long protruding from the seed, remove the seed from the jar and plant it in a seed box with a mixture the same as for dry seed. Water at once. Camellias in Southern California grow with a minimum of insect damage.

OUR BIGGEST PROBLEM has been in keeping the oak leaf roller from eating the young leaf buds of our reticulatas. The leaf rollers slide down their fine thread-like webs from the oaks above and work their way into the center of the reticulata growth buds just as they are starting to elongate. After they are inside the bud no amount of spraying seems to do any good. The best control is obtained by spraying all the oak trees in the vicinity with Sevin as soon as the first leaf roller appears in the oaks. If this does not kill all the leaf rollers a second spraying may be necessary.

For years scale insects gave camellia growers a lot of trouble, but, since water from the Colorado River came to Southern California, most of the scale disappeared as they could not stand the thin layer of salt on their outer coat every time the camellia plant was washed off. For those who do find a few scale on their plants, a 2% oil spray in the spring when the young scale are in a migratory stage will kill them. Never spray with oil when the temperature is over 85° and always have the soil around the plants wet before spraying.

Sometimes the margins of camellia leaves look as if they had been pinked with shears. This is most likely the work of the Fuller's rose beetle, or the Brachyrhinus beetle. They are easily killed by dusting the soil underneath the plant and in the surrounding areas with Sevin dust, or granules. This will also kill other beetles that sometimes eat holes in the ends of camellia buds.

In May and June when camellias are in active growth, aphids will sometimes attack the new shoots. The damage they do is not great but they are liable to disfigure some of the leaves by taking the sap from the leaves. Wash them off with water, or better still spray them with Malathion or Nicotine Sulfate. Ants will bring aphids to your camellias so keep the ants away with a little Chlordane dusted around the plants.

Sometimes slugs will crawl up camellia plants and eat holes in the flower itself. Slug bait under the plant will kill them. As we stated before, camellias have very few insect problems and if you keep your plants washed off and clean at all times, they will have even less trouble.

For the past ten years Mark J. Anthony has been the Superintendent of Descanso Gardens and for many more a horticulturist with a special interest in camellias. He is a charter member of the Southern California Camellia Society.

PUTTING DOWN ROOTS

William S. Stewart

THE DEVELOPMENT of the Pacific Tropical Botanical Garden during the past year may be thought of as the sprouting of a seed planted many years ago and nurtured by a succession of dedicated plantsmen who sustained the inspiration from one to another over a long period of time. By 1956 Dr. Harold Lyon and Dr. Herbert Beaumont had begun seeking support for a botanic garden in Hawaii devoted primarily to research and education; but it was not until August 19, 1964, that the Hawaiian Botanic Garden Foundation was successful in obtaining a Congressional Charter for such a garden in the tropics of the United States. Through the efforts of Mr. Goodale Moir and Mrs. Lester Marks, and with the help of former Secretary of the Interior Oscar Chapman, the Charter was granted and gave recognition to the potential of the project. At last on January 1, 1970, the roots of the new plant penetrated the soil of the Hawaiian Island of Kauai where some 200 acres of land was acquired in the beautiful Lawai Valley. Appropriately, the entrance to the new Garden is on a hilltop with the ancient name of "Kumuokalani" which translates as "Root of Heaven."

Surrounded by sugarcane fields, the Garden is being developed on the floor and sides of the long, narrow Lawai Valley and in a branching side area known as "4-House Canyon." Both the valley and the canyon have live, year-round freshwater streams of much beauty. The south boundary is essentially at sea level and about a half mile from the ocean, while some of the land along the northern boundary is about 600 feet in elevation.

Lawai is an erosional valley formed by stream cutting where the soils occur in an intricate, complex pattern: the valley soils were formed from alluvium and colluvium from basic igneous rocks, and the upland soils are residual from basalt. The mean annual temperature is 74° F with a minimum of about 52° F and a maximum of 90° F. Rainfall averages about 30 inches a year, or less at the lowest elevation, up to 75 inches or more at the higher sites. This great diversity in climate, soils, and topography affords a veritable kaleidoscope of distinct microenvironments which are cool, hot, wet, dry, lake, cliff, or meadow in endless combinations.

This new research garden comes on the scene at a time when there is an increased impetus being generated toward tropical biology and when the preservation of endangered species is an urgent problem of world-wide dimensions. This problem is so compelling that the first goal of the Garden is the preservation of these native Hawaiian endangered species.

A SECOND INTEGRAL activity of Pacific Tropical Botanical Garden is the collecting of tropical plants which show indications of having medicinal value. In the Pacific Islands, various plants are still used medicinally especially by the older people and those who remember how to prepare certain roots, leaves, stems, and flower parts that had long ago been found by their ancestors to be beneficial. Recent generations have had little interest in using and perpetuating this kind of knowledge, so a concerted effort is planned to collect and grow these plants, not only those of Ha-


PACIFIC TROPICAL BOTANICAL GARDEN
LAWAI VALLEY
ENTRANCE
KUMUOKALANI
4-HOUSE CANYON
SUGAR CANE
1—ADMINISTRATION
2—SERVICE BLDG.
3—STILL WATERS
4—BAMBOO BRIDGE & FIJIAN SHELTER
5—BOG
6—KAPALIULA
7—HAUL CANE ROAD & BRIDGE
8—PUMP 6
9—NURSERY
10—CHALET
X X X GARDEN ROADS
. . . TRAILS
AREA LOCATION
LIHUE →
#50
LAWAI
#53
KOLOA →
OLD CANNERY
WAILIMA RD.
← ENTRANCE
PHONE 332-8131
TO LAWAI-KAI THE ALLERTON GARDENS

waii but representatives from all tropical areas of the world. It is anticipated that in making the Garden's medicinal plant collection available for cooperative studies, there will be close work with researchers engaged in the study of ethnobotany, pharmacognosy, and other related subjects. This will be a part of a general study of tropical plants for medicinal and pharmacological uses.

The Garden will have as a third goal the searching for and collecting of tropical plants of potential economic or ornamental value. It is planned that there will be garden sites in various environments on Kauai and on the other islands of Hawaii to allow study of plants with particular cultural requirements which cannot be successfully grown in Lawai Valley. Plant breeding will be among the methods extensively utilized in the development of species for new uses.

A gift of one million dollars by the late Robert Allerton made possible the tangible beginnings of Pacific Tropical Botanical Garden, and it was organized as a private non-profit corporation directed by a Board of Trustees. Thus far during this first year, work on the grounds has been devoted to:

1. Mapping and preliminary layout plans for land utilization, with the assistance of Roger E. Holtman, landscape consultant.
2. Construction of two-and-a-half miles of access roadway through the Garden.
3. Building a system of trails around the boundaries.
4. Construction of a modest Administration Building (21x42 feet) to house the Office, Library, and Herbarium, and a Service Center (21x42 feet) as an all-purpose structure.
5. Rehabilitation of an old pump house for use as a Nursery.

A trial program during the summer brought mainland students with an interest in botany from Occidental College and Pomona College in California and Cornell University in New York. Along with local high school boys, they were indispensable in the work program, and in addition they attended seminars, went plant collecting, and lent a congenial charm to all of the Garden's activities.

NOW THE PRELIMINARIES are nearly completed and a long range program of continuing analytical investigations is about to be initiated. Studies dealing with tropical plants in relation to the whole environment are difficult to carry on with the usual method of annual budgeting which is susceptible to change from year to year. So the need for a botanic garden stressing ecology as the basis for its philosophy is being met by initiating what eventually will become a chain of gardens throughout the islands of Hawaii with sustained support of private funds. Located in representative climatic areas in the islands, they will form natural laboratories utilizing the spectacular diversity of environmental conditions found in Hawaii. There will be unparalleled opportunity for plant research.

With emphasis on both research and education, the Pacific Tropical Botanical Garden, slowly maturing, will be bearing fruit of contributions of new knowledge about plants of the tropics which is urgently needed by mankind throughout the world.

Dr. William S. Stewart is Scientific Director of the new Pacific Tropical Botanical Garden in Kauai, Hawaii, a post he assumed after serving fifteen years as director of the Los Angeles County Department of Arboreta and Botanic Gardens. A frequent contributor to Lasca Leaves during his tenure, Dr. Stewart wrote this article for the first issue of Pacific Tropical Botanical Garden's The Bulletin, *and graciously offered it for reprinting in this magazine when asked for news of his current work.*

JOB'S TEARS

Glenn Walker

HAVE YOU EVER wondered about those shiny gray seeds in the necklaces worn these days by many young people, radicals, militants, and protesters? They are Job's Tears, surely one of nature's most beautiful and marvelous creations. Several times I have asked a hippie or young black about his beads, but was always disappointed to find that he knew nothing at all about them. He had never had the pleasure, as I had, of growing his own necklace of these attractive and ancient beads.

The fascinating seeds undergo no treatment when they are made into necklaces. Their beautiful mottled gray-brown color and smooth glossy appearance are entirely natural. No coloring or lacquering is necessary. Even the holes needed for stringing grow naturally in each seed. The Biblical story of Job, after whom the beads are named, belongs to the wisdom literature of the Old Testament. While its aim has been considered to be a profound discussion of the problem of suffering, on deeper reflection it appears to be an "epic of the inner life," revealing the profound search of a sincere man for the meaning of life.

Job is a prosperous man who is an example of piety. He is the owner of many herds and flocks, the father of a large family, and the master of numerous servants. The Lord regards him as "a blameless and upright man who fears God and turns away from evil" and declares that "there is none like him on the earth."

Satan implies that Job's piety is due to his good fortune. The Lord permits Satan to test Job by destroying his property, his servants, and his children. Yet Job does not sin. Satan counters by saying that Job's piety may not be affected by loss of property, but its integrity could be tested by physical suffering. He challenges the Lord by saying "All that a man has he will give for his life. But put forth thy hand now, and touch his bone and his flesh, and he will curse thee to thy face." Satan is permitted to apply this test, except that he must spare Job's life.

Job is afflicted with loathsome sores from the sole of his foot to the crown of his head and the trial of his piety begins. He sits among the ashes and uses a piece of broken pot to scrape himself. Job's anguish is terrible. To add to his burden, his wife chides him by saying "Do you still hold fast your integrity? Curse God and die."

Job never turns against God in spite of the obvious injustice of a pious man experiencing such suffering, but his patient endurance under all these afflictions at length gives way to bitter lamentation and weeping. According to Christian legend, the plant we know today grew where Job's tears fell. Thus, the plant and its beautiful and curious seeds honor a man whose troubles and suffering did not make him lose faith in his beliefs.

THE PLANT ON WHICH Job's Tears grow has the botanical name *Coix lacryma-jobi,* given it by Carolus Linnaeus, famed Swedish botanist of the past. *Coix* (pronounced "KOH-iks") is the Greek name for a reed-leaved plant, used by Theophrastus. *Lacryma-jobi* is simply the Latin translation of "Job's Tears," but spelled without an "h" after the "c."

Plants of the genus *Coix* belong to the *Gramineae* or Grass Family, and within that family, to the tribe Maydeae, which also includes maize or corn. The Job's

Tears plant, in fact, looks very much like a miniature corn stalk. The genus *Coix* includes three to four species, the most widespread and well-known being *lacryma-jobi*, which is also called Tear Grass and Gromwell Seed as well as Job's Tears. This plant sometimes is classed as a tender perennial, but usually grows as an annual. In Southern California it is perennial, growing again each spring from the old roots. It is native to tropical eastern Asia, but is now widely distributed in the warm regions generally, and is naturalized in the southern United States.

So much attention was given by the early botanical writers to the subject of *Coix* that it might be inferred that the plant must formerly have been more extensively cultivated than it is today. It is generally believed to be the Lithospermon of Pliny. In most of the early works Lithospermon or *Coix* is spoken of, however, as a wild plant, or one cultivated as a curiosity only. Gerarde, Parkinson, Miller, etc., all allude to the use of the seeds as "bedes" (beads). The many diversities in form of the plant, confirmed by the existence of many vernacular names, establish belief in an ancient knowledge, as possessed by the aboriginal (especially Mongolian) tribes of India.

The seeds are mentioned in Vedic literature and appear to have been one of the cereals which were cultivated by the Aryans on the hill slopes of the Himalayas. The Arab travellers in the East became acquainted with the seeds and named them *Damu Daud*, "David's Tears" and afterwards *Damu Ayub*, "Job's Tears." It was the Arabs who introduced the plant into the West.

The plant forms a loose-growing tuft two to five feet tall, with stout, erect, smooth, branching stems and flat lanceolate leaf-blades one-half to two inches wide and one-third to two feet long. In tropical Asia the plant sometimes reaches a height of six to eight feet, and the perennial variety *gigantea* has been known to reach fifteen feet.

Job's Tears are the shiny mature globular fruits of this plant, so called because of the fancied resemblance of these gleaming pearl-white seed capsules to the appearance of tear-drops as they fall sparkling from the eye. The ever-graphic Gerarde solemnly declared that "Every graine resembleth the drop of teare that falleth from the eye."

The bead-like "seeds" do not grow in pods, as many persons expect, nor do they form on a cob, as the plant's corn-like appearance might suggest. Each one grows individually on its own thin flower-stalk with its pointed end uppermost. Small clusters of these "flowers" form the inflorescence of the plant, and these in turn are borne on long stems growing from where the upper leaves join the stem. The attractive pearl-gray fruits of this ornamental grass protrude from their sheaths and impart a unique and interesting appearance to the plant.

THE "TEAR" ITSELF develops from a leaf-sheath and inside this thick-walled hollow capsule the flower forms, unseen by man. From an opening in the upper end of the "tear" grows a thread-like stalk one-half to two inches long which supports a small spike of stamens, similar to the tassel on the top of a cornstalk. Also from the same opening grow two stigmas from the pistillate flower enclosed within the "tear." These thin filaments are about three-fourths inch long and are covered with many short "hairs." They look rather like fuzzy white whiskers from some small creature living inside the bead. They form the female part of the plant and receive the pollen from the male stamens above.

The beads grow to be one-fourth to one-half inch long, and as the fertilized ones mature, they gradually go through a sequence of color changes: green, yellow, brown, black, then gray. The mature bead is very hard and shiny and may vary in color from a bluish-white porcelain or pearly white to a lead color or dark gray-brown. Their mottled appearance, extreme hardness, and smooth glossy surface sometimes cause them to be mistaken for certain types of small stones such as "Apache Tears" which are also used in necklaces. The type of soil in which the seeds are grown seems to affect their color. In Long Beach, for example, we have discovered that Job's Tears grown in two different yards are of two different colors.

The forms of Job's Tears in the wild state are invariably bluish-white and extremely hard. According to some authorities, cultivation of the plants destroys very rapidly the hard pearly shell and changes the color of the grain to dull chalky whites and straw-colors, utterly devoid of the rich glassiness of the wild grains. While the Job's Tears I have grown are usually darker in color than the bluish-white ones sold commercially, they possess the same shine and hardness. The soft chalky-white beads which occasionally form on the plant are apparently the infertile seeds which never became pollinated.

The seeds mature in the autumn, usually during October in Southern California, yielding a maximum of 30 or 40 seeds per plant. They should not be picked until they have turned gray and pull free from their stalks quite easily. Beginners seem overly anxious to harvest their beads and tend to pick the seeds too early. Beads picked when jet black will not stay that color. They soon become gray also.

The beads are not hollow, but each contains a single large seed which will grow into a new plant even after being strung for awhile on a necklace. The seed completely fills the hard stony receptacle in which it grows, but underneath the flattish side of the "tear" the seed inside has an open slot or groove, somewhat like that on the side of a date pit or a grain of wheat or barley. It is this open slot in the seed which allows the needle and thread to pass through the bead when it is strung. This also explains why stringing the beads does not destroy the living seed inside. Do not try planting the beads from an imported necklace, however. These are heavily fumigated against vermin and the seeds inside probably have been killed.

SOME SELECTION of seeds is usually necessary if the necklace is to have a certain degree of uniformity while still retaining the natural beauty of random variation. Distorted seeds, extra small ones, and those that are unusual colors may be culled out. A metal washer having a hole the proper diameter makes a good device for sorting the beads according to size.

After selecting the desired beads, they may be strung on nylon filament, carpet thread, or dental floss. I prefer carpet thread because the knot holds better and the beads seem to hang looser and more naturally without bunching up. After stringing, but before tying the thread, each bead should be carefully positioned on the thread so that when all together the beads will not be too tight but will hang naturally like a chain. The finished necklace is durable, lightweight, pleasant to handle, and pleasing to the eye. It also has the intriguing property that every bead in it is unique. A careful inspection will show that each bead is different from the others. A Job's Tear necklace looks well with a remarkably large number of colors and types of clothing, informal and formal, on both men and women.

Since they are usually regarded to be an annual, Job's Tears are easy to grow, but because they are tropical, they thrive best in warm climates. The beads may be soaked in warm water for 24 hours and then sown in pots of sandy soil in a warm greenhouse in February or March. The young plants are potted and hardened off in a cold frame, then set out in ordinary soil in a sunny spot in late May or early June.

The seeds may also be planted outdoors in the late spring where they are to remain. The germination period, however, is variable, especially in cooler climates. They should be spaced or thinned to 12″ apart in ordinary to fairly rich soil in full sun. In tropical regions Job's Tears are very hardy and thrive upon almost any kind of soil. In their wild state they usually grow in humid or swampy sunny ground and are even found growing in deep water. In Southern California they germinate readily, flourish with little care, winter over to grow again next spring, and self-sow freely if all the "tears" are not harvested. An occasional bead may be chewed by a worm, but otherwise the plants seem to be free of pests.

JOB'S TEARS are sometimes grown simply as a curiosity, but often it is for the decorative value of the sprays of attractive gray seeds, either in the garden or cut before they fully mature and dried for use in flower arrangements. For ornamental purposes in the garden, the variety *aurea zebrina*, which has yellow-striped leaf blades, is especially attractive. Plants of Job's Tears are of ancient cultivation and for many centuries the seeds have been made into charms, necklaces, and other types of costume jewelry. The aboriginal tribes of India and Burma employ them for personal adornment. Necklaces, earrings, and headdresses are often largely composed of them; dresses, bags, baskets, and so on, are extensively ornamented with them. They are also used for decorating agricultural implements and cattle. In the United States, the Job's Tears necklaces which are so popular today were also quite the fashion in the past and were once worn by young and old. In those days Job's Tears were so fashionable that many of our grandmothers had complete draperies made of them. Bead door curtains are again becoming popular, so perhaps we will once again see door curtains made entirely of Job's Tears.

Today, in Haiti, the seeds are dyed many different colors and made into necklaces containing about 225 beads. These are exported to the United States where they are sold for a dollar apiece. This is an inexpensive necklace, but sometimes the bright color begins to wear off. Nothing is more attractive and fascinating, it seems to me, than the natural color and appearance of these remarkable seeds. They are even more enjoyable if you have grown them in your own garden. In South Africa a necklace of Job's Tears is placed on an infant with the idea of warding off teething troubles. Also in the United States a string of Job's Tears was once considered indispensable for babies to wear when cutting their teeth. Job's Tears do make ideal teething beads since the seeds are very smooth, extremely hard, and non-toxic. Even now, where old-fashioned customs persist, a string of Job's Tears is an acceptable gift for a layette. Necklaces of Job's Tears were also believed by the superstitious to bring good fortune and to possess other mar-

Untreated Job's Tears necklaces. The white necklace is from a plant grown in Haiti; the dark necklace from a plant grown in Long Beach, California.

velous properties, as shown by the magic necklaces of ancient Persia and the necklaces used as a curative charm in Hawaii.

FROM A REMOTE antiquity both in Europe and in India, the grains or seeds, especially of the wild plant, have been used for Mohammedan prayer beads and for the beads of rosaries. For many years Job's Tears were grown specifically for this purpose at the missions in California. Even today one of the older Franciscan brothers at the San Miguel Mission still makes such rosaries. The seeds in these prayer beads seem to last indefinitely without ever changing color or losing their stone-like hardness and pearly luster. Rosaries that are 40 years old still look the same as they did the day they were made.

A different form of Job's Tears, the variety *stenocarpa,* has cylindrical fruits which are longer than broad. These are also used for beads and other forms of ornament.

A soft-shelled variety, *ma-yuen,* is cultivated as a cereal food in Japan, Burma, India, the Philippines, the Islands of the Pacific, and Brazil. The grain of this variety is longitudinally ribbed, giving it a striated appearance, a peculiarity that is possessed only by the cultivated forms of the plant. This curious edible grain is unknown to the inhabitants of India generally, but to many of the aboriginal hill tribes it is an important article of diet. Certain forms of the grain are roasted, then husked and eaten whole, being either parched (as with Indian corn) or boiled as with rice. Other forms are so different that the grain may be milled and ground to flour and then baked into bread. In Japan the grain, pounded in a mortar and cleaned, is consumed as meal. An infusion of the parched and ground grain is used instead of tea. The Chinese use the grain in soup, as pearl barley is employed in Europe. In the Naga hills of India a wholesome malted beer is made from them.

In China, Job's Tears are widely used as a medicine because of their supposed value as a diuretic and purgative. They are also employed against diseases of the lungs and in the treatment of rheumatism. The Chinese consider them to be particularly useful in urinary and bladder conditions. A tincture or a decoction of Job's Tears has been used in Europe for catarrhal affections of the respiratory passages, in bronchitis and in inflammatory conditions of the urinary organs. In the Philippines a decoction of the root is a gonorrhea remedy, but in Malaya the same extract is used as a vermifuge in children. In the Indian Peninsula the root is a remedy for menstrual disorders and in Liberia the juice from the stem is applied locally to relieve irritation due to injury. In Vietnam the plant is a diuretic.

A new and modern use for Job's Tears, in keeping with the problems and complexities of today's world, is for "worry beads." They serve this purpose very well because of their smoothness, light weight, and cool, pleasant feel.

Job's Tears are another of nature's marvelous creations: interesting, practical, and beautiful. For those who wish to try growing their own, seeds are expected to be available beginning the end of April from The Southern California Unit of The Herb Society of America, care of Lasca Leaves.

Dr. Glenn Walker is Associate Professor in the Department of Sociology at California State College, Long Beach. A lifelong interest in plants has been centered in recent years in his association with the Southern California Unit of The Herb Society of America. Currently Garden Chairman of that organization, Dr. Walker has for the past five years devoted much of his free time to the development of the herb garden in the Arboretum. *Part of this article first appeared in The Herb Grower Magazine and is reprinted here through the courtesy of that publication.*

INSECTICIDES
TO USE OR NOT TO USE

Frank Simerly

AS WE GROW more aware of our environment we realize that continued damage to it may threaten our very survival. Unfortunately, not everyone agrees on what constitutes damage. A case in point is the use of agricultural chemicals. Since plants are basic to our environment we will certainly want to examine critically the substances used to protect them and also answer some of the obvious questions that come to mind. Do we have to use so many chemicals? Are they really necessary to protect the home garden? How dangerous are insecticides in relation to the benefits they provide?

Before we can rationally evaluate our position we need to understand insects and the control measures used for them. How many species of insects are there? Estimates range between 625,000 and 1,500,000, which is an interesting way of saying we don't actually know. The estimate for North America exceeds 82,500 species. Of course, we have no conception of the number of individual insects there may be at a given time. However, the potential of just one female cabbage aphid gives a frightening hint. She averages 16 generations between April and October each year and the average per generation is 41 young. If all survived, the descendants of one female cabbage aphid for one season would amount to one and a half septillion which, my dictionary tells me, represents 1 followed by 24 zeros. It is both fortunate and unfortunate that most insects are vegetarians, generally preferring food plants. Sometimes the diet is so limited that the insect will feed on just one plant specie. Elimination of the plant would likely mean the extinction of the insect specie.

What kinds of damage are caused by insects? They transmit diseases resulting in illness and loss of life to animals and humans. Malaria is a well-known example. They cause disease in plants. More forest trees are lost because of insects than are lost from fire. The 1944 loss in California oranges was about 10 million dollars and the yearly loss in apples throughout the country has been estimated at 25 million dollars even after expending the same sum for insecticides to protect the trees. Clearly, certain insect species must be controlled if we are to be able to afford to buy many fruits and vegetables. Others must be controlled because of the diseases they transmit. The question arises: Are there ways of controlling them without using chemicals? We know that some insects are controlled by natural predators and by parasites. In this connection, scientists are working in areas of lethal genetic characteristics, ultrasonics, and sex attractants. Nevertheless, it is estimated that for many years to come chemicals are likely to be our most effective weapon in the control of insects directly or indirectly injurious to man.

THE ARBORETUM HAS BEEN concerned with the use of chemicals for many years and has always been restrained in its use or recommendation of insecticides. Our concern is in several areas. Does the insect require control or is the damage insignificant to the well-being of the plant and its appearance? Is the pest likely to spread to other more sensitive plants? Can control be achieved by washing the insect off of the plants or by some other non-chemical method? If control is necessary and can be achieved without using chemicals, that is the way it is done. If chemical control is deemed necessary, there are still concerns. We want to use the material that is least likely to contaminate our environment and we will use the insecticide that is least toxic to our personnel and wild life.

Environmental considerations have caused us to eliminate the use of the persistent DDT-related chemicals. We still discreetly use a few of the less persistent chlorinated hydrocarbons when it is determined that the insect pest must be controlled and cannot be controlled with a less noxious chemical. The only chemical that is currently hard to equal is chlordane. It is valuable in the control of ants (often listed as the number one garden pest), termites and yellow jackets.

The next most serious consideration when we use insecticides is their toxicity to humans. Signal words on labels provide guidelines to determine degree of toxicity. For example: Danger means highly toxic; Warning means toxic; Caution means slightly toxic. No signal word means possibly toxic. All insecticides are a potential hazard to the user and should be used with care.

LISTED BELOW are 12 pesticides (no chlorinated hydrocarbons) which we inform home owners about and also listed are several common garden and house pests. After each pest is listed the numbers of the pesticides that will give effective control. The names of the insecticides will be found on container-labels as "active ingredients." The use of brand names is for convenience only and constitutes no endorsement. Numbers 1 through 6 are the least toxic materials:

NON-CHLORINATED HYDROCARBON PESTICIDES

1. Malathion	7. Cygon
2. Sevin	8. Diazinon
3. Pyrethrum	9. Dibrom
4. Rotenone	10. DDVP
5. Petroleum oils	11. Meta-Systox-R
6. Metaldehyde	12. Nicotine sulfate

House & Garden Pests	*Pesticide Controls*
Ants	1, 8
Aphids	1, 3, 4, 7, 8, 9, 11, 12
Beetles	1, 2, 4, 8
Borers	2, 8
Caterpillars	2, 3, 4, 8, 9
Codling moths	2, 8
Cutworms	2, 8, 9
Diabrotica	1, 2, 3, 4, 8, 9
Earwigs	1, 2, 8, 9
Flies	3, 4, 7, 8, 9, 10
Grasshoppers	1, 2, 8, 9
Grubs	2, 8
Lawn moths	2, 3, 4, 8, 9
Leafhoppers	1, 2, 3, 4, 8, 9, 11, 12
Leaf miners	1, 4, 7, 8, 9, 11
Mealybugs	1, 5, 7, 8, 9, 11, 12
Mosquitos	1, 2, 3, 4, 8, 9, 10
Oak moths	1, 2
Scale	1, 2, 5, 7, 8, 9, 11, 12
Slugs	6
Snails	6
Soil mealybugs	7, 11
Spider mites	5, 8, 9, 11
Spittlebugs	2, 5, 8, 9, 11, 12
Termites	Consult Exterminator
Thrips	2, 3, 4, 7, 8, 9, 11, 12
Weevils	1, 2, 8
Whiteflies	2, 5, 7, 8, 9, 11, 12
Wireworms	8

IT SHOULD BE remembered that any pesticide can be dangerous and labels, therefore, should be read and followed carefully.

Early recognition and quick action may save much worry with insects. Even so, the pesticides recommended have relatively short, effective periods and reapplication may be necessary.

Today, ecologists urge consumers to use those chemical products—detergents, insecticides, and so on—that will decompose after fulfilling their purpose and return to basic molecular structures found in nature. In a word, products that are biodegradable. We try to use biodegradable products at the Arboretum wherever possible. But in the overall view, it is more likely the misuse of agricultural chemicals, rather than a controlled, selective use, that causes serious environmental damage.

Frank Simerly has been in the service of Los Angeles County for twenty years, primarily at Descanso Gardens and the Arboretum where he is now superintendent. He has taught and lectured widely in the field of horticulture.

BOOKSHELF

An Introduction to Plant Diseases by B. E. J. Wheeler. John Wiley & Sons Ltd., New York. 374 pg. Illustrated.

The study of plant diseases (phytopathology) is a branch of botanical science, and in an academic and professional sense, it is one of the graduate programs in land-grant universities throughout the United States. It is no surprise that almost all important textbooks dealing with plant diseases are written in a classical fashion, namely, classification according to the causal agents of plant diseases. Such textbooks have separate chapters on non-parasitic diseases, on diseases incited by bacteria, on diseases incited by fungi (Pycomycetes, Ascomycetes, Basidiomycetes and Fungi Imperfecti), diseases by viruses, diseases by nematodes, and the general principles of disease control and environmental relationships. The emphasis of these books is centered on the botanical features (morphology, physiology, and cytology) of causal organisms. Therefore, some basic botanical training is needed, especially in mycology, bacteriology and genetics, if information from these textbooks is to be understood.

However, there are many plant hobbyists in the world. Even though many of them do not have classical training in botany, they do know their plants very well. In breeding and in plant culture, they have contributed much in the field of horticulture and agronomy. In case of diseases — problems in plants — they recognize blights, wilts, rusts, mildews, galls, and so on. But to gain fuller insight into these problems, a suitable book is needed. It is important to differentiate a physiological wilt from a disease wilt. It is even more important to differentiate a bacterial wilt from a fungus wilt. Furthermore, it is also important to differentiate a fusarium wilt from a verticillium wilt. It would be difficult to gain this information from most plant disease textbooks without some background knowledge about bacteria, fusarium and verticillium.

The book "An Introduction to Plant Diseases" by B. E. J. Wheeler, *Reader in Plant Pathology, Imperial College, London,* serves the purpose well for those plant hobbyists who want to know something about plant disease problems. It is written according to the generally recognized symptoms of plant diseases. If one's roses have powdery mildew and one is anxious to learn something about powdery mildew, a whole chapter on the subject can be found in this book. In a similar manner, there are chapters dealing with damping off, rusts, smuts, blights, rots, wilts, leaf spots, mosaics, yellows and others. In each chapter, the pathogenesis and control of important pathogens or physiological disturbances that are responsible for such disease syndromes are discussed. Many characteristic plates of disease specimens and microscopic features of pathogens are presented. General principles in plant disease control and their world-wide relationship are adequately discussed in the last few chapters. "An Introduction to Plant Diseases" is highly recommended as a good book for people who like plants and want to know something about their problems.

Paul Cheo

OF SPECIAL INTEREST

EXOTIC PLANT MANUAL by Alfred B. Graf, c1970, Roehrs Co., 840 p. Color and black and white photographs.

FLOWERING AND FOLIAGE HOUSE PLANTS by Jack Kramer, c1967, Arco Publishing Co., 112 p. Photographs.

WORLD ATLAS OF AGRICULTURE, c1969, Instituto Geografico De Agostini — Novara, Atlas and 2 vol. Illustrated.

FLOWERS OF THE BRAZILIAN FOREST by Margaret Mee, c1968, Tryon Galery. Color prints.

REMOTE SENSING (with Special Reference to Agriculture and Forestry), c1970, National Academy of Sciences, 423 p. Illustrated.

THE CONTROL OF GROWTH AND DIFFERENTIATION IN PLANTS by P. F. Wareing and I. D. J. Phillips, c1970, Pergammon Press, 303 p. Illustrated.

GARDENS IN AUSTRALIA, THEIR DESIGN AND CARE, by Edna Walling, c1943, Oxford University Press, 148 p. Photographs.

THE LANGUAGE OF GARDENING by George F. Hull, c1970, World Publishing Co., 191 p. Illustrated.

AUSTRALIAN WILDFLOWERS IN COLOUR by Barbara Mullins, c1969, A. H. & A. W. Reed, 112 p. Color photographs.

All listings available in Lasca Library.

Calendar 1971

April - May - June

ARBORETUM, ARCADIA

April 3 and 4
Aril Society Show

April 17 and 18
Southern California Iris Show

April 25 — 2 p.m.
Lecture, Demonstration Home Gardens
"Growing Vegetables in the Home Garden"
Gertrude Woods, Education Specialist, Dept. Arboreta and Botanic Gardens

April 24 and 25
Amaryllis Show

May 2 — 2 p.m.
Lecture Hall
"Common Plant Diseases"
Paul Cheo, Chief, Research Division, Dept. Arboreta and Botanic Gardens

May 16
Epiphyllum Show

May 23 — 2 p.m.
Lecture, Demonstration Home Gardens
"Use of Pesticides Around the Home"
Frank Simerly, Arboretum Supt.

May 28, 29, 30, 31
Santa Anita Bonsai Show

June 6 — 2 p.m.
Lecture Hall
"Smog and Its Effect on Plants"
George Hanson, Biologist, Research Division,
Dept. Arboreta and Botanic Gardens

June 19 and 20
Southern California Hemerocallis and Amaryllis Show

June 20 — 2 p.m.
Lecture in Demonstration Home Gardens
"Container Gardening"
John Provine, Head Nurseryman, Arboretum

June 26 and 27
Gladiolus Society Show

DESCANSO GARDENS LA CANADA

May 23
Art Festival on the Lawn, sponsored by Descanso Gardens Guild

SO. COAST BOTANIC GARDEN PALOS VERDES PENINSULA

May 4 — 1 to 4 p.m.
Las Colinas Garden Club Flower Show

May 22 and 23 — 1 to 4 p.m.
Silver Spur Garden Club Flower Show

June 11, 12, 13
Ninth Annual Fiesta De Flores
Hours: 1 to 7 p.m. 1st day
10 to 7 p.m. 2nd & 3rd days

All events admission free

Lasca Leaves

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LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN

The Cover

The 'John Anson Ford' camellia, named in honor of the former county supervisor who was a prime mover in the creation of the Los Angeles County Department of Arboreta and Botanic Gardens.

This hybrid is a selected seedling from crosses of three species (*C. japonica* x *C. saluenensis*) x *C. reticulata.* It is semi-double in form, deep rose pink, 4½ inches in diameter, 2½ inches in depth, with about 10 petals of excellent texture, no petaloids, and yellow anthers and filaments. It is a slow-growing, upright plant that shows good sun tolerance.

The development of this camellia can be traced back to 1958 when a group of plantsmen formed the Camellia Research Advisory Committee to sponsor a project of genetic research in camellias at the Los Angeles State and County Arboretum. Members of that committee were: Harlan Lewis, chairman, Carl Tourje, C. D. Cothran, Reginald Ragland, Walter Lammerts, James Bonner, David Armstrong, Glenn Hiatt, Howard Asper, Mark Anthony, William Stewart, Albert Longley, A. G. Plakidas, Frederick Heutts, Francis de Vos, and Samuel Emsweller. Early in 1962, Dr. Albert Longley and Dr. Clifford Parks began hybridizing among the species that are the parents of the 'John Anson Ford' camellia. From 1963 to the middle of 1967 Dr. Parks and a research team continued the work. It was taken up the following year when Dr. George Hanson joined the Arboretum research division. Dr. Hanson has continued with camellia research since.

Editor
Donald S. Dimond

Photo Credits
Cover by Frank Simerly

Department Notes

Arboretum

A GET-ACQUAINTED dinner party was given at the Arboretum on the evening of June 15 for members of the Board of Governors and members of the boards of trustees of the citizen groups that support each of our facilities, namely, the California Arboretum Foundation, the Descanso Gardens Guild, and the South Coast Botanic Garden Foundation.

The al fresco affair was held in the Demonstration Home Gardens on a warm, windless night that happily terminated a period of typically chilly, unpleasant June weather.

Dolores Hubbell, executive secretary for the sponsoring California Arboretum Foundation, seated the sixty-three guests around the eight tables so as to afford maximum opportunity for members of the different boards to get to know each other, an arrangement everyone applauded. Donald Camphouse, CAF president, introduced officers of the visiting boards: Mrs. John Crowley and Mrs. Judge Smith of the Descanso Gardens Guild, and Mrs. Harold Crozier and Mrs. Guillermo Quiros of the South Coast Botanic Garden Foundation. Dr. Samuel Ayres, long-time member of the Board of Governors and the Arboretum Foundation Board of Trustees, announced the availability of the latest addition to the booklet series on flowering plants — Colorful California Native Plants, published by the Theodore Payne Foundation, with photographs by Ralph Cornell.

After welcoming members of the various boards, Francis Ching, department director, invited everyone for a tram ride to see the Meyberg Waterfall and the just-completed aquatic garden atop Tallac Knoll, both lighted for the first time. It was a beautiful sight and on the way back everyone seemed to share the feeling that the evening had been a success and should be repeated from time to time.

Descanso Gardens

THE ANNUAL ART FESTIVAL presented by the Descanso Gardens Guild was held on Sunday, May 23rd, this year with nearly 100 exhibits covering a good part of the gardens' lawns. Most were of a botanical nature but rendered in every conceivable medium. The Festival presented a cross-section of the work of Southern California artists and was viewed by an enthusiastic crowd of art and garden lovers.

A different kind of art was displayed by varieties of *Syringa vulgaris*. In hues of blue and purple, and one in stark white, these lovely lilacs, many of them introduced by the Garden, put on a magnificent show for a number of weeks.

South Coast

LAST MONTH'S Fiesta de Flores at South Coast Botanic Garden attracted 4,000 visitors during its two-and-a-half day run. As usual, the entries of Palos Verdes Peninsula garden clubs were among the top exhibits, all of which were relocated this year to a shaded area closer to the entrance to the garden. On the closing night, 52 members of the sponsoring South Coast Botanic Garden Foundation gathered for dinner at the Petroleum Club in Long Beach to celebrate the tenth anniversary of the founding of the Foundation.

Aquatic Garden

A FEW YEARS AGO Mrs. Manfred Meyberg donated funds for the construction of a waterfall atop Tallac Knoll that would represent both a memorial to her late husband and a scenic addition to the Arboretum landscape. The result, the Meyberg Waterfall, is a lovely cascade that had seemed complete except for a source more convincing than a recirculating pipe. Additional funds from Mrs. Meyberg made possible the construction of that source, the new aquatic garden which, as Frederick Lang notes in his article in this issue, extends fatherhood to the falls by feeding them in a series of gentle rapids falling from its shaded pools. About three-quarters of an acre in all, the garden is already a favorite among fanciers of aquatic plants, of which there are over twenty-five genera and many more varieties, and of those who love the sight and sounds of rushing water.

Queen Anne Frolic

HAVING NOW ADVANCED beyond the chrysalis stage, its title and substance defined, we are delighted to pass on the golden promise of that upcoming party referred to in last issue's Department Notes. First the time, place, and date: gathering at six post meridiem on the mall fronting the Queen Anne Cottage on Friday, September 24, as a mood-setting start. The scene: the historical buildings alight and open; the Meyberg Waterfall and Aquatic Garden atop Tallac Knoll and the Demonstration Home Gardens, all nightlighted. Dinner: expected to be, if not altogether epicurean, pleasing to gourmet palates. Activities: guided tours through state historical buildings, tours around the grounds in the style of yesteryear by means of horse-drawn vehicles and vintage cars.

Through the courtesy of the Yorktown Livery and Robert Strub, president of the Los Angeles Turf Club, guests may ride in a 100-year-old Studebaker-built landau that is a reproduction of one used by President Harrison, or in the wagon, called a democrat, that is used in front of the grandstand at Santa Anita before each race. A rare treat for classic-car buffs will be provided by Sig Caswell of the Horseless Carriage Club of Southern California — eight sparklers from yesterdays' roadways.

The waterbirds of Lasca Lagoon will move over on this evening to make room for guests opting for a moonlight cruise in their own self-propelled paddle boat. And topping off this trip down memory lane will be the strains of That's A'Plenty, Muskrat Ramble, and other tunes of the twenties supplied by the Azusa Fire Department Banjo Band. The purpose of this party is that best one of all, no surprise, the raising of funds by the hosts, the California Arboretum Foundation, to fill at least some of the gaps left by the Arboretum's current austerity budget.

The tariff? You'll find that in your invitation.

THE POOLS at TALLAC KNOLL

Frederick M. Lang

TALLAC KNOLL has recently become the gatherer of waters, and like Lake Tana which fathers the Blue Nile, its pools have extended fatherhood to the Meyberg Falls.

The source lake was conceived to present a confluence of outlet springs and to provide a variety of shoreline and pool conditions so that many different environments could be experienced and observed during a stroll around the water, especially during the change of seasons. Aquatic and terrestrial plant communities were planned for these conditions, and color, form and natural associations were the criteria for their location. The area was selected among the native California oaks, yet taking advantage of the greatest amount of available light. The plan developed the concept of a perfectly natural setting, using topography to allow two water levels separated by rapids. Planting features and earthforms come into focus as soon as one approaches the turnaround, and these are sufficiently intriguing to invite closer inspection and a view from several points of vantage.

The accommodation of an existing walk was incorporated into this scheme, with a bridge added to carry traffic while affording a view of the pools at a point where the waters empty over cascades into the falls. Past the bridge the walk divides; a left hand turn gives access to the trails which follow the cascades and cross the stream again downslope. Here another bridge is located. It affords both a view and the sound of the cascading waters, allows near and distant views of the gardens, and offers several options to descend to the area below where Meyberg Falls may be viewed in full.

Materials for construction of the pools were selected to provide maximum continuance from the falls. Fortunately, Jim Blommer, the contractor who had worked the falls, was available to do these pools as well. The volcanic, lightweight Featherrock, a basaltic, glassy material, is featured for the falls and rapids. The bottom of the pools and the shorelines are fashioned from and finished with Swish-Crete, an earth and concrete mix with the ratio of 1 part cement to 14 parts of screened earth specified to conform to certain particle size and chemical qualities. This earth concrete, originally researched and devised as building material for underdeveloped countries where graded aggregates are unavailable, has the virtues of great plasticity, strength, and — when handled imaginatively — an amazingly natural appearance.

The work began with excavation, in this case executed with great care to avoid damaging roots of the surrounding oaks.

To prevent harm to the trees, specifications called for all roots to be cut with pruning equipment; if vital roots larger than 3 inches in diameter had been encountered, a design change would have been considered. This was not necessary.

PIPING WAS INSTALLED from the pump locations below the bridge. A circulating pump carries the water to pool inlets at various shoreline locations and is designed to maintain water movement and circulation vitally necessary to control the growth of algae. The pump intake line under the bridge and an outlet from the falls below are arranged so as to give the illusion of continuous water movement down the falls. Actually the falls and the pond are activated from separate pumping locations.

Construction began with the placement of 3 inches of ready-mix concrete pumped to fit the natural shape of the excavation. No forms were used, the consistency of the concrete as it was extruded from pumping equipment contained the calculated moisture to lay just right. Before losing this essential plasticity, the concrete was covered with overlapping sheets of polyvinyl chloride which provide a waterproofing membrane for the pools. A few days after this, when the first pour had set and attained sufficient curing, the rapids, certain aspects of the shoreline, and planters were built with rocks and broken concrete. Then final construction of the pools and connecting stream shell were provided with Swish-Crete, much of it given form and character by the sculptor-contractor in accordance with the landscape architect's plan.

After clean-up, water circulating tests, and some adjustment to perfect shoreline inlet effects and velocity, and with shallow water in the pools, the aquatic landscape was installed by Bill Miller with material from Miller Water Gardens, San Gabriel, and Van Ness Water Gardens, Upland.

The plans called for 60 hardy waterlilies (*Nymphaea* varieties) for early bloom, with distribution of various colors throughout the pools; for several tropical lilies, including those that are fragrant and night blooming; for species of lotus (Nelumbium), and the huge *Victoria regia,* which, specially grown, was installed after July 1st, a date after which tropical lilies started under special temperature conditions may be set out into the open in California.

PLANTER POCKETS, approximately 12 inches high and 24 inches wide, had been built up for these in the bottom of the pool and a soil and organic matter mix had been placed into these pockets. During the middle of April, the hardy lily bulbs were planted, along with other water plants such as parrots feather (*Myriophyllum brasiliense*), lance leaf (*Alisma* sp.), water hawthorne (*Aponogeton distachyus*), floating heart (*Nymphoides peltatum*) and azure water hyacinth (*Eichhornia azurea*). Tropical lilies were planted a few weeks later. Places were provided for shallow water plants and bog plants at various places at the perimeter and at shallow slopes in the shoreline. Azure pickerel-weed (*Pontederia cordata*), water iris (*Iris pseudacorus*), species of umbrella plant (*Cyperus alternifolius*), and Egyptian paper plant (*Cyperus papyrus*), dwarf pickerel-weed, calla lilies (*Zantadeschia aetheopica*), narrow-leaved cattail (*Typha angustifolia*), water canna (*Thalia dealbata*), water chestnut (*Trapa natans*), water cress (*Nasturtium officinale*), and water poppy (*Hydrocleys nymphoides*) were scattered around in these places. The pools were then filled with water to the control level, and with the green plants and almost immediate appearance of lily flowers, an environment visibly came to life. Various environments have been established along the shoreline. Wet slopes with inlet water slowly seeping from above are ideal for the Louisiana iris. Several forms of *Agapanthus africanus*

Photos by Frederick Richards

The Aquatic Garden—Tallac Knoll

Photo by Frederick Richards

Meyberg Falls

are used on slopes or above. In wet and dry soil, above the rocky shore, Kenilworth ivy (*Cymbalaria muralis*) does its thing of spreading in cracks and crevices and overhang into the water. *Liriope spicata* is massed, and *Ophiopogon japonicus* is used transitionally near where the lawns descend to the water in grassy slopes. Mascarene grass (*Zoysia tenuifolia*), provides a mossy look immediately above another corner of the rocky shore.

Displaying still another texture over the shoreline's edge are the bright green leaves of *Herniaria glabra*, which will turn bronzy-red in winter.

THE MOST important consideration esthetically had been the effect of mirroring the existing trees in the water, even with the movement caused by the ripples and splash of the falls. With this double function of the trees, all other shoreline planting was given the supporting role of providing contrast, color, and texture. *Acacia pendula,* the weeping myall of Australia, is used to fill the almost traditional role of a weeping tree. Its pendant, narrow-leafed branches will develop into graceful cascades of gray on the knolls above the waterfall. To dramatize this gray by contrast, shades of purples to blues are massed on the slopes. *Dodonaea viscosa* 'Purpurea', *Hibiscus huegelii,* species of *Tibouchina* are featured with carpets of *Tulbaghia fragans* and *Ajuga* drifting around to the shoreline and into the dappled shade of the nearest oak.

Hemerocallis clones from the Grace Kallam collection were used extensively for massing, providing a flowering meadow effect, nicely mirrored when seen from the bridge. A grassy path between this flower border and the oaks leads to the bridge.

Under the oak trees on the fall side of the pond, some existing *Alsophila cooperi* tree ferns and arborescent philodendron offer the opportunity to expand this natural shade garden environment into a fern collection.

Dicksonia antartica and other tree ferns were transplanted from a crowded corner in the tropical garden on the knoll and new ferns were generously provided by the owner of El Modeno Gardens, Jan Groot. Among these are *Aspidium capense, Asplenium bulbiferum, Cyathea medullaris, Cibotium chamissoi, Cyrtomium falcata, Microlepia platyphylla, Nephrolepis exaltata, Pyrrosia lingua* and *Sadleria cyatheoides.* Other ferns will be added to the collection as time goes on. Meanwhile colorful *Impatiens sultanii* and *Begonia richmondensis* brighten the space between ferns. Hybrid Indica azaleas are massed in the filtered sunlight toward the pond. *Brunfelsia eximia floribunda,* and *Brunfelsia eximia macrantha, Ceratostigma plumbaginoides* and *Campanula* provide the cooling blue shades.

Two existing *Phoenix dactylifera* palms provided a somewhat stilted background. To soften the sentinel effect, several *Erythea armata* palms were added as a grouping. Gray-leafed *Euryops pectinatu,* daisy shrubs, complete the down-beat background.

Foliage planting is featured along the stream descending toward the falls. Included are Araliads, among them *Fatsia japonica,* the often seen *Brassaia actinophylla,* and a rarely encountered *Schefflera,* a recent Horace Anderson introduction. *Asparagus* species, *Liriope* and *Aspidistra* are tucked in among the rocks, depending on the available light, the opportunities of the construction and the exposure to view.

THE LOWER BRIDGE and the steep banks below presented special challenges, but combining such well-tried material as *Nandina domestica, Xylosma congestum* and *Vinca major,* a start was made to set the falls into a leafy, woodsy glen.

All together, the pools with their different shorelines, plantings, and rapids and the bridges overlooking the falls and varied landscapes bring a new attraction to the Arboretum that complements existing geographic settings.

With so many new attractions, Tallac Knoll becomes an area to be viewed after dark. Mercury vapor lights now flood the oaks in moonlight blue, terrace lights show shadows of ferns and the warm colors of begonias and azaleas. The falls are dramatized by their water turned into cascades of light. The peacocks have a new rival in beauty.

Frederick Lang has been a landscape architect in Southern California for over 30 years. Among his numerous credits are collaboration on the landscape masterplan for U.C. Irvine, and the landscape design for Dana Point Harbor and Lion Country Safari, the latter two projects with his firm, Lang & Wood. Mr. Lang is an instructor in the Extension Service at U.C. Irvine, a consultant to Sunset Magazine, and a longtime member of the California Arboretum Foundation, Inc.

SOME COMMON DISEASES OF ORNAMENTAL PLANTS IN THE LOS ANGELES AREA

P. C. Cheo

MAN HAS BEEN THREATENED from earliest times with the destruction of food crops by disease and insects. Numerous references to blights and mildews of cereals and vines are found in the Bible and in the writings of Ovid, Pliny, and other recorders of Roman history. The prophets of the Old Testament generally ascribed these afflictions to the wrath of God visited upon the people for some transgression. Robigus, the god of cereal rust, was worshipped by the Romans as a benefactor of the farmer and was appeased each spring in a ceremony that included the sacrifice of a yellow dog or some other domestic, rust-colored animal. It was not until the beginning of the nineteenth century that disease in plants became the object of scientific study.

Plants indeed suffer from various kinds of disease if we define disease as any departure from the state of health caused by factors that bring about a destructive process in the plant as an organism. With this definition in mind, plant diseases can be classified into the following three categories:

(1) *Diseases due to unfavorable environmental conditions*

Unfavorable environmental conditions can be the direct and indirect cause of plant disease. Plants are adapted to certain geographical regions in relation to temperature, rainfall, photoperiod, and soil conditions. Therefore, for its healthy development a particular plant has certain requirements with regard to these factors. If these requirements are not met, poor development will result. Disease due to unfavorable climatic conditions include some that are well known: sun scald, frost damage, root suffocation, dwarfing, and sterility. An important aspect of environmental disease nowadays is the increasing damage to plants from air pollution. For many years, the industrial output of sulfur dioxide has been the chief cause of damage; now the list extends to ozone, peroxyacetyl nitrate, oxides of nitrogen, fluoride and ethylene gas. Estimates of annual losses to agriculture from air pollutants ranged from $150 million to $500 million during the decade 1951-1960. About one-fourth of this $500 million loss occurred in California. The damage to the Ponderosa pine forest in the San Bernardino mountains specifies clearly the effect of unfavorable environmental conditions on the growth of plants.

(2) *Diseases due to nutritional disorders*

Overfeeding and overwatering are just as harmful as undernourishment and lack of water. Therefore, a balance of fertilization and water requirement in relation to soil structure is needed for each set of growth conditions. For instance, for healthy growth, very small amounts of zinc, boron, iron, molybdenum, copper, sulfur and manganese are needed. However, these elements can easily become toxic to plants when they are present in more than minute amounts or when they are out of balance.

In southern California, rainwater is lacking during the summer months, therefore irrigation water is applied. This creates a problem of salt buildup in soil, especially in areas where hard pan is present. Poor drainage, soil alkalinity, lack of porosity and organic matter, and overwatering are part of the nutritional disorder problems of the local area.

(3) *Diseases due to parasitic organisms*

Parasitic organisms are responsible for the majority of economically important plant diseases. According to the different types of organisms involved, these diseases can be further classified as follows:

(a) *Diseases due to bacteria*

Bacteria are single-celled organisms. Microscopic in size, they multiply by fission. Some are equipped with flagella for swimming. They usually infect the plant through artificial or natural wounds, and spread by rain, wind, and insects.

(b) *Diseases due to fungi*

Fungi are usually called molds. They are multicellular, algae-like plants without chlorophyll that reproduce by vegetative branching of mycelia and production of asexual spores and sexual spores. They infect plants through wounds and natural openings, such as stomata, lenticels, growth cracks of root branching, and by direct penetration with mechanical pressure and enzyme secretion. They also can be carried and transmitted by various insects.

(c) *Diseases due to virus*

Viruses are molecules consisting of an inner core of nucleic acid, which carries the genes for its own multiplication and an outside layer of protein. Viruses can be specifically transmitted by insects or they can be mechanically transmitted through abrasion. Virus when inside the plant cell controls the activities of the cell by producing more virus particles, thus depriving the needs of the plant.

(d) *Disease due to phanerogamic parasites*

Many flowering plants are parasitic because of lack of chlorophyll. The dodders and the mistletoes are outstanding examples.

(e) *Diseases due to nematodes*

The nematodes are round worms which live in soil or water. Many are free-living. Others are parasitic on animals and plants. They invade roots for their nourishment, injure them or form root knots; they also, in a few cases, infest leaves and flower parts.

EVEN THOUGH unfavorable environments, nutritional disorders, or parasitic organisms may be individually responsible for producing disease in plants, they also have a collective effect. For example, although the presence of a parasitic organism may not by itself cause a disease, certain environmental conditions, or a nutritional disorder, or both, may predispose a plant to parasitic infection. Further, those environmental conditions favorable to a disease must be present for an epidemic condition to develop.

Some common ornamental diseases in southern California are:

(1) *Crown gall of nursery stocks*

Crown gall is a major plant disease in many areas of the world. According to an estimate made in 1963 California orchards suffered losses in excess of $6 million a year as a result of crown gall infection. Galls vary in size up to 12 inches or more in diameter. They are composed of disorganized tissue that lacks the typical pattern of annual growth rings. Galls in the crown area are more likely to cause serious damage through girdling than gall in other parts of roots and branches, hence the name crown gall.

The bacterium responsible for crown gall is called *Agrobacterium tumefaciens.* It can infect most woody plants, including rose, cypress, eucalyptus, fig, olive, pyracantha, willows, and many fruit trees. The disease occurs when bacteria in the soil or on tools gets into growth cracks or into wounds caused by tools—such as hoeing, disking, or removing suckers.

Infected plants should be removed and burned. Heavily infested areas should be fumigated before replanting. A mixture of chloropicrin and methyl bromide at the rate of 320 pounds per acre is recommended. Fumigated soil, however, can be easily contaminated and quickly build up with the bacteria. Bacticin his been recommended by the University of Cali-

Crown galls on roots of pecan caused by Agrobacterium tumefaciens, *a bacterium. These galls of various size may appear on roots, branches, trunk or crown area. Bacteria infection produces growth substances stimulating rapid plant cell division and enlargement resulting in gall formation.*

fornia for treatment of galls. The material is painted over the entire gall and extended for an inch over surrounding healthy bark. For large galls, two or more applications may be required. Exposing galls to the air for several days before treatment favors absorption of Bacticin and improves results. Treated areas should be left exposed for several weeks. Elgetol (sodium dinitro-ortho-cresolete) when mixed with methanol has also been used for treatment of crown galls.

(2) *Fireblight*

Fireblight is the most destructive disease on pear and to a lesser extent on apple and quince. It is also prevalent and destructive in ornamentals of the rose family, such as pyracantha, cotoneaster, loquat, hawthorn, photinia, strawberry, Heteromeles, sorbus, spirea, rose, etc. It was first reported in 1780 in the fruit region of the Hudson Valley in New York and therefore is considered American in origin. After a century, the disease was reported all over the world. Fireblight did not reach the fruit-growing section of the far west until about 1900 when it appeared in California. Enormous loss occurred in California orchards in the years 1900-1910, and by 1908 it appeared in Oregon. It was the first disease of plants to be established as caused by bacteria.

Usually fireblight is seen as a blossom and spur blight soon after full blown. The blossoms and leaves of the fruit-spurs dry and turn brown and, in pear, characteristically black. Soon after blossom blight the sudden death of terminal twigs is apparent. From terminal twig the infection can extend to large branches, limbs or main trunk, causing the characteristic depressed cankers. As soon as a branch or limb is girdled by the extension of the canker, it dies quickly.

The early infection originates from overwintering cankers which exude slimy masses of countless fireblight bacteria and these are spread by rain, wind and insects. Bees, especially, are responsible for spreading blossom blight in their tasks for pollination. Bacteria infects plants through wounds due to insects, abrasive wounds due to wind blown dusts, and natural openings, such as stomata and lenticels.

The bacterium is named *Erwinia amylovora,* a rod-shaped bacterium with flagella all around.

Diseased branches and cankers should be removed during the dormant season. This is important in order to eliminate or reduce the source of infection in the spring. Dead and discolored bark and wood should also be removed and the wood painted with disinfectants, such as 10% household bleach or Bordeaux oil paint (raw linseed oil with commercial Bordeaux powder). Cankers can be treated without surgery by painting with a zinc chloride concoction made by dissolving 6 pounds of zinc chloride in a solvent consisting of 1 gallon of denatured alcohol, 1 pint of water and 3 ounces of concentrated hydrochloric acid. The acid should be added slowly and stirred constantly with a wooden paddle. The solution becomes very hot. This is applied directly to the surface of the canker; it penetrates well into the bark and wood and serves to kill bacteria inside. A dormant spray with copper sulphate (2-4 lb. to 100 gallons) before bud break is sometimes recommended in severe cases. However, regular blossom spray, especially in the case of fruit trees (pear) is required for good control of fireblight. Sprays are needed at 3 to 5 day intervals, or just before humid periods when the temperature is above 60° F. Start sprays at very early bloom (10 per cent blossoms open) and continue through blooming. A weak Bordeaux mixture (½ - ½ - 100) or streptomycin at 50-100 ppm will control blossom blight if well timed. Streptomycin should not be used on *Cotoneaster recemiflora* and *Crataegus mollis*.

The very succulent growth following heavy fertilization with nitrogen is very susceptible to fireblight; therefore, heavy nitrogen fertilization should be avoided. Some species are more resistant than others, for instance *Cotoneaster adpressa* and *C. microphyll* show marked resistance, while *C. dammert, C. pannosa,* and *C. horizontalis* are moderately resistant.

(3) *Virus diseases of orchids*

The spotting, streaking, mottling, yellowing and sometimes floral necrosis of greenhouse-grown orchids are now generally known to be caused by a group of plant viruses, singly or in complexes. These maladies are considered very troublesome to orchid growers. At certain times of the year when growing conditions are altered or plants are repotted these symptoms might disappear entirely, presenting a false comfort that the problem is over, but later on these syndromes may come back in a more severe form spreading to valuable clones with alarming speed.

THE GENERAL recognition of virus symptoms is important. Characteristic symptoms for identifying the type of virus are not very dependable since symptoms vary with varietal difference and mixed infection with 2 or 3 viruses is very common. If the virus problem can be recognized, then the initiative has to be taken for prevention of further virus spread.

Three viruses of the orchid group have been recognized, isolated and studied here in the United States. The first one is the Cymbidium mosaic virus, also called the black streak, leaf necrosis and chlorotic ringspot, adequately describing the various symptoms it causes. This

Virus disease in orchids — these diamond-shaped necrotic spots are one of the typical virus symptoms in orchids. The plant is Pholidota impricata.

virus or its closely related strain or strains affects more than 20 genera of the family Orchidaceae. It is very infectious and stable, and virus in the sap from infected Cattleya leaves can be diluted as much as 100,000 times before infectivity is lost.

Virus symptoms can be easily noticed in Cattleya, Cymbidium, Vanda and Phalaenopsis. Recently it was reported that flower necrosis of Cattleya can be caused by Cymbidium mosaic virus alone.

The second virus of importance is the orchid strain of tobacco mosaic virus. This virus has been earlier named Odontoglossum ringspot virus because of characteristic ringspot symptoms on *Odontoglossum grande*. It is as infectious but even more stable than the Cymbidium mosaic virus. A limited survey of orchid virus in California by Dr. C. I. Kado of the University of California disclosed that Cymbidium mosaic virus and two strains of orchid tobacco mosaic virus were simultaneously infecting about 10 per cent of the Cattleya and Cymbidium plants tested.

Color-break and malformation of the flowers of Vanda are caused by Vanda mosaic virus, the third orchid virus.

Indicator test plants are very useful for orchid growers for testing the presence of virus infection in orchids. A small piece of leaf tissue from the suspect plant is ground or macerated, and the crude juice with addition of a little water or neutral phosphate buffer solution and a sprinkle of 600 mesh of carborundum is then lightly rubbed on the upper leaf surface of indicator test plants. The presence of virus is responded by the production of necrotic local lesions on test plants about 5 - 7 days later. Red necrotic lesions produced on *Cassia occidentalis* leaves indicate the presence of Cymbidium mosaic virus and necrotic lesions produced on *Nicotaina glutinosa* indicate the presence of orchid strain of tobacco mosaic virus. Other indicator plants such as *Datura stramonium* and *Chenopodium amaranticolor* can also be used.

ORCHID VIRUSES ARE SPREAD mainly by hands and tools during pruning, dividing and harvesting operations. Therefore, sanitation precautions are very important. Hands should be carefully washed with soap and hot water after handling diseased or suspected diseased plant materials and tools. Hand tools can be sterilized by flaming with portable gas torches, or dipped into 1-100 dilution of Phytosan solution (Consan-20). The presence of diseased plants is the major source of infection. Besides sanitary precautions, regular insecticide spray is helpful in preventing accidental spread of infection by feeding

Powdery mildew of photinia — white, powdery, felt-like growth covering the entire leaf surface. This severe infection will result in killing of the terminal growth.

insects. It is very possible that pollen can transmit these viruses. Therefore, suspected diseased plants should not be used for breeding purposes.

(4) *Armillaria root-rot disease*

The root-rot fungus, *Armillaria mellea,* is known to occur throughout the world in both temperate and tropical regions. While *Armillaria* root rot is the most common name of the disorder, it is also known as Oak root fungus disease, shoestring fungus rot and mushroom fungus rot. Close to seven hundred different types of plants, including trees, shrubs, vines, and a few herbaceous types are known to be affected by this pathogen. In the United States the disease is probably most destructive to stone fruit and citrus trees in the Pacific Coast states. In southern California, because of a year round warm climate, it is troublesome to many ornamental shrubs such as azaleas, roses, holly, lilac, privet, camellia, etc., in home gardens.

One of the first noticeable symptoms of *Armillaria* root rot is a reduction in growth rate. Leaves become yellow and drop prematurely. Symptoms may appear on only one or two limbs at first, but gradually extend to the whole tree. In the advance stage, the whitish mycelial mats extend beyond the root area to the crown region. Once the crown or trunk is girdled by the fungus growth, the tree or shrub is killed. Examining the root and crown area by peeling the bark, may expose flattened whitish fungus mycelium in a characteristic fan-like margin. This whitish mat occurs between the bark and wood, and this helps to distinguish it from other wood-rotting fungi. In fall after the first rain, clusters of mushrooms around the base of infected trees or stumps are generally produced. The presence of mushrooms confirms the diagnosis of the problem. The mushroom is commonly named Honey mushroom and is edible.

Once the tree or shrub is infected a gradual decline sets in, the cultural condition will then be the deciding factor in the eventual fate of the infected plant. Improper nutrition, unfavorable temperatures and light conditions for the healthy growth of the trees, and high moisture level in the root area, hasten the disease development. Good cultural management can encourage new root growth which may keep the infected tree going on for many years until it is completely girdled in the crown and trunk area. The development of the fungus is inhibited by conditions of dryness and high temperature. Therefore, it is good practice in the case of infected oak or fruit trees to expose the crown area and its surrounding main roots to an air-dry condition. This practice has been followed on oak trees at Descanso Gardens and here at the Arboretum with considerable success.

CHEMICAL TESTS in the laboratory of the Research Division have indicated that actidione is highly effective in inhibiting the growth of *A. mellea.* At a concentrated level of 25 ppm (parts per million or 0.0025%) complete inhibition of fungus growth is achieved. The strength of the actidione solution can be increased to 200 and 300 ppm without any harmful effect to the tree. Therefore, application of 200-300 ppm of actidione in 1% DMSO (Dimethyl sulfoxide) as a penetrant to the crown area—preferably with heavy application through cracked bark to bring the solution into bark and wood crevices—could help to save some valuable oaks for a longer life span.

Trees or shrubs that die from *Armillaria* infection should be dug up and burned. Roots or stumps should not be left under the ground. The underground disease debris serves as a source of infection for the next planting. The diseased area should be fumigated before replanting. Carbon disulfide or methyl bromide can be used effectively for spot fumigation. Fumigation of soil should be done only by commercial growers or pest control

Flower blight of camellia — the characteristic netted effect and firmness of the diseased flower petals distinguishes the flower blight from frost damage or wind injury.

operators, as it is poisonous and explosive and therefore dangerous in urban areas. Use of this material is difficult in a home garden, for all plants in the treated area must be removed before treatment or the chemical will kill them.

Relative resistance does exist among plant species. A list of ornamental plants that show different degrees of resistance can be obtained from the California Agricultural Experiment Station. However, many complications are involved in plant resistance. Plants that are well adjusted to one area can be highly resistant, while in another area, because of soil, climate, rainfall, insect infestation and management, they may lose their resistance. Furthermore, there are many strains of *Armillaria* and their pathogenicity to different plants varies. A plant may be quite resistant to one strain in an area and may respond in a different way in other areas where different strains exist. In brief, the avoidance of heavy watering and a good cultural practice to keep the plant in healthy growth condition is essential in combating the *Armillaria* root rot problem.

(5) *Powdery mildew of roses*

The powdery mildews comprise a large group of diseases which affect many host plants throughout the temperate zones. These fungi are Ascomycetes and belong to the family Erysiphaceae, all of which are obligate parasites. They do not grow saprophytically in dead plant parts and have not been grown in an artificial media like many other pathogenic fungi. One of the most widespread and destructive is *Sphaerotheca pannosa* var. Rosae, the primary cause of powdery mildew of roses. The causal fungus attacks only plants in the genus Rosa.

POWDERY MILDEWS usually appear as a superficial white to light gray with a powdery coating or thick felt on leaves, buds, flowers, and young shoots. Heavy infection at early stages causes distortion, dwarfing and curling of terminal growth. In serious infections the tips of canes may be killed. Infected buds often do not open again. The petals when infected may become discolored, dwarfed and eventually dried.

The powdery mildew produces an abundance of asexual spores in chain-like fashion on leaf surfaces. Wind and rain splash carry spores to healthy plants. Each spore is a potential source of new infection and under favorable conditions only about 72 hours are required for the mildew fungus to go through a complete cycle from one spore generation to the next. However, mycelium latent in buds during the dormant season is said to renew growth in the spring.

The conidia, asexual spores, can obtain moisture from the leaf surface for germination, and most rapid germination is at 76-80° F. The spore quickly puts out a germ tube which penetrates the cuticle and epidermal cell of the rose leaf, resulting in the formation of a haustorium within the cell. Haustoria are so-called roots of the mildew and serve to absorb food and water from the cell, supplying the needs of the extended mycelia covering the leaf surface.

In many parts of the U.S. where pruning is not so extensive as here in southern California, the dormant plants, immediately after pruning, should be sprayed with liquid lime sulfur dust (325 mesh). A systemic spraying program is essential for powdery mildew control. Once a good program is established, the problem with powdery mildew should be solved. As early as April, before any sign of mildew, rose foliage should be protected with fungicide. Sulfur for many years has been very effective against powdery mildew. Other fungicides, such as Karathane or Mildex and Actidione PM, an antibiotic, plus a wetting agent or spreader-sticker are also effective. Sulfur, lime sulfur, Karathane and Actidione PM are phytotoxic when air temperature is above 85° F. On hot days, spraying with such fungicides should be avoided. A new fungicide called benlate wettable powder (Benomyl fungicide) is very effective in controlling powdery mildew of roses. It does not burn leaves at high temperatures. Under most conditions biweekly applications are sufficient. During the cloudy, rainy season, weekly application is preferable. If effective control of mildew can be obtained in the early months, the following hot, dry season of June, July, August and September are quite safe from powdery mildew infection. Further sprays may not be required during these months.

Varietal resistance does exist among roses. Many climbers, ramblers and certain hybrid teas are very susceptible.

(6) *Sycamore blight or anthracnose*

The most common and serious fungus disease of the sycamore is sycamore blight, sometimes called anthracnose. This disease is caused by the fungus *Gnomonia veneta*. Sycamores particularly, and to some extent oaks, are attacked.

SYCAMORE BLIGHT appears in the spring during wet and cloudy weather, when buds are opening and leaves are expanding, as these conditions favor blight development. Light brown dead areas appear frequently along the veins. The spots may enlarge to include the whole leaf which soon falls to the ground. Twigs may brown and die as they emerge from the bud. In this stage the disease may be confused with late frost injury. Small cream-colored dots, about the size of a pinhead, or short tendrils appear on the underside of the infected leaves along the veins during moist weather and serve as a characteristic diagnostic feature of this disease. These are masses of spores (conidia and conidiophores) extruded from the fructification in the leaf tissues. Killed leaves soon shrivel and drop; the severely infected trees remain bare until the second crop of leaves is produced later in the summer.

Small twigs are killed and cankers are formed on branches. Below the cankers, water sprouts develop, resulting in an irregular bunchy growth. Cankers also develop on large branches and trunk, and may girdle them. Cankers are perennials, therefore serve as the source of infection in the spring time.

For control, infected twigs and branches should be pruned out and fallen diseased leaves under the tree cleaned up. This is important, since these all serve as a source of infection. Puratized agricultural spray has been used in past years very successfully for controlling this blight, but since it is a mercury compound its use is inadvisable today. Cyprex is now recommended for sycamore blight. A very thorough coverage is necessary. The first application should be at the bud-breaking stage around late January or early February. The second

Root Knot nematode in parsnip. The nematode larva penetrates the epidermis of the root region. Cells near its head divide rapidly and then those immediately surrounding its mouth enlarge, in the formation of the so-called "giant cells." Cell division and enlargement continues in the tissue immediately surrounding the giant cells, causing the root to swell and produce a "root knot."

spray should be given 10 to 14 days later when leaves begin to expand. If the spring months are wet, further application is necessary. Increasing the vigor of the tree through fertilization at the time of bud break is considered advantageous.

(7) *Flower blight of camellia*

Flower blight caused by the fungus *Sclerotinia camelliae* is the most common disease of camellias in California. It was first reported in California in the San Francisco Bay area in 1938, where it was apparently introduced from Japan. This disease has since spread to most southern states. This blight is confined to the flowers, causing an unsightly look in the blooming season. Infection takes place any time after the petals begin to show color. Small tan and brown spots appear singly or in groups on the petals. These spots gradually enlarge until the whole flower may become brown. As the tissue changes color, the veins tend to become darker, giving a netted effect to the diseased flowers. This distinguishes flower blight from wind injury or frost damage which usually appears at the tips of the petals. The disease does not produce a rot; the petals merely turn brown and at a later stage the blossoms fall off.

The small micro-conidia develop under moist conditions on fallen flowers and give them a glistening appearance. Later, dark brown to black resting bodies, called sclerotia, develop. The sclerotia lie dormant on the ground or buried in the soil or mulching materials during the summer. As the blooming period approaches, sclerotia become germinate, producing a small cup-shaped structure (apothecium) on a stalk about the size of a dime. Large numbers of spores are ejected from the apothecium and carried by wind current. Spores landing on flowers will germinate and produce infection if condensed moisture, such as dew, is present.

All infected flowers should be collected and destroyed; these infected flowers are the major sources of infection for the coming blooming seasons. The same lot of sclerotia may produce apothecia for at least five years. Pentachloronitrobenzene (PCNB) can be used as a ground spray to inhibit the development of apothecia. The ground spray should be applied before the blooming season. PCNB

(75% wettable) at the rate of 3 lbs. per 1,000 square feet plus 1 to 4 ounces of detergent gives good control. Ground spray is effective but it has to be thoroughly done. Air-borne spores can be carried from one back yard to another. It is not practical to spray the flowers before or after opening with a protectant fungicide since petal tissue unfolds rapidly and is difficult to keep covered with spray material.

(8) *Root-Knot nematode of ornamental plants*

In the southwest, the root-knot nematodes (*Meloidogyne* spp.) rank as one of the major causes of plant disease losses. The root-knot disease affects a very extensive list of host plants. Over 1,700 plants, including close to 100 common ornamental plants are reported to be infected with *M. incognia* var. acrita. Nematodes are slender, active, worm-like organisms. The smallest are about 1/250 of an inch long, while the adults of certain animal parasites can grow to be several feet long. In a number of plant-parasitic forms, the adult female becomes a swollen, pouch-like organism, while the male remains slender and worm-like.

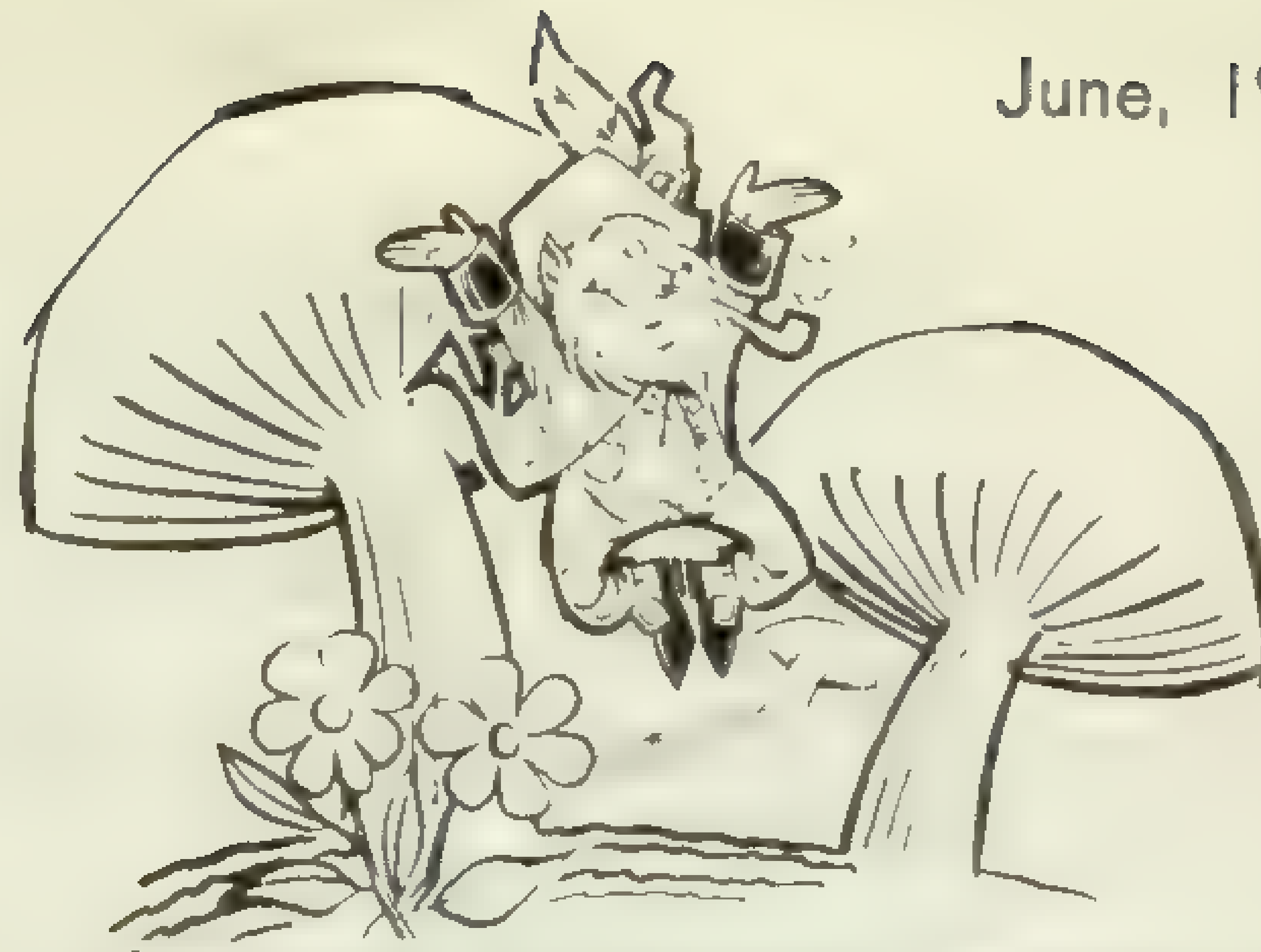
NEMATODE INFESTATION destroys plant roots which results in a weak top growth and reduced yield. When young plants are placed in heavily infested soil, root growth may be completely prevented. The root-knot disease is very distinctive because of the galls produced on roots and tubers. The above-ground symptoms consist chiefly of paler-than-normal foliage color, unthrifty development, dwarfing, wilt in hot dry weather, and sometimes death. The home gardener's first aim in preventing the nematode problem should be to keep nematodes from entering the garden. He should examine all transplants he brings home for the presence of small swelling on the roots. Nematodes can build up population very fast in the mild climate of southern California. Once the soil is heavily infested with nematodes, the most effective chemical control is by fumigation. Fumigation is not easily done by home gardeners; professional help is advisable. There are many fumigants on the market—such as D-D soil fumigants, nemafeume, ethylene dibromide fumigants, chloropicrin, carbon disulfide, etc. Vapam is a liquid form, easier to apply. A soil drench, Nemagon, is effective against nematodes. It offers the advantage over fumigants in that it may be applied safely to soil in which certain plants are growing.

A new chemical for nematode control was tested recently with success at the University of California at Riverside. This systemic nematicide, D-1410, is effective for foliar spray at 4 lbs. per 100 gallons (tobacco, tomato, pumpkin) and soil drench at 20 lbs. per acre (rose) in controlling root-knot nematodes and lesion nematodes. The best control was achieved when initial sprays were applied at the time of the nematode infestation of the soil and when additional sprays were applied one or two weeks later.

The best means of combating root-knot nematodes is by crop rotation using resistant plants. The use of resistant plants for many years will gradually decrease the population of nematodes in the soil. Among the vegetable crops resistant or tolerant to root-knot nematodes are sweet corn, asparagus, Western lima beans, and cabbage. For ornamentals, such plants as African marigolds, azaleas, lantana, oleander, may be grown. Fallowing is also helpful. Leaving a portion of the garden idle for a season, while the soil is turned over frequently to dry out, makes it unfavorable for nematodes to survive. All weeds should be eliminated during this period, for they will serve as hosts for nematodes to survive.

Dr. Paul C. Cheo is Chief of the Research Division at the Los Angeles State and County Arboretum. A plant pathologist, he is primarily concerned with oak root-rot fungus studies and research on plant resistance to virus diseases.

It's Green-Gill Time Again



G. F. Orr

WITH THE COMING of summer, mushrooms and "toadstools" will again appear in the lawns in Los Angeles and neighboring counties. "Toadstools," of course, is a name used by many to denote the poisonous varieties of mushrooms. Most of the handbooks on mushroom identification tend to stress spring and fall (with their accompanying rains) as the best collecting periods. The Los Angeles region is, however, rather different and many mushrooms appear during the warmer period of the year because of frequent cool nights, high humidity and abundant lawn fertilization and watering. Several other varieties appear in lawns and other places from about mid-November to April during the rainy season.

There are many varieties of mushrooms in the Southern California region, some of which are quite poisonous. The poisonous ones are infrequently observed unless one is specifically searching in various sections of the hills and mountains. Three varieties of mushrooms are quite abundant during the summer in Los Angeles and nearby counties: *Agaricus silvicola, Lepiota molybdites* and *Lepiota rachodes*. One of these, *L. molybdites,* is toxic. Adequate descriptive information may prevent gastrointestinal distress. These mushrooms are described below.

AGARICUS SILVICOLA, the Sylvan Agaric (Fig. 1), is the most prominent of lawn mushrooms in the Los Angeles area, but it may also be found in duff and decaying leaves beneath trees and shrubs. This species may appear in varying numbers throughout the year, but it is somewhat less prominent during the summer months.

In lawns: CAP 1½ to 4 inches broad, hemispherical at first, then becoming rather convex upon expansion; white,

Figure 1

dirty white, gray or buff in color, turning yellowish when rubbed, bruised or cut. The surface may be smooth, cracked or scaly. FLESH white, thick with a slightly acrid or phenolic taste. STEM 2 to 5 inches long, somewhat thick and occasionally bulbous on the basal portion buried in the grass, turning yellowish when bruised. RING usually prominent on the stem, often appearing two-layered and occasionally disappearing in age. GILLS occasionally whitish or pinkish white when very young, becoming pink, changing to brown and finally purple-brown (almost black) when fully mature; free from and not attached to the stem.

In moulding leaves and in denser shade: CAPS 2 to 5 inches broad, very white, surface smooth and quickly changing to yellow when bruised or rubbed. FLESH thick, white, changing to yellow when cut or broken; taste slightly acrid. STEM 3 to 6 inches tall, often wavy, white, smooth and frequently abruptly bulbous at the basal portion buried in the leaves; on being rubbed or bruised, changes to yellow. RING prominent, almost double or two layered, quite persistent. GILLS at first pink, changing to brown and finally purple-brown (almost black); free from and not attached to the stem.

This variety is closely related to the mushroom commonly sold at the vegetable market. The acrid taste that is present when the mushroom is raw disappears upon cooking. This mushroom is edible and quite good to eat.

LEPIOTA MOLYBDITES, the Green-Gill (Fig. 2), is abundant from about mid-June to mid-September during the warmest summer months. I have seen "Fairy Rings" of this mushroom nearly 35 feet in diameter in some lawns in the Los Angeles area. This variety is almost always found in lawns; rarely in deep shade or in decaying organic matter.

Figure 2

CAP 3 to 10 inches broad, at first hemispherical, becoming convex or flat, whitish with more or less concentric rings of irregular gray to brown patches or scales. FLESH thick, white; taste mild. STEM 4 to 8 inches tall, tapering more or less gradually from a bulbous base, whitish or pale brown changing to reddish when cut, smooth. RING prominent and becoming moveable as the mushroom matures, persistent. GILLS at first white, but changing to an iridescent green and finally to a dirty green at maturity; free from and not attached to the stem.

One variety, occasionally found in certain areas in western Los Angeles, possesses gills which are green before the cap is fully expanded. The Sylvan Agaric and the Green-Gill may sometimes be found growing together in the lawns.

Young specimens of the Green-Gill are pleasant and mild to the taste, but produce a very severe gastric upset that includes vomiting, diarrhea, cramps and other unpleasant symptoms. As little as one tablespoon of the raw mushroom will bring about symptoms in 4 to 6 hours after ingestion. Cooking does not destroy the toxic principle and intake of alcoholic beverages while eating this species will increase the severity of the reaction. Peculiar reactions have also been reported by individuals who have used alcohol while eating mushrooms of the Inky Cap variety.

Should illness occur from partaking of this toxic mushroom, a physician should be called. The Poison Information Center at the Children's Hospital should also be notified for they can provide information regarding the proper treatment for such poisonings. Symptoms may last for as long as 18 hours; longer if a physician's aid is not available. I have never heard of any deaths caused by this variety despite the violence of the upset. In fact, I have heard reports of two individuals who claim that they eat the Green-Gill regularly with relative impunity. However, I have been made ill by this mushroom and have no desire to try it again.

LEPIOTA RACHODES, the Summer Parasol (Fig. 3), is usually found in

Figure 3

piles of decaying leaves in well shaded areas or in duff beneath various types of trees. This variety has not been found growing in open areas in lawns and appears to be restricted to the cooler shaded locations.

CAP 1½ to 6 inches broad, hemispherical at first, but becoming convex or nearly flat at maturity, occasionally with a hump in the center; more or less dirty white with gray to brown irregular scales or patches in concentric rings from the center outward. FLESH thick, white, becoming brownish or reddish when bruised or cut; taste mild. STEM 3 to 8 inches tall, white to brownish, often enlarged or bulbous at the base, tapering upward to the gills. RING prominent, moveable upon aging, persistent. GILLS white, becoming somewhat grayish in age; free from and not attached to the stem.

This mushroom is edible and quite good, especially when young, but it is somewhat bitter when old. Caution should be exercised to prevent confusion of this species with young specimens of the Green-Gill because their appearance is very similar. An error in identification would be uncomfortable and perhaps costly.

Mushroom hunting can be very pleasant and such pleasantness can be increased enormously if the mushrooms collected are good edible ones. A reasonable amount of caution during identification and prior to eating may prevent much unexpected discomfort.

Since 1962 when he took his doctorate in mycology at UCLA, Dr. G. F. Orr has served as Botanist-Mycologist Consultant for the Children's Hospital in Los Angeles and Supervisory Mycologist at the National Communicable Disease Center in Kansas City. He is currently Research Microbiologist at the Desert Test Center in Dugway, Utah. Dr. Orr has published numerous technical papers on fungal taxonomy, physiology, distribution and isolation.

Photos by Dr. F. E. Swatek and Miss Harriet E. Baker.

BOOKSHELF

WEST AUSTRALIA NATIVE PLANTS IN CULTIVATION by A. R. Fairall, M. C., F.A.I.R.R. Pergamon Press, Rushcutters Bay, NSW, Australia, 253 pg. Illustrated.

For the plant lover, the reading of the work under review will be a vicarious visit to a wonderland of extraordinary floral beauty, each page another milestone on an imaginative journey in a botanic region known for its remarkable variety of endemic forms. In all, there are three endemic genera and 3,000 endemic species of flowering plants in what botanists call the "Southwest Province" of Western Australia. Arthur Fairall's scholarly book pictures 106 of these in full color, beautifully rendered, and the text describes nearly 1,000 species and forms in language written for the layman.

In his preoccupation with extensive coverage of this esthetic treat, the reader could pardonably pass over the primary purpose of the work. As the title suggests, the author has placed special emphasis on a detailed discussion of proven methods of introducing the West Australia species of flowering plants into cultivation. Here, his dedication is clearly evident. For the material included is in fact a summary of the work on native West Australia species at Kings Park Botanic Gardens, Perth, since he was appointed superintendent in 1962.

While written in a West Australia context on the basis of actual experience in that area only, the work will be useful elsewhere, and particularly in Southern California and other parts of the American Southwest where Australian natives have long been widely represented in public and private gardens. Therefore, this new book is not for public libraries only, but should find a place in the home bookshelves of every Southern California plant lover, to serve as a practical guide so that he may share the rich botanic heritage of our "geographical twin" on the other side of the world.

Ross Gast

OF SPECIAL INTEREST

GLOSSARY OF INDIAN MEDICINAL PLANTS by R. N. Chopra, S. L. Nayar, and I. C. Chopra. 329 p. Council of Scientific & Industrial Research in India, New Delhi. 1956.

METHODS IN PLANT PATHOLOGY by Z. Kiraly. 509 p. Akademai Kiado, Budapest. 1970. Black and white photographs.

ROSES (Volume I of the Time-Life Encyclopedia of Gardening) by James Underwood Crockett and editors of Time-Life Books. 160 p. Time-Life Books, N.Y. 1971. Color photographs.

TEXTBOOK OF AGRICULTURAL ENTOMOLOGY by Hem Singh Pruthi. 977 p. Indian Council of Scientific Research, New Delhi. 1969. Black and white photographs.

FERNS OF VICTORIA AND TASMANIA by N. A. Wakefield. 71 p. Field Naturalists Club of Victoria, Australia. 1955. Black and white photographs and prints.

PATHOLOGICAL WILT OF PLANTS by Dr. J. Smolak. 127 p. Swets and Zeitlinger, Amsterdam. 1970. Black and white prints.

WEST AUSTRALIAN NATIVE PLANTS IN CULTIVATION by A. R. Fairall. 253 p. Pergamon Press, Australia. 1970. Color photographs.

THE SEA GRASSES OF THE WORLD by C. Den Hartog. 275 p. North-Holland Publishing Co., Amsterdam and London. 1970. Black and white photographs and drawings.

FLOWERS AND ME by Joan Pare. 127 p. Constantia Publishers, Cape Town. 1970. Color and black and white photographs.

THE WATER ENCYCLOPEDIA by David Keith Todd. 559 p. Water Information Center, Port Washington, New York. 1970. No illustrations.

Calendar 1971

July - August - September

ARBORETUM, ARCADIA

July 3, 4, 5
Cactus and Succulent Society Show

July 10 and 11
San Gabriel Valley Begonia Show

July 11 — 2 p.m.
Sunday Afternoon Lecture—
Demonstration Home Gardens
"What to do with Your Old, Overgrown Plants"
Don Fitch, Staff Nurseryman

August 1 — 2 p.m.
Sunday Afternoon Lecture—
Demonstration Home Gardens
"Annual Color for the Home Garden"
John Provine, Staff Horticulturist

DESCANSO GARDENS LA CANADA

July 1 through 31
Art Exhibit—
County Employees Association
Hospitality House

August 1 through 31
Art Exhibit—Glendale Art Association
Hospitality House

September 1 through 30
Art Exhibit—Ruby Andreason
Hospitality House

September 25 and 26
Annual Bonsai Show—
Descanso Bonsai Society
Hospitality House

SO. COAST BOTANIC GARDEN PALOS VERDES PENINSULA

July and August
Exhibit of insectivorous plants
Information Center

Garden open every day—
8 a.m. - 5:30 p.m.

Tram tours:

Wednesday, Thursday, Friday—
1 and 2 p.m.

Saturday and Sunday—
11 a.m., 1, 2, 3, 4 p.m.

All events admission free

September
1971
Vol. XXI
No. 3

Lasca Leaves

DEPARTMENT OF ARBORETA AND BOTANIC GARDENS, COUNTY OF LOS ANGELES

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CALIFORNIA ARBORETUM FOUNDATION, INC.

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BOARD OF TRUSTEES

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Lasca Leaves

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LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN

The Cover

Xanthorrhoea quadrangulata, or grass tree as it is popularly known in its native Australia where it is a conspicuous feature of the landscape. A very interesting, slow-growing perennial that is flourishing at the Arboretum in light shade. For the first five years or so the plant resembles a mound of coarse grass. Then, flowering, creamy-white spikes shoot out from the center, 6-8 feet long. This is a drought-resistant plant, tolerant of soils, and requiring little care. The Arboretum obtained seed from the Adelaide Botanic Garden in 1951 and following the usual test period introduced the plant to the nursery trade in 1967.

Editor
Donald S. Dimond

Photo Credits
Cover by Frank Simerly

department notes

Queen Anne Frolic

THE MOST COMMON reaction among planners, hosts, and guests of the first-of-its-kind party at the Arboretum was that it exceeded all expectations. The weather was balmy perfection, the barbecued beef dinner was delicious, the historical buildings were alive with visitors as they might have been nearly a century ago, the vintage cars, horseless carriages, paddle boats, and other entertainments were patronized by almost a thousand people, and the music played far into the night. The inclination in retrospect is to single out those responsible for the success of this fund-raising party. It is impossible, unless one were to name individually a good part of the California Arboretum Foundation, members of Las Voluntarias, the Arboretum staff, the foundation Board of Trustees, the department Board of Governors, the president of the Descanso Gardens Guild, the many who provided the entertainment, and an assortment of wives and husbands who cheerfully lent their collective hands to the myriad chores necessary for an event of this kind. Summing up the results in terms of figures, a net of $4,600 was raised, a good part of which will be used for seeds and plants for the Arboretum during the coming year. Mark the evening of September 24, 1971 as one milestone in the short history of the Arboretum that surely will be repeated.

Photo: Peter Douglas

View from in front of Queen Anne cottage, starting point for rides in vintage cars.

Retirement

AFTER TEN YEARS OF supervising the development of South Coast Botanic Garden from a barren tract of land consisting of a few feet of top soil atop a hundred or more feet of trash to a garden with respectable collections of pines, eucalyptus, ficus, flowering fruit trees, and ground covers, Superintendent Donald P. Woolley has retired at a vigorous 68 years of age. At a farewell luncheon on August 20 attended by staff and friends, the mood was purposely light-hearted in accord with Don's wishes, with no effort made by Director Francis Ching and other speakers to recount his many achievements. But they exist in the record and in the memories of Don's legion of friends and co-workers, many of whom shared with him the heartbreaking setbacks arising from broken pipes, root-burned trees and shrubs, and other horticultural catastrophes resulting from unstable land and unusual, to say the least, soil conditions. In developing a botanic garden on what was successively a diatomaceous earth mine and then a county dump there were no reference books to turn to; Don's approach to his task was necessarily one of trial and error based on his years of experience as a horticulturist. Before going to South Coast he had worked at the Arboretum for seven years as chief horticulturist, a period that included two years as acting superintendent, and before that, he spent eleven years at UCLA, first as an orchardist and then as senior superintendent of cultivations. Although Don has retired from County service he has by no means retired from active work in his field. We talked with him on the telephone recently, following his return from a three-week vacation with his wife in the Hawaiian Islands, and he told us that in addition to serving as a consultant to South Coast he is already lined up for teaching and lecture assignments for the coming fall and spring seasons.

Photo: Palos Verdes Newspapers

Department director Francis Ching, retiring South Coast Botanic Garden superintendent Don Woolley, and assistant director Glenn Hiatt, left to right, share a moment of levity at a farewell luncheon honoring Mr. Woolley.

Musical at Descanso

AN UNUSUAL FUND-RAISING party was presented October 9th in the Hospitality House of Descanso Gardens by the Descanso Gardens Guild. Titled "An Evening With The Old Masters," it offered talented young musicians performing during a champagne reception, through the dinner hour, and, later in the evening, in concert performance. The accent was on elegance. A gourmet dinner was set off by the loveliest of floral decorations and the various soloists and instrumental groups lent a special charm to the affair by appearing in costumes, some representative of the period of the composers they were playing, others an actual facsimile, as in the case of one soloist dressed as Chopin and another dressed as the wife of Robert Schumann. Proceeds from the event will be used both for the Guild's programs to aid handicapped children and for general improvements within Descanso Gardens.

Smog and Longevity

FURTHER EVIDENCE that smog may be reducing the life span of humans has been uncovered by two geneticists working in different fields but drawn together by a common interest. W. E. Trout, III, of the City of Hope Medical Center in Duarte, and our own senior biologist, George Hanson, collaborated on a paper indirectly bearing on this subject which Dr. Hanson presented at the annual meetings of the Genetics Society last August 23-26 in Rochester, New York. Entitled The Effect of Los Angeles Smog on the Longevity of Normal and Hyperkinetic *Drosophila melanogaster*, it detailed in classical research-lab language how virgin female Drosophilas, a species of fruit fly, were placed in chambers and exposed to "ambient Los Angeles basin air." The results, for the flies and very possibly all the rest of us, were not happy. Smog reduced the life span of the flies approximately 15%, based on average summertime smog levels here. It has to be noted, of course, that insects and humans have very different respiratory systems, and this is encouraging for us. On the other hand, we and insects are not so different metabolically speaking, and that could be the rub. In any case, Dr. Hanson and his colleague cautiously conclude that "these preliminary results have confirmed our suspicions that the Southern California climate is not what it used to be and the change may affect the life span of humans as well as flies." We have had some thoughts along these lines, too.

Coffee Shop

RATHER EXTENSIVE renovation and upgrading of the eating facilities in the Peacock Pavilion have elevated what was heretofore a snack bar into a coffee shop with menu to match. To add to the comfort and attractiveness of the surroundings, air conditioning has been installed and each day a bouquet of fresh flowers will be placed on the tables. Robert Parker and Charles Russell of Acreage Concessions, Inc., operators of the facility, and Dolores Hubbell, executive secretary for the California Arboretum Foundation which oversees the operation, extend a cordial invitation to everyone to drop in to the new Peacock Pavilion Coffee Shop to inspect the quarters and sample the menu.

Repeat Bonanza

PLANNING one fund-raising event on the heels of another is like preparing tomorrow's menu on a full stomach — usually there is little appetite for the job. Not, however, for Las Voluntarias. Having proven themselves under fire, they know that planning for an event several months in advance is the price of success. So it is that that colorful treasure and plant sale, the Baldwin Bonanza, held a year ago last May, will be repeated next April 8th and 9th. What the planners are looking for now is help in the form of donated, salable articles: botanical and historical books and pictures, antiques, jewelry, attractive bric-a-brac, choice white elephants in good condition, and so on. For its part, the Arboretum will offer a selection of rare and unusual plants, the kind next to impossible to find in nurseries. It is hoped that each member of the Foundation will donate at least one *good* item, always bearing in mind that all donations are tax deductible. Articles may be left at the Arboretum gatehouse window any day from 8:30 to 5, and since they have to be sorted, catalogued, and priced, the sooner the better.

Appointment

THOSE WHO HAVE seen the Arboretum's new aquatic garden or who have read Frederick Lang's account of its development in our last issue, have already had the opportunity to form an impression of Mr. Lang's work and style. From everything we have heard, the impression is highly favorable and so we are particularly pleased to report that he has been retained as a consulting landscape architect for the department. Some of the projects on his agenda are new landscaping around the Queen Anne Cottage, landscaping of Baldwin Avenue and the Foothill Freeway where they adjoin the Arboretum, reworking the entryways of Descanso Gardens and South Coast Botanic Garden, and developing plans for future landscaping at our High Desert Arboretum. When he is not working on these projects or serving on several Orange County urban renewal committees, Mr. Lang will be teaching at U. C. Irvine and working with his firm, Lang & Wood, on a variety of recreational, school, and commercial landscaping jobs, the most immediate being a 425-unit housing complex called Crystal Springs Terrace, just south of San Francisco, and Dana Point Harbor, south of Laguna Beach.

The Persistent Emigrant

Frank Simerly

Ye who would pass by and raise your hand against me, harken ere you harm me. I am the heat of your hearth on the cold winter nights; the friendly shade screening you from the summer sun; and my fruits are refreshing draughts quenching your thirst as you journey on. I am the beam that holds your house, the board of your table, the bed on which you lie, and the timber that builds your boat. I am the handle of your hoe, the door of your homestead, the wood of your cradle, and the shell of your coffin. I am the gift of God and the friend of man.

Anonymous

OF ALL THE MANY trees introduced into California, none have the colorful and interesting history of the eucalyptus that we have come to take so much for granted. We see them in our gardens, protecting our orange groves from the wind, and planted along the highways, but how many of us really appreciate them? The gum trees are in fact so widely planted and seen in such large number that many people have assumed the plants are native to California, which of course, is not the case.

All eucalyptus come to us from Australia, New Guinea, and Tasmania. They were first discovered by a young botanist, Joseph Banks, who was one of the naturalists accompanying Captain Cook when that famous explorer discovered the east coast of Australia in 1770.

The word eucalyptus is from the Greek and may be translated "well hidden." The name was suggested by the cap-like structure which completely hides an immature bloom. Botanists have since classified over 600 distinct species and it is generally felt that the number is destined to be amended upwards.

When a Californian discusses the eucalyptus or gum tree, he most usually is referring to the blue gum, *Eucalyptus globulus*. Like many of us, he is apt to be unaware of the great variety within the genus. He will have noted gums towering over 150 feet here in California, but may not have seen the giants found in Australia that are nearly 300 feet high. Even less familiar will be the many plants that never achieve a height exceeding 10 or 15 feet (better classified as shrubs), and the small, multiple-trunked trees Australians call mallees. The mallees generally achieve a height of approximately thirty feet at maturity.

The diversity of the trees is not confined to the proportions of their growth but may also be seen in the foliages which often differ from youth to maturity and include a multitude of shapes and colors. Leaves can be found in almost every shade of green and even grey. The unusual flowers are also varied. Many are so small, such as the *E. pulverulenta* flowers, that they are hardly noticed; others are so large and brilliant that they demand attention. Most striking are the bright red flowers of *E. rhodantha,* often found with dimensions of up to three inches across. One of the most desirable mallees for the home garden is *E. erythrocorys* which has yellow flowers that are covered by two scarlet caps prior to opening.

THE AUSTRALIANS have made many uses of the trees that are said to constitute almost 85 percent of Australia's forest regions. The wood is an excellent fuel and makes fine charcoal. It is used as paper pulp and furnishes raw material for the cellulose industry. It is made into fibreboard and into plywood and is a beautiful veneer. Apart from these uses, the wood has been utilized in the paneling of railroad sleepers, as crossties, mine timbers, fences, and pier pilings. They have, in fact, been tried in almost every conceivable item that could be made from wood.

The trees are also valued for the essential oils derived from their leaves. The oils are combined in pharmaceuticals, stain removers, solvents, disinfectants, and are used as raw material for synthetic thymol and menthol. They are also valuable as perfume fixatives and are substituted for bergamot essence and are used for hyacinth scent in perfumery.

The fact that there are eucalyptus in bloom almost every month of the year and that the flowers are frequented by bees demonstrates their usefulness in the production of honey. Eucalyptus honey is of excellent quality.

The tree that influenced our California landscape more than any other introduced tree found its way into our country over a hundred years ago. It is not known who should be credited with the introduction or even when the first plants entered California, but there are records of fourteen varieties that were planted in 1856 by William C. Walker in his Golden Gate Nursery in San Francisco.

The planting of eucalyptus began to snowball in the 1870's after the Central Pacific railroad was completed and large numbers of settlers began to migrate to California. Seedlings were selling for as much as ten dollars each, but as greater quantities became available they dropped to twenty-five cents each. Large plantations were developed. One in Hayward contained 170,000 trees. The citrus industry got its start just after the Santa Fe railroad was completed in 1885 and it didn't take long for the citrus growers to utilize the gum trees to protect their orchards from the withering Santa Ana winds.

PRIOR TO THE 1900's, eucalyptus had been used primarily for firewood, windbreaks, highway and home plantings. But in 1904 there was the scare of an impending hardwood famine and the eucalyptus was suggested as the solution. Along with the suggestion that hardwood would bring a premium price was one that presented the eucalyptus tree as the answer to the problem. The eucalyptus timber boom that followed was the product of this line of reasoning and the gums were discussed as "get rich" trees.

Corporations were formed to exploit the situation. The many virtues of the tree were described in magazines, newspapers, and books. The Eucalyptus Timber Corporation printed pamphlets to encourage investment in its companies. Many of the big planters and promoters were sincere but there were also many who were nothing more than profiteers. A standard procedure of the latter was to purchase poor land for as little as $15 an acre, plant gum trees, and then sell the improved property for as much as $250 an acre, with the claim that in ten years the timber yield would be worth $2,500 an acre. By 1912 there were 50,000 acres planted to eucalyptus in California.

Adding to the esteem of the omnipresent gums was the widespread superstition that they helped to control malaria. They actually did stop malaria in the Bakersfield area. Their thirsty roots dried up swampy areas that had been breeding places for mosquitos. However, the knowledge of malaria at that time was almost nil and the reason for the decline of malaria when gum trees were present wasn't discovered until later.

Although the eucalyptus was accorded many powers to heal, the superstitious belief in the tree never reached the fever pitch in the United States that it achieved in Spain. "In Cordova, young gum trees were stripped of their leaves and it was impossible to keep them alive until guards were posted to protect the trees. In one Spanish town there was a regulation prohibiting the picking of the eucalyptus leaves without an official per-

Photo: Frank Simerly

E. globulus — *the largest and most widely planted eucalyptus in California. This specimen is located just south of the South African section at the Arboretum.*

mit issued only on evidence of the medical need of the applicant." (Abbot Kinney, *Eucalyptus,* p. 135.) Californians agreed to the extent that better health seemed to accompany the planting of a gum tree.

There are many uses for eucalyptus oils in medicine today but the list is nominal compared to those published at the turn of the century. "According to one San Francisco doctor, the 136 cases of various diseases he treated with eucalyptus extract were either cured or showed improvement. Diseases treated included remittent fever, typhoid fever, valvular diseases of the heart, dysentery, chronic diarrhea, gonorrhea and dropsy." (Abbot Kinney, *Eucalyptus,* p. 158.)

The discovery of the true cause of malaria ended the planting of the gum tree for its curative power. It is still used, however, to drink up excessive soil water and also has oils used in pharmaceuticals. The eucalyptus timber farmer of the early 1900's probably felt he was accomplishing two feats at one time. He was improving the climate about his home as well as growing the trees that would stave off the hardwood famine.

ALTHOUGH several eucalyptus species had been planted by the turn of the century, only one (*E. globulus*) was planted with a commercial end in view. The unusual blue gum was considered a "Jack in the Beanstalk" tree.

It is still considered one of the fastest growing trees in the world. Almost 90 percent of the gum trees planted in California prior to the 1900's were the blue gums.

By 1910 there were at least 100 companies in the Southwest dealing in the ubiquitous gum tree. At the Chicago World's Fair specimens were displayed to show the utility of the hardwood. The wood had been worked into various boards and implements for the exhibit.

As trees reached a suitable size, Californians, eager to show their value, cut them and tried the wood in every imaginable way. Pilings made from the trees were tried all along the coast. The wood was utilized for flooring, veneer, beams, wagon wheels, and fence posts — in most every case with disappointing results. "An experiment made with the blue gum by the Southern Pacific Company showed it to be above average for a tie in all respects but one. It checked to such an extent that room could hardly be found to bolt down the rails." (Abbot Kinney, *Eucalyptus*, p. 39.)

It soon became clear that the blue gum is not the best of timber for general purposes. It is only second rate for ship building and pilings. It does not last well in the ground or in the water. The leaves do not give the highest yield of oil nor is it the best honey-making tree for bees. It does rate high in all these things but not high enough for commercial use.

The eucalyptus grower of the 1900's was truly disappointed by his disheartening experiments. Complete disillusionment came in the early part of the century when the U.S. Department of Agriculture printed several circulars giving the results of eucalyptus experiments. The department found that most of the difficulty was due to improper aging of the lumber and the time it took to cure the wood made its commercial use impractical. They also found that the Australians did not use the blue gum nearly as much as other species. It was discovered that the trees cut in Australia for the mills were on the average, 100 or more years old, and were easier to cure because of their age. The Australians had difficulties in curing their lumber but, as they had few trees to compete with the gums, they had little other choice.

The marks of the great eucalyptus experiment are still borne by the Southwest. It is almost impossible to travel through any of the densely populated areas without seeing them, the patriarchs dominating the landscape and standing as monuments to our colorful past. The experiment is by no means ended.

Although the blue gum has practical limitations, it is one of the wind breaks still being used for our citrus groves. It is also effective along highways. There are even experiments indicating that the blue gum has value as semichemical wood pulp.

BUT WHAT OF the many other species of the gum tree? There are more than two dozen that have proven desirable for home landscaping and that can be found in most nurseries. They include: *Eucalyptus caesia, E. citriodora, E. torquata, E. viminalis, E. ficifolia,* and several others. The florist trade is using large quantities of the *E. pulverulenta* foliage for flower arrangements. Many new species are being used in highway plantings to create sound barriers as well as a more beautiful drive. And we would certainly be remiss if we didn't mention the more than 300 species of eucalyptus being tested at the Los Angeles State and County Arboretum in Arcadia. Undoubtedly many of the trees will prove themselves both adaptable and desirable for planting in the southland.

In 1963 the Arboretum introduced *E. calophylla* into the nursery trade and is

Photo: Frank Simerly

E. pauciflora — *a prospective Arboretum introduction.*

planning on introducing at least two more species by the end of next year. *E. pauciflora* is one of these species. It is an attractive tree that grows to the moderate height of thirty feet making it suitable for home use. It has a vase-shaped growth habit, lovely white bark that attracts attention and it is one of the most frost-hardy of the gums. Another promising eucalyptus is *E. lindleyana.* It is as broad as it is high, about forty feet, and has a beautiful weeping habit. We rate *E. preissiana* highly at the Arboretum but have been unsuccessful in acquiring viable seed so that we can test it further. This plant will grow twenty feet or so in height and has handsome chartreuse flowers. We have many more horticulturally fine eucalyptus that are still being evaluated for possible introduction.

The eucalyptus has a bright future in agriculture as well as horticulture. A 1955 publication of the Food and Agriculture Organization of the United Nations was devoted to the gum trees and in it Marcel Leloup, Forestry Division Director, says, "The creation of new forests by planting is one of the more important problems facing the foresters of the world. They are constantly in search of tree species capable of rapid growth, high yields, able to survive under a variety of conditions and useful for the protection of soil and water resources as well as other special products. One of the most versatile and interesting of such tree groups is the genus Eucalyptus, now widely planted in every continent of the globe."

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In his nineteen years of service to the Department, Frank Simerly, superintendent of the Arboretum, has taught and lectured widely on various aspects of horticulture and has been a frequent contributor to Lasca Leaves.

Some Outstanding Shade Trees for Southern California

George H. Spalding

Photo: Ralph D. Cornell

Podocarpus gracilior

SOUTHERN CALIFORNIA gardeners are fortunate in having a wide variety of trees available to them. Making a choice in this situation is sometimes difficult. Aside from such horticultural considerations as location, soil, and exposure there is the attitude of the person making the selection, perhaps the most important consideration of all.

None of the trees is perfect, if perfect means being in flower year round and never dropping leaves. Nonetheless, there are a number which, though falling short of this ideal, have, by reason of their adaptability, great value as shade trees. Those discussed in this article are outstanding in this respect.

Podocarpus gracilior — Fern Pine

This beautiful native of Africa is one of the most outstanding shade trees for a wide range of situations. Often sold in nurseries as *Podocarpus elatior,* it has been grown in Southern California at least for 40-50 years. It is one of the cleanest trees in that leaf drop is no problem as the leaves are so small and needle-like. It is free of insect pests and disease. In other words, it comes close to being the ideal shade tree for all areas in which it can be grown. Its major drawback, if it can be called one, is that it takes so long to reach its mature growth of 50-70 feet and a width of 20-30 feet.

Seedling grown plants are quite upright. Cutting grown or grafted plants tend to be rather supple and floppy. They are fine for espaliers because of their tendency to make horizontal growth. They are often used as a substitute for vines along a fence or arbor. Both types make outstanding evergreen hedges, especially when clipped.

As a mature tree it has a billowy outline which is soft and pleasing. The shade is quite dense.

It would be very easy to say that this is one of the best all-around trees in existence. Ideal for street or patio use and also excellent for container use when young. Very tolerant of a variety of soils, it can be grown over a wide area.

Schinus terebinthifolius, *with close-up of flowers and berries.*

Schinus terebinthifolius

Brazilian Pepper

A native of Brazil, *Schinus terebinthifolius* is another fine, small shade tree for patio or garden. It is one of the best for use as a lawn tree since it thrives on the type of watering program usually given lawns in this area. It heads too low for street use where 14 feet is often required height for the lowest branches.

This species of *Schinus* is much heavier and more densely foliaged than *Schinus molle,* the long grown and beautiful California Pepper. The leaves are dark green, somewhat shiny, and evergreen. The inconspicuous flowers are followed by scarlet berries. A certain amount of pruning is necessary to develop an open crown and overcome a tendency to cross branching and heavy growth. The ultimate height will be about 25 feet. One caution should be noted — during the past year or two there has been some evidence of damage and occasionally outright killing of trees by verticillium wilt. The best control is to watch the watering and feed regularly. In spite of this it is one of the best shade trees for this area.

Melia azedarach cv. *umbraculifera*

Texas Umbrella Tree

The Texas Umbrella Tree is practically indispensable for those hot desert areas where very few trees will grow. It is a fast-growing tree which tolerates a wide variety of soil and growing conditions. The foliage is bright green and the leaves are bipinnately compound. In spring the tree is covered with fragrant clusters of small lavender flowers that are followed in the fall by yellow fruits often used for beads. Under garden or lawn conditions it will be a messy tree and will tend to send up suckers because of garden waterings. It is not good near the coast nor in areas of heavy winds as the brittle branches tend to break. But in the hotter desert areas of southern California where it has been widely planted, the Texas Umbrella Tree is very effective, and those who have enjoyed its shade on a hot summer day in the desert will be ever grateful for it.

View of the drooping flowers of the Texas Umbrella Tree.

Photos this page: Ralph D. Cornell

Photo: Grant Hildebrand

The flowers of K. integrifoliola *offer color during the summer and then the seed pods slowly deepen to a salmon pink in the fall. This specimen is located near the tram-loading area at the Arboretum.*

Koelreuteria integrifoliola (no common name)

A small, deciduous tree from China which seldom attains a height of more than 30 feet. The large leaves are bipinnate. The leaflets ovate-oblong about 4 inches long. The entire leaf often reaches 14 inches in length. Flowers are small but produced in large terminal panicles in summer when flowering trees are at a premium. The fruit which follows is bladderlike, somewhat resembling inverted Japanese lanterns. They are green at first turning a beautiful salmon pink with age.

This is the smallest of the genus, all of which are worthwhile ornamental trees. *Koelreuteria integrifoliola* is well suited to the small city lot and will stand temperatures as low as 20°F, probably lower. In this area it self sows readily and seedlings are easily transplanted. We still do not know the full potential of this tree as it was introduced by the Los Angeles State and County Arboretum in 1958. The oldest tree there is only 19 years old and until its recent removal to a new location, requiring heavy pruning, was rather broad topped and very attractive. Like the rest of the genus it is free of disease and insect pests.

Photo: Grant Hildebrand

This venerable Magnolia grandiflora *is growing in the Arboretum in the park-like area west of the Queen Anne Cottage.*

Magnolia grandiflora Magnolia

Perhaps of the best known of the large evergreen shade trees in Southern California is *Magnolia grandiflora.* It can become an immense tree, growing to 100 feet in its native southeastern United States. It will probably not reach quite that height here because of the lack of natural rainfall in the quantities needed and because of low atmospheric humidity. Still, we can boast some that are at least 70-80 feet. Most gardeners in this area prefer the smaller growing varieties such as St. Mary. Both the species and its varieties take many years to reach ultimate size.

The large leaves can reach 8 inches in length. They are thick, shiny green above, and usually have a rusty tomentum beneath. The showy white flowers are 6-8 inches in diameter and very fragrant. It is in bloom through most of the summer and fall.

Magnolia grandiflora is most suitable for parks and large garden areas. The named varieties, such as St. Mary mentioned above, may be suitable for smaller areas.

It should be kept in mind that the usual watering practices in this area tend to encourage surface roots and the system suggested for *Morus alba* can be used with this tree also. However, surface roots can be removed if done before they reach 1 inch in diameter.

Photo: Grant Hildebranc

This mapleleaf mulberry, one of the fruitless forms of Morus alba, *is growing in the Demonstration Home Gardens at the Arboretum. It has a spread and height of about 30 feet.*

Morus alba cv. Mapleleaf Fruitless Mulberry

Among the fastest growing are the fruitless forms of *Morus alba.* The family with a new home can have usable shade in three years or less by planting this species or one of the varieties. The Mapleleaf variety is particularly fast. Trees can be purchased, bare root, from December to March in sizes from 4 to 12 feet tall or more, which gets you off to a flying start. With proper care a tree 20 feet tall and 20 feet across is possible in three years.

As I mentioned at the outset, no tree is perfect in all respects and this one is no exception. The leaves drop every fall, although in a relatively short period of time. Also, they are very large and easy to rake up. Because the tree grows so rapidly, pruning is a yearly chore, particularly in the formative stage. Branches grow to six feet or more in one year and quickly develop a large top which is sometimes too heavy for the young trunk. So stake well, thin judiciously and head back long branches during the winter months when the structure of the tree is visible.

DEEP WATERING IS ESSENTIAL. A good method is to sink 3 to 4 foot lengths of pipe (about 4″ in diameter) into the ground around the tree at 6-foot intervals and about 6 feet from the trunk. Fill with pea stone or larger and let the water trickle in each section of pipe for several hours. This should be done at varying intervals depending on the type of soil.

Surface watering (except when first planted and until the tree is established) will cause surface rooting and its attendant problems. However, this method can be used if the top two inches of soil are cultivated the following day so the soil dries out. This will help to discourage surface roots. If the tile method is used, the tiles will have to be moved outward as the tree grows and additional tiles added as the circumference increases as they should be kept at the drip line. Once the tree is established it is fairly drought tolerant.

If you want a dense shade tree 20 x 20 feet in three years, this is your tree. The kids will enjoy climbing in it too. Let them.

Photos: Ralph D. Cornell

A camphor tree in full, magnificent maturity. This 88-year-old specimen is located in Pomona, California.

Cinnamomum camphora
Camphor Tree

For those with a real love of trees and the space to grow them, the camphor is one of the finest trees that can be grown in the warmer areas of California. This native of China and Japan can reach a height of 50 feet or so, with an equal or greater spread. It is beautiful in all seasons. The new foliage in spring may be pink, red or bronze, depending on the tree. The foliage becomes light-green and the leaves turn shiny as the tree matures. Old trees lose their lowest branches and often have a rather swollen base with large roots protruding above the soil. There is some leaf drop most of the year but the heaviest is in March. This is a detriment to some people, but there is no such thing as a perfectly clean tree. If you have ever seen it on a rainy winter's day when the trunk and larger branches appear black against the yellow green leaves, you will agree that it is truly one of the real aristocrats among trees. No special care is needed in growing the camphor, but as with any plant, the better the soil and care it receives the greater the reward in growth. While not usually bothered by pests it is subject to verticillium wilt, one of the root rots. When attacked by this rot, twigs, leaves, branches, and sometimes the whole center of the tree will wilt and die. For many years nothing could be done to control this disease. Recently a new systemic fungicide, Benlate (benomil), became available and appears to be of considerable value in controlling verticillium when used as a spray on the foliage. In spite of this, camphors are not difficult to grow.

Jacaranda acutifolia Jacaranda

It almost seems superfluous to discuss this popular and widely planted tree. To newcomers who are not familiar with its beauty some information on its culture may be of value. If a really fine tree is wanted, regular pruning and removal of the water sprouts which occur throughout the tree is necessary. It is very tolerant of many types of soils, but of course will not do well in poorly drained or highly compacted soils. The work which may be necessary to develop a well-shaped tree is quickly forgotten when the blooms envelop the tree in a cloud of lavender blue and the ground beneath is carpeted with fallen flowers. This Brazilian native graces the streets and gardens of many cities all over the warmer areas of the world. In southern California it has been used for many years as a street tree, for park plantings, and in home grounds. Some consider it a litterbug, but for many more its heavy leaf fall is a small price to pay for the wealth of beauty which often comes twice a year. The heaviest bloom is usually in May or June, but frequently there is a secondary blooming in July or August. The foliage is fine and rather fern-like. It is a round-headed tree which can reach 25-40 feet with 15-30 feet spread, occasionally more. It is slightly tender to frost and infrequently is severely damaged by cold. However it grows rapidly and when lightly frosted recovers quickly.

Cupaniopsis anacardioides Carrotwood Tree

In this day of small suburban lots, suitable small trees are hard to find. The carrotwood is both suitable and relatively small. A moderate to slow grower, it will eventually reach a height of 30 to 40 feet and a spread of about 20 feet. Multiple trunk specimens will have a considerably wider spread. It somewhat resembles the carob, but is more delicate and airy in appearance and has none of the carob's faults. The leaves are composed of 6 to 10 leathery leaflets, are evergreen, and provide a dense heavy shade. It is probably one of the cleanest trees available today and is fine for use as patio, lawn or street tree. There has recently been evidence of verticillium wilt in heavy soils where drainage is poor or in lawns where poor watering practices are followed. This can be treated with Benlate as mentioned for camphor. The carrotwood can be grown as a single or multiple-trunked tree and the choice is up to the individual planting it. Either way it is a fine evergreen tree and a fine import from Australia, its native home.

Photos: Robert Copper

At the Arboretum — two young trees: left, jacaranda; above, carrotwood.

Photo Ralph D. Cornell

Flowering silk tree (Albizia julibrissin).

Albizia julibrissin **Silk Tree**

This is another small tree suitable for use in gardens with limited space. Native over a wide part of Asia from Iran to Japan, this deciduous tree is the mimosa of the eastern United States. It is fast growing and can reach a height of 40 feet with an equal spread. However, it can be kept to a much smaller size by regular pruning. The foliage is pinnately compound and in some respects resembles a coarser jacaranda leaf. A really flat-topped tree, it is especially attractive when viewed from above, as the fluffy pink flowers are held above the foliage. It is usually more attractive when grown in its natural form as a multiple-trunked tree. The foliage is light enough so that grass can usually be grown underneath. Its one fault is heavy litter of fallen leaves and flowers beneath. Another tree particularly useful for the deserts of the southwest, it makes a very fine patio tree because of its light, filtered shade and umbrella form. Flower color will vary from light to deep rose pink when grown from seed. An all-around fine small tree which will grow with a minimum of care.

George Spalding has been on the staff of the Arboretum since its inception in 1948 and over the years has served in a number of capacities. Currently botanical information consultant to the public, he also is an advisor to Time-Life Books and other publications.

Treating for Increasing Life of Cut Camellia Blooms

Mark J. Anthony

"Summary"

"1. Camellia flowers when stored in a saturated water atmosphere, the flowers themselves not touching water, retained their freshness and turgidity up to two weeks. Application of naphthalene acetic acid (NAA) dissolved in acetone near the floral axis, increased the life span of these flowers to 28 days.

"2. Camellia flowers stored floating on water deteriorated within seven days. Addition to the water of inorganic phosphate, NAA, and combinations of the same increased the life span by not more than two days. Other treatments were less successful."

THIS SUMMARY is taken from the report of Bonner and Honda in our Society's "Camellia Research," published in 1950 and reprinted in March 1955 CAMELLIA REVIEW. The original report was based on their work performed at Cal Tech and which was supported by our Society. The essentials of the report were quoted by Cothran in our CAMELLIA CULTURE (pages 201 and 203).

The above outstanding results were obtained when the temperature was 25°C (or 77°F)!

You are not likely to have the equipment to duplicate these conditions any more than I have. However, we can get fairly close by (a) applying naphthalene acetic acid (NAA) to the floral axis of our blooms; (b) maintaining fairly high relative humidity in a bloom box stored in our refrigerator; and (c) keeping the stems of the blooms damp. After using several technics which gave pleasing results, I am using the treating procedures outlined below.

MIXING NAPHTHALENE ACETIC ACID* (NAA)

A 125 ppm (parts per million) aqueous solution of NAA can be made by mixing approximately 100 milligrams of the NAA powder in a quart of tap water. 100 mg NAA is about ½ the size of a pencil eraser or would fill about half of a quarter inch size capsule. It doesn't hurt to have a little extra NAA powder in the water because NAA is rather insoluble in water and you can't get as much as Bonner and Honda used in their acetone solution. Never mind the expense because 25 grams (or 25,000 milligrams) costs only $2.50 and should last you 25 years or more.

No special storage provisions are necessary for either the dry powder or the aqueous solution. The exact proportions are not necessary. A solution as low as 15 ppm was effective and the saturated aqueous solution of 400 ppm is not as strong as Bonner's acetone solution. The purpose of the NAA is to strengthen the bonds between the petals and the stem and to delay the petals' dropping off (abscission).

BLOOM-TREATING PROCEDURE

WITH A WINDEX BOTTLE you can spray NAA solution down into the axis of the flower. Generally, I have directed squirts from 3 to 5 directions always avoiding hitting stamen.

The total liquid will be 6 or 8 drops. In my bloom boxes, I have been using milk bottle tops for holding cotton wads which have been generously wet with the NAA solution. Make sure that the stem of the bloom is in contact with this wet cotton. After the blooms are placed in the box, I spray the shredded paper lightly with the solution.

Although you can not assure having saturated vapor in your closed box in a refrigerator, it is believed that you get high relative humidity. If you have your refrigerator set at the highest temperature, the result is about 38° to 40° F. Assume the outside air is 55° to 65°F, and relative humidity was 50% when the box is closed. When you cool the box in the refrigerator, the air inside should be from 80 to 100% relative humidity if no moisture is lost from the air. Throughout the storage the relative humidity will be helped by the evaporation from the liquid on the cotton, the chopped fibers and the blooms themselves. The extensive liquid surfaces tend to maintain high relative humidity.

BOXES FOR BLOOMS

Probably the best size box for fitting in most refrigerators is 20″ x 15″ x 5″. To preserve a cardboard box, use aluminum foil to cover the bottom and have the foil come up about an inch and a half on each side. Cover the bottom with absorbent cotton and wet this with about two tumblers of water or NAA solution mentioned above. Then cover the cotton with shredded wax paper to a depth of 1½″. This should be lightly sprayed with a windex bottle when you have flowers in the box.

RESULTS

WITHOUT HIGH PRICED apparatus, we have been able to benefit from Bonner's fine research. During the past two years my show blooms, many of which were cut several days ahead, uniformly showed a fresh appearance on the second day of shows. The blooms did not wilt like many others which allegedly had been picked within 24 hours of entering the show.

A gibbed 'Debutante' which was cut October 9th and given "The Treatment" still had its form and turgid petals at the time of our Fall Show (Dec. 4, 5) even though some petals were browning. Its companion piece, a cymbidium given "the works" on May 14 (1965) was still recognizable as a cymbidium even though some petals were brown at edges.

We have air expressed several boxes of treated camellia blooms to my sister in Oklahoma and they last very well for a few weeks. She displays them during the day with the lid off the box. At night, the closed box is stored in the air raid shelter (do you remember these? They were the successors to the storm cellars). My sister reports that 3 of the blooms shipped last April 28 were still fairly presentable on her birthday June 2nd.

Mark J. Anthony is the superintendent of Descanso Gardens. A horticulturist with a special interest in camellias, he is a frequent contributor to Lasca Leaves.

Christmas Gift Items

MEMO FROM OUR GIFT SHOP: Did you know that we carry a complete line of the Sunset Books? Gardening, landscaping, building, remodeling, home design, hobby, travel, recreation, and pictorial, to name a few. You will also enjoy exploring the Golden Nature Guide Books. All are moderately priced and make excellent Christmas gifts.

BOOKSHELF

PROPAGATING HOUSE PLANTS by Arno and Irene Nehrling. Hearthside Press, Inc., New York. 1971. 292 pg. Illustrated.

Growing public awareness of the value of living plants in our everyday life has led to their increased use in our homes. And, with more people buying plants for their homes there is the need for information on how to grow and care for them. This is the first step for the novice who, unless he is the type who likes to come to grips with fairly sophisticated, unfamiliar material, is likely to pass by Propagating House Plants in favor of a book bearing a simpler title and promising, as a consequence, easy-to-follow instructions. By the same token, the experienced grower would be attracted by the title and would not be disappointed in what he found. The authors have packed their book with valuable information on every form of plant propagation from seed to grafting. In fact, it is an attempt to cover the whole field of propagation by a couple who seem to have spent a lifetime in the practice of their subject. The material, presented through text, drawings, color and black-and-white photographs, covers far more than is necessary for anyone wanting to learn only about the propagation of house plants.

I was astonished at the variety of plants recommended for house plant propagation. Specific directions were given for propagating each one, including old friends like the philodendrons, dracenas, and palms, and others, less common in our area, that I am tempted to try. Actually, although the book contains all the basic information on plant propagation and describes both professional and amateur methods, it is written for use in the colder parts of the country. Plants that we grow in Southern California out in the open ground all year round are treasured as house plants. The authors speak of starting plants in the ground in the summer and digging them up and bringing them into the house for growing and blooming in the winter. We don't have to do this nor do we need to think about artificial heat to keep plants alive over the winter. The urban home or apartment as a rule does not have the room to grow plants in the scope that is prescribed in this book. I was amused to find my giant *Grevillea robusta* mentioned as a house plant subject. On the other hand, the weedy, self-sowing sweet alyssum was considered something worthy of digging out of the garden in late summer and bringing into the house to bloom in winter. Also, I have a hard time believing that morning glories would twine over my drapes and bloom in the winter time — but then I have never tried it.

The section on Fun For Children, showing them how to grow plants from carrot tops, grass hair on a sponge, and so on, was a good idea I thought. Togetherness of the family, or just keeping the kids occupied and out of mother's hair during the cold winter months are both good ideas. Besides, it is a way to start children on the road to understanding how plants grow.

Overall, I think the book is worthwhile, even among the great many available on the same subject, and particularly for the grower with some experience.

One last word — a handclap for the table of contents. Any information on any subject could be easily found.

Lydia Birt Williams

RECENT ACQUISITIONS TO LASCA LIBRARY

ASPECTS OF NATURE by Alexander Humboldt. Lea and Blanchard, Philadelphia. 1849.

LAWNS AND GROUND COVERS by James Crockett. Time-Life Books, New York. 1971. Color illustrations.

THE POCKET ENCYCLOPEDIA OF CACTI AND SUCCULENTS by Edgar and Brian Lamb. Macmillan Co., New York. 1969. 326 color photographs.

THE NEW HANDBOOK OF ATTRACTING BIRDS by Thomas P. McElroy, Jr. Alfred Knopf, New York. Illustrated.

MOSS FLORA OF THE PACIFIC NORTHWEST by Elva Lawton. The Hattori Botanical Laboratory, Tokyo, Japan. 1971. 195 plates.

FLORA ILUSTRADA DE ENTRE RIOS by A. Burkartx-Gramineas. Coleccion & Cientifica Del Inta, Buenos Aires. 1969. Illustrated.

FLORA PATAGONICA — TYPHACEAE A ORCHIDACEAE by M. Correa. Coleccion & Cientifica Del Inta, Buenos Aires. 1969. Illustrated.

Calendar 1971

October - November - December

ARBORETUM, ARCADIA

October 29 through 31
14th Annual San Gabriel Valley Fall Flower and Garden Show
Co-Sponsored by
Star News
Foothill Inter-City Newspapers and
California Arboretum Foundation, Inc.
Show Hours—Friday 1:30-5:30
Saturday 9:00-6:00
Sunday 9:00-6:00

November 7 — 2 p.m.
Sunday Afternoon Lecture
Lecture Hall
"Medicinal Plants Around the Home"
Dr. Leonid Enari, Staff Biologist

December 16 — 7 p.m. - 9 p.m.
Christmas Open House
Santa Anita Depot

DESCANSO GARDENS LA CANADA

October 30 and 31 — 9 a.m. - 4:30 p.m.
Chrysanthemum Show

November 17 — 8 p.m.
The Theodore Payne Foundation Lecture
"Unusual Wild Flowers from Strange Places"
Dr. Edmund O. Jaeger, Author and Naturalist

December 4 and 5 — 9 a.m. - 4:30 p.m.
Early Camellia Show

December 4 through 12 — 9:30 a.m. - 4:30 p.m.
Christmas Decorations Exhibit
Hospitality House

SOUTH COAST BOTANIC GARDEN PALOS VERDES PENINSULA

October 20 — 1 p.m. - 3:30 p.m.
Costa Verde District Flower Show

November 17 and December 15 — 8 a.m.
Bird Walk Training Program
Audubon Society

All events admission free

December
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No. 4

Lasca Leaves

— Final

DEPARTMENT OF ARBORETA AND BOTANIC GARDENS, COUNTY OF LOS ANGELES

Arcadia, California 91006 • Telephone (213) 681-5277

Francis Ching, *Director;* **Glenn Hiatt,** *Assistant Director;* **Lee H. Wakeman,** *Executive Assistant.*

Los Angeles State and County Arboretum: Frank Simerly, *Superintendent;* William Hawkinson, *Assistant Superintendent;* John Provine, *Horticulturist;* Earl Ross, *Orchidist.*

Descanso Gardens: Mark Anthony, *Superintendent;* George Lewis, *Assistant Superintendent.*

South Coast Botanic Garden: Armand Sariñana, *Superintendent;* Edward Hartnagel, *Assistant Superintendent.*

Research Division: *Chief,* Paul Cheo, *Ph.D., pathology, mycology;* Leonid Enari, *Ph.D., plant identification, taxonomy;* Robert Gonderman, *Ph.D., plant physiology;* George Hanson, *Ph.D., plant breeding, air pollution;* Harry Walker, *Ph.D., entomology;* Kenneth Montgomery, *fire-retardant plants, ecology;* Jeannette Huber, *Associate Herbarium Curator;* Dan Martel, *plant recorder;* Carlos Jativa, *plant breeding.*

Education Division: *Chief,* Gertrude Woods; Tak Niiya, *education specialist;* Patricia Warren, *Associate Curator, history;* George Spalding, *botanical information consultant;* Hazel Rodgers, *library assistant.*

Public Services Division: *Chief,* Donald S. Dimond; Robert Copper, *Head Tour Guide,* Los Angeles State and County Arboretum; Don Graf, *Senior Tour Guide,* Descanso Gardens; Henry Noerdlinger, *Tour Guide,* South Coast Botanic Garden; Alan Lugena, *graphic artist.*

CALIFORNIA ARBORETUM FOUNDATION, INC.

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LOS ANGELES STATE & COUNTY ARBORETUM   DESCANSO GARDENS   SOUTH COAST BOTANIC GARDEN

The Cover

Cassia leptophylla, commonly known as the Gold Medallion Tree, belongs to a large genus comprising herbs, shrubs, and trees and is directly related to the famous "shower" trees of Hawaii which are much too tender to thrive in this area. *C. leptophylla,* native to Brazil, is a small round-headed tree, 20 to 25 feet high and about 12 feet across. It produces large, bright yellow flowers in clusters, blooming profusely in July and August. In sheltered areas the tree is evergreen, dropping its leaves just prior to the onset of new leaves. When mature, the tree has sustained temperatures of 21°F without any visible damage. It grows 2 to 3 feet a year, and requires well-drained soil. To do well it needs full sun and a thorough soaking once or twice monthly in hot weather. The Gold Medallion Tree was introduced to the nursery trade in 1964 by the Los Angeles State and County Arboretum. Provided its basic requirements are met, it needs little care, only enough to shape and remove any dead wood.

Editor
Donald S. Dimond

Photo Credits
Cover by Frank Simerly

department notes

Lectures and Walks

JUDGING FROM THE attendance, last year's Sunday Afternoon Lectures at the Arboretum seemed to provide many people with the impetus needed to overcome the usual weekend inertia. They seemed also to open up new aspects of the garden that led to the exploration of areas commonly seen only from the tram — the South African and Australian sections, for example. Whatever the reasons for their success, Director Francis Ching has decided to make them a more or less permanent fixture on the Department's calendar of events. The lineup for '73 begins with a lecture-demonstration February 27 on home vegetable gardening by staff education specialist Tak Niiya, who has made the children's vegetable gardens at South Coast Botanic Garden objects of utilitarian beauty. On March 19, Frank Simerly, Arboretum superintendent, will discuss the growing of azaleas in the home garden; on April 23, horticulturist John Provine will detail the subtleties of container gardening; and on May 14, George Spalding, our horticultural information consultant who has traveled widely in Australia, will talk on Australian plants in the Southern California garden. Two highly experienced staff greenhouse workers, John Provine and Don Fitch, will conclude the spring series on June 18 with a lecture-demonstration on plant propagation for the home gardener.

Walking being a rewarding, as well as popular, pastime these days, three Sunday morning garden walks have been scheduled for the spring, each led by one or more staff specialists. Like the bird walks that are a feature at each of the Department's facilities, these leisurely walks through the Demonstration Home Gardens, the Aquatic Garden, and the Australian section can be expected to attract a large following, particularly if the weather is nice.

Education Appointment

AFTER FOURTEEN YEARS of service as an education specialist with the Department, Gertrude Woods has been appointed chief of the education division. The position is not entirely new to Mrs. Woods who has served 18 months as acting chief at different periods in the past. In making the appointment, Director Francis Ching took note of her long activity in the field of conservation education, her development of the Department's youth education program, and her leadership of numerous teacher workshops. Mrs. Woods' new responsibilities include the historical section, the library, and adult education classes.

Photo: Don Dimond

Gertrude Woods, recently appointed chief of the Education Division.

Photo: Don Dimond

Armand Sariñana, new superintendent of South Coast Botanic Garden.

New Superintendent

A NEW ERA BEGAN at South Coast Botanic Garden last December 6 when Armand Sariñana reported for duty as the garden's second superintendent in its 12 years of life. In addition to his academic background — he is a graduate of Pomona College — Mr. Sariñana brings considerable administrative experience to his new post from his previous position as general manager of the J. Harold Mitchell Company, a company dealing in residential and commercial pest control, plant diseases, turfgrass, and horticultural supplies. Although his time is largely taken up with the demands of his new responsibilities at the garden, Mr. Sariñana will take part in the Department's adult education program this spring, teaching an evening class at the Arboretum on "Garden Insects and Diseases."

Arbor Day

THE USUAL ARBOR DAY celebrations that have taken place each year on the grounds of the Department's facilities will be replaced by school-centered programs available to all elementary schools in Los Angeles County. The aim of the new program is to reach a greater number of young people than heretofore possible and to involve them more deeply in the basic meanings of Arbor Day: conservation and beautification of the environment. The essence of the program is a handsome, teacher resource-kit consisting of directions for tree planting, a 10 x 12 folder containing a sample school program, environmental fact sheets, and a list of organizations supplying information on ecology and related subjects. Additionally, the Department is offering schools participating in the program a choice of trees in five gallon containers: A *Tabebuia chrysotricha* (Golden Trumpet), or a *Melaleuca linariifolia* (Flaxleaf Paperbark), both Arboretum introductions. The kit has already been widely and enthusiastically accepted by classroom teachers who are delighted to have a collection of immediately useful material available to them. The Arbor Day committee of Las Voluntarias members led by Betty Price worked for many months to obtain and put together the necessary information.

Camellia Show

CAMELLIA FANCIERS are advised to look ahead to this year's show at Descanso Gardens on March 4th and 5th when a record number of flowers are expected to be on display. One of the great annual floral events in the country, the show represents the collective effort of many growers and specialists working together under the sponsoring Southern California Camellia Council. According to show chairman John Movich, miniature camellias—those with flowers about 1½ inches in diameter—will be the feature of this year's show. Among the standard displays will be the larger-than-normal flowers resulting from treatment with gibberellic acid. This technique and the technique of propagation by grafting will be demonstrated during the run of the show.

Ecology Walk

A NATURAL POND — or even, in time, a man-made one—is generally recognized as offering perhaps the best environment for the study of ecology. This is because the living organisms in and around a pond are by their diversity and their interrelationship a microcosm of larger and more complex environments. With this in mind, the Department's Public Services Division has developed a self-guided walking tour of the Arboretum's Upper Pond. The walk is self-guided by reason of a handsome, 22-page brochure that takes the visitor around the 1200-foot circumference in seven steps, at each of which things to look for and study are described in text and illustrated in superb drawings rendered by part-time tour guide, Ray Robinson. Brochures will be placed in a covered box on a redwood post where the walk begins and the public will be invited, but not requested, to return brochures for reuse.

Photo: Don Dimond

Macramé pothangers made by members of Las Voluntarias for Bonanza II are shown by Grace Robinson, chairman of work committee.

Baldwin Bonanza II

ALTHOUGH IT'S STILL a couple of months away, the pot is beginning to boil for the repeat version of the Baldwin Bonanza, that happy fund-raising affair that took place at the Arboretum almost two years ago. Members of Las Voluntarias are busily potting and growing plants and terrariums, and sorting out, putting together, and creating an assortment of macrame and other handcrafted items all calculated to make the Baldwin Bonanza of next April 9th a super event. Members of the California Arboretum Foundation and their guests will have a first chance at the goodies during a cocktail and hors d'oeuvres preview from 6 to 8 on Saturday evening.

Photo: Louis Nunez, *Arcadia Tribune*

Three new officers of Las Voluntarias are, left to right: Norma Woodward, treasurer; Ruth Mary Larson, president; and Peggy Dorsett, vice president.

Elections

AT ITS FIFTH ANNUAL meeting held last January 10 at the Arboretum, members of Las Voluntarias elected a new slate of officers. The new president is Ruth Mary Larson, long active as a school field trip leader; first vice president is Peggy Dorsett; second vice president is Helen Thompson; secretary is Annabel King; and treasurer is Norma Woodward. Since its inception, Las Voluntarias has contributed significantly through its officers and membership — at the last count, 147 — to the Arboretum's services to the public, demonstrating in the process its capacity for effective, well-disciplined organization. As another gesture of its devotion to the garden, this year each member joined the California Arboretum Foundation and then unanimously agreed to make membership in that organization a requirement for membership in their own.

Speaking of the California Arboretum Foundation, the Board of Trustees of this pioneer group also had an election. The new officers are Mrs. Peter L. Douglas, president; William E. Eilau, first vice president; Robert E. Paradise, second vice president; Mrs. Dolores K. Hubbell, executive secretary; and Dave Paradis, treasurer. Mrs. Douglas is one of the Department's and Foundation's most active workers. She has served on numerous Las Voluntarias committees and also as the organization's president. Last year she was a vice president of the CAF and was appointed in March to the Board of Governors by Supervisor Frank G. Bonelli, filling the vacancy left by the death of Mrs. Rudolph J. Richards.

Photo: Robert V. Webber

Descanso Christmas Show

AS THE ADJOINING photograph suggests, the Christmas Decoration Show put on at Descanso Gardens by the Descanso Gardens Guild was a photographer's delight. Some 85 designers and artists took part in last December's event which attracted 20,000 visitors during its 10-day run. As usual, the show offered many features, not the least of which was the traditional Red Carpet Tea, a preview for Guild members, exhibitors, and the press, all of whom were treated to the caroling of the Madrigal Singers of La Canada High School.

BALDWIN AVENUE LANDSCAPING

Frank Simerly

THE CONSTRUCTION of the Foothill Freeway has created a maze of on and off ramps from the freeway and Colorado Boulevard in which large areas of emptiness were left over, creating a vista of bareness. Normally, such a happening would be considered a disaster but we were enthusiastic about the possibility for development.

Our enthusiasm is two pronged; the project has been a cooperative one that has fully involved the City of Arcadia and the Los Angeles State and County Arboretum. It is not often that two separate governmental organizations can unify to achieve a common goal as occurred on the Baldwin Avenue project. In fact, even the State of California freeway planting division has specified many of the plant species used in our development for their freeway planting to give further continuity to the landscape.

The other reason for our enthusiasm is the plants that are being used. They are mostly Arboretum introductions and are, in the main, plants that will provide brilliant splashes of color throughout the year. The trees were planted from fifteen-gallon containers and included six *Tabebuia avellanedae* var. *paulensis;* twelve *Chorisia speciosa;* ten *Cassia leptophylla;* four *Jacaranda acutifolia* and several *Eucalyptus citriodora* and *E. maculata* to tie the plantings together with the existing landscape. Ground covers include 15,000 *Osteospermum fruticosum* 'Burgundy Mound'; 40,000 *Osteospermum fruticosum* 'Snow White'; 5,000 *Osteospermum fruticosum* 'prostrate' and several thousand *Arctotheca calendula.*

As additional segments of the Foothill Freeway are completed, Baldwin Avenue will become the gateway to Arcadia and the primary approach to the Los Angeles State and County Arboretum. The plantings we have added will make Baldwin Avenue one of the most beautiful streets in Southern California.

The Cultural Potential of Hibiscus in Southern California

Ross H. Gast

IN SOUTHERN CALIFORNIA, inadequate directions on the planting and care of ornamental hibiscus given at point of sale are responsible for the early demise of more plants than the periodic ravages of killing frost.

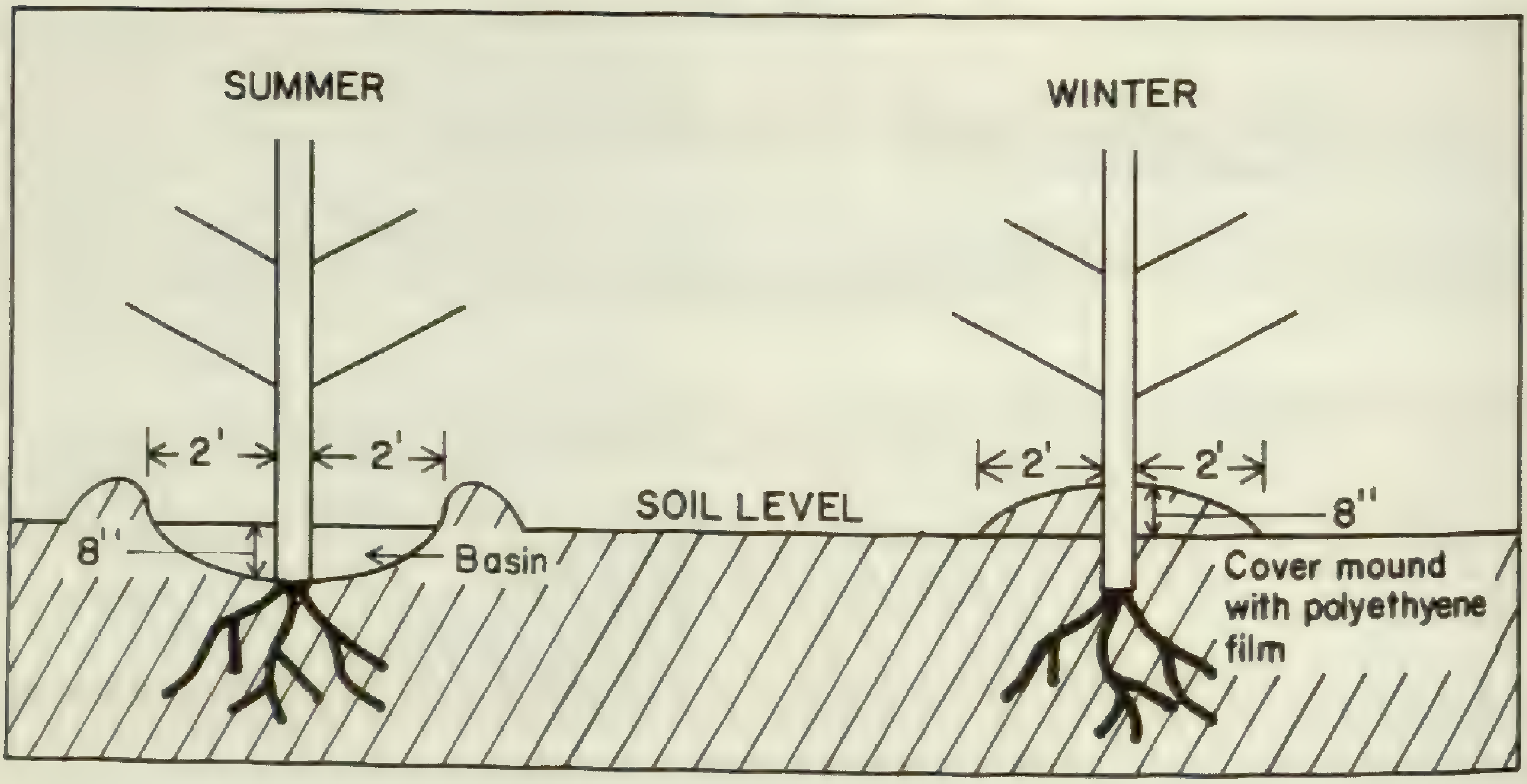
The blame should not be placed entirely on the shoulders of the seller, however, for much of the confusion regarding the culture of this popular garden plant is due to its complicated genetic origin.

For ornamental hibiscus, as we grow it today, is in reality a highly polymorphic cross-compatible group of species and complex hybrids and their derivatives. The development of garden hybrids began before recorded horticultural history and is being continued in many parts of the world today.

Linnaeus, the father of systematic botany, designated this genetically compatible group as *H. rosa-sinensis,* or Rose-of-China, and although the earliest known development of hibiscus hybrids seems to have taken place there, none of the species involved in the complex is native to China. Most authorities agree that all forms of rosa-sinensis have evolved from the several known species but admit that there may be some additional lost, or not yet identified, species which have contributed to the early horticultural development of ornamental hibiscus.

The species which have been identified as progenitors of our modern hybrids are native to several widely distant parts of the world. They vary greatly in plant vigor, growth habit, flower form, and color, and, therefore in cultural requirements, as do their hybrids. For instance, the Hawaiian whites are strong growers and differ greatly from such species as *H. liliiflorus,* which is indigenous to the South Indian Ocean islands where it is most often found growing wild as an underwood. Exceptional plant vigor almost always results from a cross between the native Hawaiian white and other species or old forms. This is not the case with hybrids resulting from crosses with *H. liliiflorus,* which is a weaker grower. For this reason, cultural directions should be more specific, taking into consideration the genetic history of the cultivar.

In our introduction we stated that inadequate instruction at planting time was responsible for the loss of more plants than frost damage. This statement should rightly be qualified, or rather, should be enlarged upon at this point. By frost damage we mean total loss resulting from the freezing of the plant by the extremely low temperatures that



Summer, winter care.

periodically occur in many areas of the Los Angeles Basin. This kind of damage is not to be confused with winter losses which are the direct result of faulty selection of planting sites, time of planting, and improper cultural practices, particularly during the late fall and winter.

The usual instructions available to the homeowner do not emphasize the fact that in Southern California soils become progressively colder during the winter months and often do not really warm up until June. Modern hybrid hibiscus are particularly susceptible to "cold feet," particularly when subjected to excess moisture, and are therefore less able to resist sudden drops in temperature or other adverse conditions. In Florida, on the other hand, hibiscus plants will often recover from even severe frost damage because the soils of that state never become very cold despite the catastrophic frosts that sometime occur.

In the Los Angeles Basin there are many different thermal areas, some of which are, for all practical purposes, frost free, and others where even the hardiest cultivars will not survive periodic frost damage. Slight differences in elevation, air drainage and other factors affecting temperature often exist quite close together; in some cases they may be found on a single house lot. On my own hillside home in Los Feliz, hibiscus plants have never suffered frost damage in the higher spots, while lower plantings have been lost.

It follows that nurserymen should know the approximate temperature conditions in the general area they serve and should advise their customers accordingly. From a practical standpoint such advice could cause some loss of immediate sales, but in the long run would prove profitable. Sydney, Australia, like Los Angeles, has both thermal belts and areas where frosts occur nearly every winter. Some years ago, a Sydney nurseryman decided to specialize in hibiscus. He realized, however, that to be successful he must have customers who themselves were successful with the queen of tropical flowers. He therefore made a survey of the locality which he served, and learned the approximate limits of the thermal belts where optimum conditions for ornamental hibiscus prevailed. He then published this with cultural directions for distribution to prospective customers. His varietal recommendations, too, were based on his findings. The high sales enjoyed by the enterprising nurseryman and the subsequent incidence of hibiscus in Sydney gardens testify to his success.

Unfortunately, there are not a large number of varieties of hibiscus propagated for sale in Southern California. Those that are consist mainly of the older hybrids which have been in the trade in this country and Europe for over a hundred years. However, one large producer does make periodic introductions of new varieties on an exclusive basis, usually as patented plants.

REASONS FOR THE limited offerings of hibiscus varieties are both cultural and economic. Thirty years ago the list was very much longer, but at that time growers could economically produce grafted hibiscus, just as they do now in most other areas where hibiscus is popular. Today producers say that only cultivars which will root easily from greenwood cuttings and which grow well on their own roots can be economically produced for the retail outlets. Thus most of the highly complex hybrids, such as those in Hawaii, are not considered by local wholesale growers.

Limiting the propagation and sale of hibiscus cultivars to proven hybrids does have the advantage of insuring the offering of only such plants as will survive extreme temperatures in most years. But breeding work, such as has been done at the Los Angeles State and County Arboretum in recent years, has resulted in the development of many equally satisfactory hybrids for this area, both in flower quality and plant vigor. Unfortunately, these could not be turned over to individual nurseries on an exclusive basis, and the larger producers say that, as a general rule, they must have this advantage to offset the high cost of advertising and building up stock. Because of these economic factors the results of breeding work have not been fully exploited.

Further, there are many suitable cultivars for our area available in Florida and elsewhere which have not been given a commercial trial here. Unless they are given sales-exposure by the nursery trade they will never be known to the public. In Florida, the several annual hibiscus shows held by the various local chapters of the American Hibiscus Society bring out hundreds of new cultivars. There are many Florida nurseries specializing in hibiscus, most of them offering a long list of varieties. Some of these were developed by the writer here, but were not found acceptable by the local nursery trade. The same situation prevails, in a lesser degree, in Australia, where interest in hibiscus has increased tremendously in the past decade. This has been the case particularly in Queensland.

As we have pointed out, cultural directions for hibiscus should take into consideration the genetic background of the cultivar. In the following paragraphs, brief general instructions are given for common varieties, with pointers on the specific requirements for some of them.

WELL DRAINED SOILS A FIRST REQUIREMENT

The average homeowner has little choice of soil types, but he can improve that which is available to him. It is not easy to create better drainage conditions in the heavier soil types. Nevertheless, some effort should be made, particularly in the case of the heavy clays (adobe), because it is difficult to establish hibiscus in such soils. There are inherited reasons for this: most of the species from which modern hybrids were originated are native to areas having soils of volcanic origin, which are naturally well drained. A few specific instructions on this subject will be covered later under the discussion on watering and winter care.

PLANTING DIRECTIONS

Full sun is not always available to the homeowner, but hibiscus do equally well in morning sun and afternoon shade, an environment usually found on even the smallest house lot.

The planting of hibiscus in lawns and other areas where heavy applications of water are made exposes plants to "wet feet" and therefore a high incidence of winter loss. Perhaps the most attractive home planting is a hedge or border of a single variety, particularly if one of the more vigorous growers is selected and is kept in hand with the pruning shears. The popular White Wings is particularly effective for such use as it is a profuse bloomer over a long season and the foliage as well as the bloom is attractive. It can be pruned shapely at almost any time of the year. It can also be trained as a standard and in this form its growing habit makes it particularly desirable.

Unfortunately, there are too few low growers available, the only form that is really suitable for mixed shrub borders. To stand alone, Crown of Bohemia should be selected. Ross Estey is also attractive as a single planting with low growing shrubs of annuals.

TIME OF PLANTING

The best months to plant hibiscus depend on the variety and the age and size of the plant. Most growers propagate during the winter and spring, offering plants rooted at that time for sale during the summer and fall. If these plants are planted early enough, that is, not later than September 1, they will become established before the cold weather sets in and are thus able to withstand cold winter soil temperatures. My personal preference is for older plants, setting them out in April or May. Not much growth can be seen the first several weeks, but as the weather warms up the plant gets the benefit of a full growing season before it is exposed to winter temperatures. If late planting is necessary, then the selection of year-old plants in gallons, or older plants in three- or five-gallon containers should be considered. If such plants should appear to be rootbound in the container, a judicious amount of root pruning should be resorted to before planting. Properly done, this will not affect the growth of the plant. In heavier soils it is good practice to put five or six inches of pea gravel in the bottom of the hole before planting, then to fill in with a light soil into which has been incorporated a gallon-can-full of steer manure and a tablespoon of a balanced commercial fertilizer. One readily available mix is that sold as a dichondra food.

PEST CONTROL

Pest control is particularly important during the first year when, it is hoped, the plant will be growing fast. But except for some unusual insects or virus, control can be maintained with a strong spray from the sprinkler. For the record, I was using this method of pest control long before most of the ubiquitous anti-pesticide partisans were born!

PRUNING

The best time to prune ornamental hibiscus is a frequent subject for debate. But here again the genetic origin of the hybrids must be taken into consideration. First-generation hybrids from almost any interspecific cross, or with a species as one parent, usually show extreme hybrid vigor. This is noted in Agnes Galt and Kona, both of Hawaiian white parentage. Ross Estey is a third-generation hybrid from the same species and it, too, must be kept in hand with the shears. Crown of Bohemia is also a strong grower, but is quite well behaved and seldom becomes "leggy." The same is true of California Gold. But the common red, called Brilliant, and most other old varieties need attention if they are to keep in shape and flower as they should. Some years ago, before the larger nurseries began to propagate hibiscus from greenwood tips under the mist system, most stock was produced by smaller growers who were not so choosy about the cutting material. It was the common practice at that time for gardeners hired on a maintenance basis by householders to prune hibiscus under their care in December and January. They then took the prunings with them and either sold them for cutting material to nurseries, or propagated plants themselves as a backyard venture.

Pruning in December and January is an extremely dangerous practice in almost all cases, but particularly so in marginal growing areas. Cutting back sharply, as was usually done by gardeners, is a shock and weakens the plant at a time when it is most susceptible to winter kill. It seems to be the consensus of most experienced and responsible gardeners now to cut back hibiscus a little at a time, thinning out the plant and topping back vagrant growth, then shaping up the plant in early spring after the danger of frost has passed.

FERTILIZATION

In Southern California hibiscus thrive best in a soil with a pH of about 5.5 or 6, but only through experimentation with one's own soil can this balance be effected.

My personal preference for year-round feeding is a commercial mixture of about 4-8-8 with a side dressing of blood meal each month. The high acid fertilizers should be used sparingly as they can cause bud drop. Frequency of application, too, must be guided by experience. The most important point to remember is that hibiscus are good feeders, and both the length of the blooming season and the amount of bloom can be increased by adequate use of plant foods. Most hibiscus in Southern California are undernourished and overwatered.

IRRIGATION

As a general rule, hibiscus should be given generous applications of water as needed, rather than frequent light sprinkling. Early in the summer, when the soil begins to warm up, individual basins should be worked up around each plant or, in the case of row planting, around several plants. These basins should be filled with a quantity of water sufficient to assure thorough soaking of the roots. In the winter months, however, the basins should be filled in and the soil mounded up around the base of the plants so as to drain the water away during the rainy season. For plantings in heavy soil, a sheet of polyethylene of sufficient size to cover the root zone will help to keep the soil warmer and better drained. In light soils during extended dry seasons in winter, the cover can be removed and the plants watered sparingly. The objective of this winter-care program is to force the plants into a winter resting period.

CONTAINER CULTURE

So far, we have been discussing the planting and care of hibiscus varieties easily available in Southern California. For the venturesome, there exists the possibility of enjoying even the highly complex hybrids such as are grown in Hawaii, Florida, and other more favored areas for hibiscus. This calls for growing the plants in large containers which can be moved into shelter during the winter months if necessary.

Almost any variety of ornamental hibiscus will do well in containers, even those as small as 12 inches in diameter. The restriction of the roots does not seem to affect growth or bloom just so long as the plant is adequately fed and watered. The English nurserymen and fanciers grow hibiscus this way out of necessity, and in England one sees huge plants, many years old, in 18- to 20-inch tubs.

While a small amount of greenhouse or lathhouse space is handy for winter storage, such an arrangement is not necessary. The only requirement is that plants are not exposed to freezing temperatures in storage and, where it is to be a dry storage, a judicious amount of cutting back is done.

During the summer the potted or tubbed plants can be placed almost anywhere in the garden or patio. Members of the American Hibiscus Society who live in the colder parts of the South plant in clay containers from which the bottom has been tapped out. In early summer these are planted outdoors in the soil just as they are. Forced along, they usually produce blooms for several weeks before the danger of freezing requires the gardener to remove the container from the soil, cut back the roots which have grown through the bottom, and place them in winter storage.

For those who are interested in growing hibiscus in containers, a membership in the American Hibiscus Society will be extremely helpful. The annual dues, which are five dollars, include a copy of the quarterly, "Seed Pod." This spritely, well-edited publication carries a wealth of cultural and other timely material, together with advertisements of nurseries specializing in hibiscus who will ship to California. Stock must necessarily come in either as scion wood or bare root. In the former case, if a small area of bench space in a greenhouse is not available for rooting cuttings, it will be necessary to master the simple rules for grafting hibiscus. In some cases the proper conditions can be developed for propagating such material by use of a small rooting outfit, heated by a short heating cable, and covered with polyethylene. These can usually be secured through local nurseries or supply houses.

Ross H. Gast has been working with ornamental hibiscus for over 35 years. In pursuit of his avocation he has traveled all over the world, notably among the islands of the South Pacific and South Indian Oceans where he rediscovered several species that became the parents of hybrids he developed and introduced in Florida, Australia, and Southern California. A veteran editor and publisher, Mr. Gast has written numerous articles for foreign and American journals, including Lasca Leaves.

POISONOUS PLANTS AROUND THE HOME

P. C. Cheo

THE VERSATILITY of plants and plant products in furnishing human needs is unbounded. From the dawn of civilization, plant have provided all the essentials for human existence, and though civilization has progressed to the complexity of industrial development and space exploration, plants still are major sources of chemicals required by our technology. We all are familiar with the medicinal aspect of plant products. Many of the so-called miracle drugs such as aspirin, quinine, penicillin (from mold which is a plant), and streptomycin (soil fungus — also a plant), originated from plant sources. Today in our fight against cancer the major efforts of many scientists are still concentrating on finding the right molecule from plant sources to cure this disease. *Camptotheca acuminata* (camptothecin) is one promising source of an anti-cancer drug now under clinical tests.

Plants can provide what we need in all aspects of life. They produce starch, sugars, protein, fats, oils, spices and vitamins for our food, fibers for our clothing, wood for our dwellings, furniture and tools, dyes and fragrances for our appreciation, and antibiotics and drugs for preventing and curing infection. Furthermore, it may be recognized in the future that molecules from plants may give us peace of mind, a feeling of inward satisfaction, a desire for creativity, or some genuine wisdom. All these starches, sugars, proteins, and the rest, involve a variety of chemical substances, many of them still unknown to mankind. The formation of these chemical substances takes place in plant tissue. The process is complicated by many different steps of biochemical synthesis resulting in the formation of intermediate products or byproducts of a different chemical nature. Such multiplicity of chemical substances existing in different plant species provides rich resources for our utilization. It is no surprise that among so many chemical substances quite a few are poisonous or toxic to humans and animals. Some plant species or plant parts contain high levels of these poisonous chemicals; they are thus referred to as poisonous plants.

MEDICINES AND POISONS are hardly well-defined separate items; the determination depends mainly on the application. The same substance used by a physician to save a life can also be used to take a life. It is an old saying that medicines are substances which make the sick well and the well sick. Technically, therefore, one cannot differentiate a medicinal plant or a drug plant from a poisonous plant; it all depends on the purpose of the user and the consequences. It is probably fair to say that all medicines are poisonous except that they serve certain specific physiological or antibiotic functions in curbing the further development of animal or human maladies at certain dosage levels. The dosage level in this definition is very important, since overdose can become poisonous.

However, in this matter, overindulgence in anything is harmful and this includes spices, seasonings such as salt and sugar, vitamins, or even meals. Thus, it is plain that edible, medicinal and poisonous plants cannot be considered as entirely separate and distinct classifications, but are merely arbitrary designations made for practical purposes.

When we speak of poisonous plants, we usually have in mind the kinds of reactions resulting from contact or ingestion. Common reactions, immediate or delayed, are nausea, vomiting, stomach pain, itching blistering, diarrhea, cerebral depression, convulsion, and, in extreme cases, coma and death. These different reactions, from mild to severe, may vary according to the amount of intake. Also, there is a difference in individual sensitivity to the poisonous principle. For instance, a small percentage of the population is completely immune to poison ivy which causes contact dermatitis to a majority of us. Furthermore, with the same amount of intake of a given plant in proportion to body weight, some people have less violent reactions than others. Usually a child is more apt to be seriously harmed by poisonous plant intake because of smaller body weight. Dosages innocuous to an adult can cause serious reactions in a child.

MORE RECENT scientific investigation of the internal biological clock and rhythm of animals and plants indicates that the daily and seasonal inborn physiological fluctuation affects the lethal dosage level of medicines or poisons. Clinical trials have shown that certain drugs can be more effective if given at certain times of the day. Drs. Franz Halberg and Erhard Haus of the University of Minnesota have found that lethal doses vary considerably in rats according to the time of day a drug is given. Thus the reaction of particular poisonous plants may vary from individual to individual and from hour to hour. Further complications can be involved when an allergic response is included. Some people are specifically allergic to peaches, strawberries, and other fruits; they would certainly consider these plants to be poisonous to them.

Many food plants contain powerful poisons. For instance, solanine is a compound poisonous to humans (it also has some medicinal value) and is present in small or large amounts in most of the plants in the family Solanaceae, depending on species and different parts of the plant and seasonal variation. Potato and tomato plants contain it, and also the Jimson weed (*Datura stramonium*).

Then, should we call both potato and tomato poisonous plants? Probably we should, because if one eats potato leaves or tomato leaves, there could be ill or poisonous effects, which is probably why there are many people who still consider tomatoes, the fruit, to be poisonous. Even the potato tuber can be poisonous if it is exposed to sunlight for a period of time. Sunlight induces the formation of chlorophyll from protochlorophyll which is present in the skin of the tuber and thus capable of carrying on the process of photosynthesis as in the case of leaves. Solanine formation is one of the byproducts of photosynthesis. The green potato tubers are reported to be poisonous if taken up to specific amounts according to the individual.

Knowledge, or awareness, of poisonous plants goes back to antiquity. A first century Greek physician, Dioscorides, wrote a work on plants called The Greek Herbal of Dioscorides, which contained information that remained standard for centuries and which accurately identified many plants we now know have toxic parts. The very word "toxic," used to describe the poisonous principle in a plant, comes from an ancient word meaning "bow poison," and refers, of course, to the poisons derived from plants that prehistoric as well as later tribes put on the tips of their arrows for hunting and fighting.

In the United States, knowledge of poisonous plants has developed mainly out of concern for the health of livestock, and this development took place only as the vast cattle ranges of the West were opened up. It is only in relatively recent times that the threat of poisonous plants to humans has been under investigation.

Poisoning of any kind, whether it be from plants or animals, can produce some terrible reactions. Among plants, perhaps the worst in this respect is the water hemlock. Eaten in sufficient quantity, it has been reported to cause the most violent convulsions and swellings of the body invariably resulting in death. It is all the more dangerous because adults as well as children can easily mistake its roots, said to be pleasant tasting, with those of wild parsnip or other edible roots. The famous poison hemlock with which Socrates was put to death produced relatively mild reactions. According to records, Socrates was able to tell his friends of the effects of the poison as it made its way from his feet to his heart in a progressive paralysis of the central nervous system.

The question has been asked: is taste a good index of the edibility of a plant? Unfortunately it is not. Plants that taste good are not necessarily safe, just as those that are bitter and unpleasant are not necessarily poisonous or dangerous. Further, there is no accounting for taste anyway, as illustrated by the familiar phrase, "one man's meat is another man's poison." The only reliable index is scientific evidence. In any case, compared to other causes of mortality to man, the incidental death due to poisonous plants is very low — an average of 150 annually in the United States, which is much less than death due to food poisoning. Losses of livestock due to plant poisoning, however, are estimated to cost several million dollars every year.

THE GREATEST threat of poisonous plants is to children. The plant hobbyist who likes to keep ornamental plants inside the house should be aware of the possible poisonous effect of these inedible plants to their children, especially babies. It should be clear that house plants, as well as many other things that can be put in the mouth, should be kept out of reach of infants. Children at understanding ages are not likely to eat indiscriminately. Since most of these plants are bitter and unpleasant in taste, this fact alone will discourage their eating enough to harm them. More precaution should be employed with respect to plants with colorful and tempting berries, fruits, or seeds that can be easily taken. Castor bean seeds, for example, are highly poisonous; 1 to 3 seeds, thoroughly chewed and swallowed by a child, likely will cause death. However, if seeds are swallowed without chewing, it is unlikely to produce harmful effects.

Most ornamental plants are inedible. Since we do not know much about their chemistry we should also consider them possibly poisonous. We should teach our children what to eat and what not to eat. If poisoning is suspected, the following procedure is recommended:* A physician or a hospital emergency room should be contacted immediately. If this cannot be done, and the victim is not unconscious or convulsive, vomiting should be induced by first giving him a cup of lukewarm salt water (a heaping *teaspoon* of table salt dissolved in the cup of water), and then tickling the back of the throat with a blunt object, such as a spoon handle. This will serve to both dilute the poison, and empty the stomach. Even if the person vomits or if vomiting does not take place within 2 minutes, if Syrup of Ipecac is available, one tablespoon should then be given. A physician should be contacted even if the person vomits.

The following list of known poisonous plants is prepared by Dr. Leonid Enari, biologist on the research staff of the Los Angeles County Department of Arboreta and Botanic Gardens. These plants contain high levels of poisonous principles in one or more of their parts. A more detailed description of these plants together with seventy-four drawings will soon be issued by the Department in a brochure titled, Poisonous Plants of Southern California.

**G. A. Heidbreder, M.D., M.P.H., Health Officer, County of Los Angeles Health Dept.*

COMMON NAME	SCIENTIFIC NAME	PLANT TYPE	TOXIC PART
Rosary pea, jequirity pea, precatory bean, prayer bean or love bean	Abrus precatorius	WV	Seeds
Bushmans poison	Acokanthera oppositifolia (A. venenata)	S	Entire plant
Monkshoods	Aconitum napellus and other species	P	Entire plant
Baneberry	Actaea rubra	P	Entire plant
Horsechestnuts	Aesculus californica and other species	T	Seeds, flowers, leaves
Naked Lady	Amaryllis belladonna	B	Bulbs
Belladonna	Atropa belladonna	P	Entire plant
Boxwoods	Buxus sempervirens and other species	S	Leaves
Caladiums	Caladium bicolor and other species	P	Entire plant
Hemp, marijuana, hashish or pot	Cannabis sativa	A	Entire plant, but particularly the flowering tips of female plants
Nightblooming jasmine	Cestrum nocturnum	S	Berries, leaves
Water hemlock	Cicuta douglasii	P	Entire plant
Autumn crocus	Colchicum autumnale	B	Entire plant
Elephants-Ear	Colocasia esculenta	P	Entire plant
Poison hemlock	Conium maculatum	A	Entire plant
Lily-of-the-valley	Convallaria majalis	P	Entire plant
Daphnes	Daphne odora and other species	S	Berries, flowers, leaves, bark
Jimson weed, Jamestown weed, thornapple, apple of Peru or tolquacha	Datura stramonium	A	Entire plant
Angel's trumpet	Datura suaveolens	S	Entire plant
Rattlebox	Daubentonia punicea	S	Seeds
Larkspur	Delphinium ajacis and other species	A	Entire plant
Delphiniums	Delphiniums elatum and other species	P	Entire plant
Bleeding hearts	Dicentra formosa and other species	P	Entire plant
Dumb canes	Dieffenbachia picta and other species	P	Entire plant
Foxglove	Digitalis purpurea	A, P	Entire plant
Skyflowers	Duranta erecta and other species	S, T	Berries

COMMON NAME	SCIENTIFIC NAME	PLANT TYPE	TOXIC PART
Crown-of-thorns	Euphorbia millii	S	Entire plant
Poinsettia	Euphorbia pulcherrima	S	Entire plant
Milk bush	Euphorbia tirucallii	S	Entire plant
Carolina jasmine	Gelsemium sempervirens	WV	Entire plant
Glory lily	Gloriosa superba	PV	Entire plant
Ivies	Hedera helix and other species	WV	Berries, leaves
Hyacinths	Hyacinthus orientalis and other species	B	Bulbs
Hydrangea	Hydrangea macrophylla	S	Shoots, leaves
Hollies	Ilex aquifolium and other species	S, T	Berries
Coral plant	Jatropha multifida	S	Entire plant, but particularly seed
Lantanas	Lantana camara and other species	S	Berries
Sweet pea	Lathyrus odoratus	AV	Seeds
Privets	Ligustrum japonicum and other species	S, T	Berries, leaves
Peyote	Lophophora williamsii	P	Entire plant
Apples	Malus domestica and other species	T	Seeds
Chinaberry tree	Melia azedarach	T	Berries, flowers
Four-o'clock	Mirabilis jalapa	A	Seeds
Daffodils	Narcissus pseudo-narcissus and other species	B	Bulbs
Oleander	Nerium oleander	S	Entire plant
Tobaccos	Nicotiana glauca and other species	S, A	Entire plant
Opium poppy	Papaver somniferum	A	Unripe fruits (seed-capsules)
Virginia creeper	Parthenocissus quinquefolia	WV	Berries (1)
Philodendrons	Philodendron selloum and other species	P	Entire plant
Mistletoes	Phoradendron flavescens and other species	S	Berries
Pokeweed, pokeberry, inkberry, or pigeonberry	Phytolacca americana	P	Entire plant(2)
Bird-of-paradise-bush	Poinciana gilliesii	S	Seeds
Apricots	Prunus armeniaca and other species	T	Pits (seeds)
Plums	Prunus domestica and other species	T	Pits (seeds)
English laurel	Prunus laurocerasus	S, T	Seeds, leaves
Peaches	Prunus persica and other species	T	Pits (seeds)

COMMON NAME	SCIENTIFIC NAME	PLANT TYPE	TOXIC PART
Cherries	Prunus cerasus and other species	T	Pits (seeds), leaves
Oaks	Quercus agrifolia and other species	T	Acorns
Rhubarb	Rheum rhaponticum	P	Leaf-blades
Azaleas	Rhododendron indicum and other species	S	Entire plant
Rhododendrons	Rhododendron macrophyllum and other species	S	Entire plant
Castor bean	Ricinus communis	A, P, S, T	Entire plant, but particularly seeds
Black locust	Robinia pseudo acacia	T	Seeds, young leaves, inner bark
Elderberries	Sambucus caerulea and other species	S, T	Unripe berries, leaves, wood(3)
Jerusalem cherry	Solanum pseudo Capsicum	S	Berries (4)
Potato	Solanum tuberosum	P	Shoot, fruits (berries), and sun-green tubers
Mescal bean	Sophora secundiflora	S, T	Seeds
Bird-of-paradise-flower	Strelitzia reginae	P	Seeds
Yews	Taxus baccata and other species	S, T	Leaves, twigs, seeds
Yellow oleander	Thevetia peruviana	S	Entire plant
False hellebores	Veratrum californicum and other species	P	Entire plant
Fava bean, horse bean, English bean or Windsor bean	Vicia faba	A	Seeds (5)
Wisterias	Wisteria floribunda and other species	WV	Seeds
Death camasses	Zigadenus venenosus and other species	B	Entire plant

NOTES: 1—The berries are suspected of causing poisoning and death of children.

2—Young tender shoots are frequently eaten as cooked greens. If thoroughly cooked in two waters, they are quite safe to eat.

3—The ripe berries are edible without harm and are frequently used for wine, pie and jelly.

4—The berries are believed to be poisonous.

5—The seeds can cause fatal anemia ("favism"), but only to few individuals of Italian, Greek or Negro descent. This inherited trait has been known for centuries and is characterized by a deficiency of glucose-6-phosphate dehydrogenase (G-6-PD), an enzyme. The beans can be eaten without danger by those not carrying this inherited trait.

Key: Plant Type

A — Annual herbaceous plant
P — Perennial herbaceous plant
B — Bulbous plant
S — Shrub
T — Tree
AV — Annual herbaceous vine
PV — Perennial herbaceous vine
WV — Woody vine

A VERSATILE PRIVET

Ross Goodrich

TO ANYONE who ever had to trim a privet hedge with hand shears the name ligustrum is probably a nasty word. Even a short hedge, let alone one up to two hundred feet long, keeps one busy enough in the spring to ruin many weekends. This of course before the electric or power trimmer.

But to put in a word for the many good ligustrums. They range in size from shrubs to small trees. Some are thick foliaged with shiny leaves, others of skimpy growth with dull leaves, some are variegated or golden in color. They can be either evergreen or deciduous, although with some this factor depends on climate.

Now to small and not too well known ligustrum. It is the attractive *Ligustrum japonicum* cv. Rotundifolium, also known as *L. coriaceum*, that gets to a height of only four to five feet, rarely to six. This gives one plenty of time to enjoy it in its smaller stages of growth.

The leaves of this plant are dark green, brilliant, shiny and leathery. To use the word leathery is almost stretching a point since many think that leathery is synonymous with dull and rough. But there they are, shiny, even when they have dust upon them. They are almost round, mostly short pointed, and sometimes slightly, but not often, indented at the apex. They are almost always recurved from the center vein.

In appearance the plant is a ball of green, a little irregularly shaped it is true, but round. The places where it might show up best are in individual plantings, either in the ground or in containers, but it can also be grown as a small hedge. Almost always the trimming would best be done with hand pruners as opposed to hedge shears that would scar the leaves where they were cut. Its new growth does not cover these cuts quickly as the faster growing ligustrums do.

L. japonicum cv. Rotundifolium will grow in most soils; a little shade doesn't hurt, but full sun is better. Unless plants with pests on them are nearby it probably will have no infestations. There is one little problem — its stems are brittle. The upright branches break quite easily. A bump from a lawnmower or the stomp of a careless person can ruin the shape of a plant for some time. This can be prevented by locating the plants where this hazard is at a minimum.

The plant shown here is one of the three most uniform specimens at the Arboretum. Their location is to the west of the upper lake at the edge of the meadow and they can be seen from the road despite their small size. Their height at present is from three, to three-and-one-half feet; the width is two-and-one-half to three feet. These plants were grown from cuttings in 1966 and set out in April of 1968, which is not at all bad for a slow-growing plant. They have bloomed fairly regularly with tiny, almost white blossoms in clusters of from two to four inches long. Not spectacular enough to grow them for this reason, but attractive. When the blossoms dry they soon fall to the ground and are not unsightly on the bush for long.

Ross Goodrich is responsible for the Asiatic Section at the Arboretum where he has been a gardener for nearly two decades. In this time he has written numerous articles for Lasca Leaves and other publications.

BOOKSHELF

RECENT ACQUISITIONS TO LASCA LIBRARY

PRESSED FLOWER PICTURES by Pamela McDowall. 78 p. Black and white photographs, 24 colored plates. Charles Scribner's & Son, New York. 1969.

THE ALGAE AND THEIR LIFE RELATIONS by Josephine E. Tilden. 550 p. Black and white photographs. Hafner Publishing Co., New York and London. 1968.

THE LAZY GARDENER'S GARDEN BOOK by William Morwood. 200 p. Black and white photographs. Doubleday and Co., Inc. 1970.

THE COMPLETE BOOK OF GROUNDCOVERS by Robert E. Atkinson. 210 p. Black & white photographs. David McKay Company, Inc., New York.

GARDEN HOBBIES by Estelle H. Ries. 291 p. Black and white photographs. A. S. Barnes and Company, Inc., Cranbury, New Jersey. 1970.

TREES OF THE EASTERN AND CENTRAL UNITED STATES AND CANADA by William M. Harlow. 288 p. Black and white photographs. Dover Publications, Inc., New York. 1957.

KEEPING THE PLANTS YOU PICK by Laura Louise Foster. 148 p. Black and white photographs. Thomas Y. Crowell Company, New York.

TREES, STRUCTURE AND FUNCTION by Martin H. Zimmermann & Claud L. Brown. 336 p. Black and white photographs. Springer-Verlag, New York, Inc. 1971.

NEW LIVES, NEW LANDSCAPES by Van Fairbrother. 397 p. Black and white photographs. Alfred A. Knopf., New York. 1970.

THE ROSE FAMILY by Olive L. Earle. 63 p. Black and white photographs. William Morrow and Company, New York.

FLOWERING HOUSE PLANTS (A volume of Time-Life Encyclopedia of Gardening) by James Underwood Crockett. 160 p. Colored photographs. Joan D. Manley. 1971.

MOLECULAR APPROACHES TO PLANT PHYSIOLOGY by C. A. Price. 398 p. Black and white photographs. McGraw Hill, Inc. 1970.

MANUAL OF THE CARICES OR THE ROCKY MOUNTAINS AND COLORADO BASIN by Frederick J. Hermann. 397 p. Black and white photographs. U.S. Government Printing Office. 1970.

UNDERSTANDING ECOLOGY by Shelly Grossman. 128 p. 96 colored and black and white photographs. Grosset & Dunlap, publishers, New York. 1967.

ASPECTS OF NATURE by Alexander Van Humboldt. 469 p. Lea and Blanchard, Philadelphia. 1849.

TURFGRASS PESTS. 48 p. Black and white and colored photographs. Agricultural Publications, University of California, Berkeley. 1971.

LAWNS AND GROUND COVERS (A volume of the Time-Life Encyclopedia of Gardening) by James Underwood Crockett. 160 p. Colored photographs. Joan D. Manley. 1971.

THE POCKET ENCYCLOPEDIA OF CACTI IN COLOR by Edgar and Brian Lamb. 217 p. Colored photographs. Blandford Press Ltd. 1969.

Calendar

February - March

ARBORETUM, ARCADIA

March 10 — 8 p.m.
Theodore Payne Foundation Lecture
"High Desert Wild Flowers"
Jane S. Pinheiro,
Painter of Wild Flowers

March 19 — 2 p.m.
Sunday Afternoon Lecture Series
"Growing Azaleas in the Home Garden"
Frank Simerly,
Arboretum Superintendent

DESCANSO GARDENS
LA CANADA

March 11, 12
Daffodil Show
Hours: 1-5, Saturday
8-5, Sunday

ALL EVENTS ADMISSION FREE

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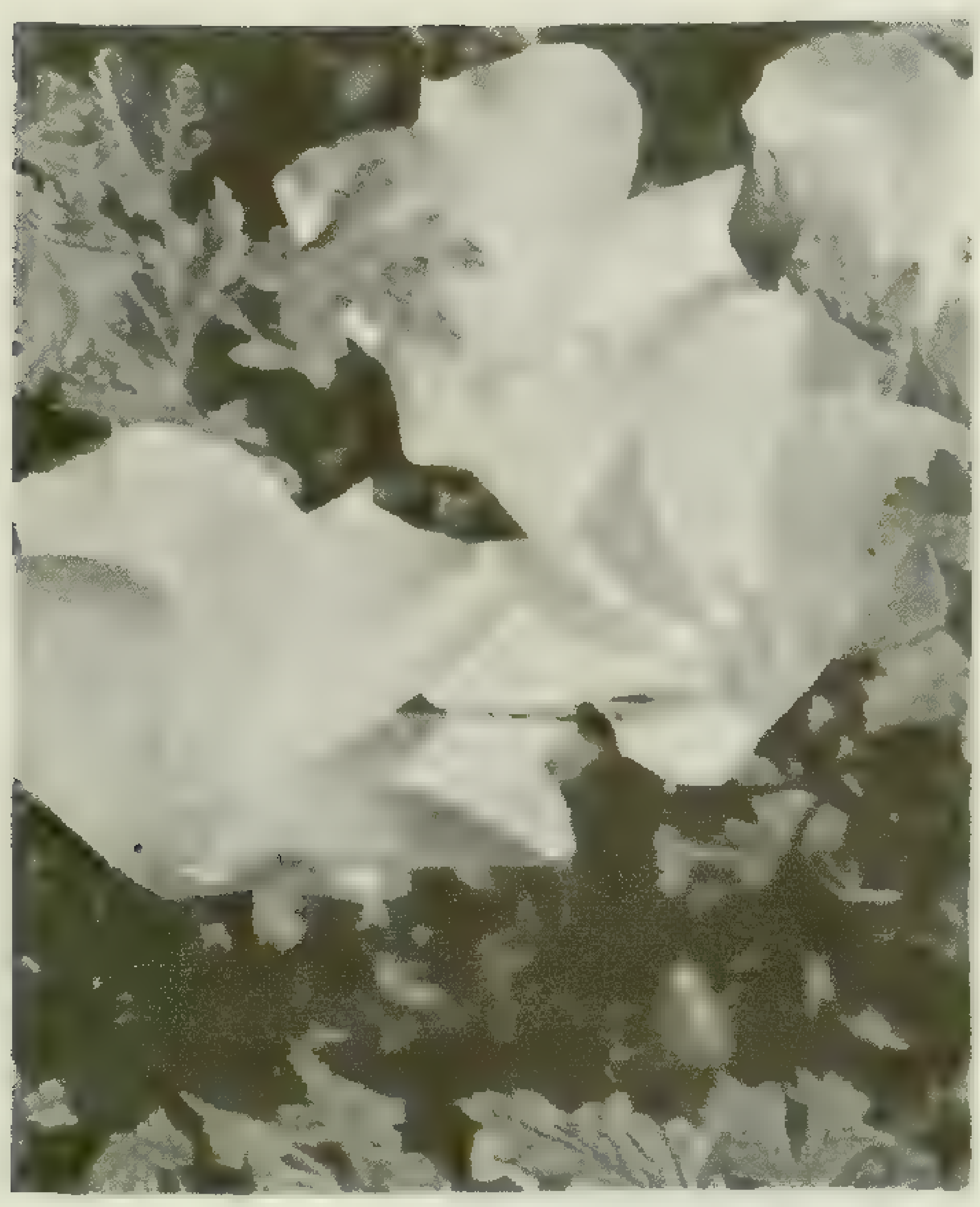
LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN



The Cover

Hibiscus huegelii, commonly known as Blue Hibiscus, is an evergreen shrub native to Western Australia with a dark green, finely-cut leaf. Its delicate flowers are lilac-blue, 4 to 5 inches across, have a satin sheen, and are slightly twisted. It blooms periodically throughout the year but heaviest in March and April, doing best in full sun and in soil having good drainage.

It is best propagated from cuttings taken right after flowering and placed in sand in light shade. Seed germination is poor.

Hibiscus huegelii was introduced to the nursery trade in 1968 by the Los Angeles State and County Arboretum. It is a lovely addition to a garden and requires little care beyond occasional pruning and a light soaking monthly or twice monthly in hot weather.

Editor
Donald S. Dimond

Photo Credits
Cover by Francis Ching

department notes

Frank G. Bonelli

THE PASSING of Supervisor Frank G. Bonelli and the appointment of Pete Schabarum by Governor Reagan to fill the vacancy calls attention to the important role a Los Angeles County supervisor plays in the affairs of a county facility. In this, as well as in other respects, the Los Angeles State and County Arboretum could not have had a better friend than Frank Bonelli. Throughout the 19 years of its existence Mr. Bonelli lent his active support to those projects he felt would make it better able to fulfill its obligations to the community. The most recent Bonelli-supported projects were the new research building and the restoration and relocation of an old railroad depot in the historical section of the Arboretum.

Centennial

NEXT JUNE 19 will mark the 100th anniversary of the birthday of Theodore Payne, an English-born American credited with doing more to protect, propagate, and popularize California's wild flowers and native plants than any other person. With the support of a host of admirers, the Theodore Payne Foundation for Wild Flowers and Native Plants, the organization Mr. Payne founded shortly before his death in 1963, has set in motion plans for numerous celebratory activities during the year.

The Los Angeles County Board of Supervisors unanimously approved a motion of its chairman, Supervisor Warren M. Dorn, that 1972 be designated "Theodore Payne Centennial Year."

Letters from historical, philatelic, and botanical societies and from conservation groups and public officials, have been written to the Postmaster General in Washington urging a commemorative postage stamp. A drawing that included a likeness of Payne was made by the head graphic artist in the Chief Administrative Offices, Frank Ackerman, and sent along to serve either for direct reproduction or as a suggested model. Merrill Dunlap, new president of the Payne Foundation, has announced a birthday celebration on June 18, at the Theodore Payne headquarters in Sun Valley. At that time, 20 acres deeded to the Foundation for the native plant nursery by Eddie Merrill, a devoted friend of Payne's, will be dedicated as part of the ceremony.

The Theodore Payne Foundation Nursery is the only nursery that deals exclusively in the propagation and sale of California native plants. At the same time, the Foundation does all it can to broaden the cultivation of wild flowers. At Descanso Gardens a new 100-acre addition to the native plant garden is devoted exclusively to wild flowers, both the seed and the planting resulting from the generosity of the Theodore Payne Foundation. In this concentrated area visitors can enjoy lupine, California poppies, godetia, clarkia, baby-blue eyes and other natives that may not ordinarily grow alongside each other.

The original native plant garden at Descanso contains seventeen acres of native trees, shrubs, and perennials. Designated and planted initially by Payne in 1959, it was developed with the idea of providing the homeowner with the opportunity to view some of the more desirable natives that would do well in a low-maintenance garden.

Los Angeles County Supervisor Pete Schabarum

Pete Schabarum

TO SUPERVISOR Pete Schabarum we extend our cordial welcome and our best wishes as he assumes a difficult and demanding position. We know that he has a background of particular interest to the Department of Arboreta and Botanic Gardens. He was chairman of the Assembly Subcommittee on Air Pollution in 1970 and has come to be recognized as an expert in this area. In the last four years he has authored, or coauthored almost every piece of legislation on air pollution that became law. We think he will look with favor on our air pollution research projects concerned with plants. In 1965 he served as the foreman of the Los Angeles County Grand Jury, the youngest ever so named. During his term the Grand Jury was noted for its active campaign against rising costs in County government and its investigations of political wrongdoing. Sports fans are familiar with a different aspect of Pete Schabarum's background. As a halfback for the University of California Golden Bears he played in three successive Rose Bowl games followed by three years of professional football with the San Francisco Forty-Niners. Today, at 43, he still gives the appearance of an athlete in top physical shape.

Expanded Services

THE SHORTENING intervals between announcements of one new development or another at South Coast Botanic Garden are indicative of the progress being made at the Department's youngest facility. From the Public Services Division comes the welcome news that starting March 20, tram tours will be given seven days a week and school field trips five days a week. It was only a little over a year ago, November 27, 1970, to be exact, that a tram was acquired.

A Gross Contest

AS THE BALDWIN BONANZA draws near — April 9th — volunteers, trustees, and staff are feverishly turning to their favorite forms of divination in an effort to come up with the figure that will match the gross receipts of the event. The one who comes closest will be the winning guest of the chairmen of the BONANZA at a celebration luncheon on the 13th. Contest privileges included the right to pay an entrance fee of one dollar, sift through the figures of last year — the gross was $4,926.08 — quiz those involved for possible tips on what the take might be this year, and freedom to make use of any kind of calculating device whatsoever, not excluding abacuses, astrology charts, or computers. Should profits result from this gross contest they will be added to the total income of the BALDWIN BONANZA. That figure and the name of the winner will be listed somewhere in the pages of the June issue of *Lasca Leaves*.

New kiosk at the Arboretum is more brightly hued than the passing peacock. Staffer Chris Van Wagner reads the notices on one of the four information panels.

Photo: Frank Simerly

Dr. Harry Walker

Retirement

HAVING REACHED the mandatory retirement age, Dr. Harry Walker, entomologist in the Department's research division, bid an official farewell to nearly a hundred staff members and wives attending a dinner party in his honor last January 27. Dr. Walker came to the Arboretum in 1966 following his return from a mission in Cyprus where he served as a consultant for the United Nations to underdeveloped countries. Altogether, he was with the U.N. for ten years, traveling around the world working largely on weed and pest control. At the Arboretum his work has been primarily concerned with the collection of aphid species among the various woody plants on the grounds. In the course of this work several new species of aphids were found and lists of host plants infested with various aphid species have been published in scientific journals and are available to the home gardener.

Although he has officially left the Department, Dr. Walker has been coming to his office almost daily to finish up a project he considers may well prove to be of greater practical use than anything he has done. From pages of hand-written notes he is assembling lists of Arboretum plants according to their relative degree of aphid infestation under the headings Heavy, Moderate, Light, and No Infestation. His initial findings show the plants under Heavy and No Infestation to be about equal in number. Those under Moderate and Light are in the same ratio but total about 50% less.

Tree Cassias for that Tropical Effect

Samuel Ayres, Jr.

VISITORS TO HAWAII and other tropical areas are usually impressed and thrilled with the beauty of the flowering trees which greet them. One of the most exciting of these colorful trees is the Golden Shower tree (*Cassia fistula*) from India, blooming in the spring with butter-yellow flowers in racemes a foot or more in length. The trees are frequently photographed and tourists from California sometimes bring home seeds in the hope that they can be grown in our mild climate.

They are usually unsuccessful in this venture because Southern California's climate is Mediterranean rather than tropical, which means dry hot summers and cool moist winters with occasional drops of temperature to freezing or below, and plants which are happy in the tropics usually will not tolerate these conditions unless a completely frost-free location can be found, which is a rarity.

It is not necessary, however, for Southern Californians to envy the Golden Shower tree. At least five other species of tree cassias are being grown here successfully, cassias which are equally beautiful and which can tolerate temperatures to 27° F. without damage and possibly even several degrees lower when well established, although they should not be subjected to temperatures in the low twenties or below.

My first acquaintance with tree cassias in California was about thirty years ago when I received a one-gallon specimen I had purchased from Edwin A. Menninger of Stuart, Florida and which arrived by railway express, bearing the name *Cassia carnaval*. This tree was planted on the edge of a canyon near our home in La Cañada and I believe it is the ancestor of all the trees bearing that name. It has grown into a beautiful upright specimen about 25 or 30 feet in height, and for about six or seven weeks in September and October is covered with a golden crown of brilliant yellow flowers in clusters a foot to a foot and a half in length. It had no common name so we christened it the "Crown of Gold" tree. Our tree withstood the 1949 freeze when the temperature dropped to 27° for three consecutive nights, accompanied by six inches of snow. It also survived a disastrous fire which raced through our canyon about four and a half years ago, badly burning the entire west side of the tree. The tree is nearly evergreen, although the strong Santa Ana winds in our area usually partially defoliate it during the winter months. It sets seeds freely and seeds have been distributed to the Los Angeles State and County Arboretum where a number of specimens are growing.

Photos: Samuel Ayres, Jr.

Cassia carnaval

ABOUT FOUR years ago, through the generosity of Mrs. Julia Knight, groups of these trees were planted on Oakwood Avenue in La Cañada and have since demonstrated their suitability as street trees. They have been greatly admired by local residents and visitors. A specimen may also be seen in front of the Greek Theater in Hollywood.

Cassia carnaval, sometimes called *Cassia excelsa,* is a native of Argentina. It is illustrated in color in the booklets entitled "Flowering Trees for Year-Round Color in Southern California," which may be purchased at the gift shop at the Arboretum and at Descanso Gardens.

Cassia leptophylla, also illustrated in the flowering tree booklet, comes from Brazil and is an equally exciting rival of Hawaii's Golden Shower tree. This species may also be seen growing at the Arboretum and has recently been planted on Baldwin Avenue, bordering the Arboretum on the east. Four specimens are growing on the south side of the Otis Art Institute on Wilshire Boulevard just west of McArthur Park in Los Angeles.

Cassia leptophylla is slightly smaller in stature and has more of an umbrella shape than *Cassia carnaval,* which may make it less suitable for planting between the sidewalk and curb, but it is unexcelled as a specimen tree. It blooms earlier than *Cassia carnaval,* usually during July and August, but sometimes as early as June, according to location. Individual blossoms are larger than those of *Cassia carnaval,* up to a silver dollar or more, although the flower clusters are not as long. The flowers are so large that they suggested the name "Gold Medallion" tree, which it is frequently called. This tree has essentially the same temperature tolerance as *Cassia carnaval* and is nearly evergreen except in the areas exposed to Santa Ana winds.

Cassia multijuga, also from Brazil, has a more slender upright growth habit with smaller, deeper yellow flowers on conical spikes a foot to a foot and a half in length, blooming in September and October, and resembling a golden fountain. It might appropriately be called the "Golden Fountain" tree.

Cassia multijuga

Cassia leptophylla

Cassia liebmannii was obtained a number of years ago as a rooted specimen from the U.S. Department of Agriculture. The tree has attained a height of about 20 feet, is somewhat slender, and the golden blossoms occur in pagoda-like clusters so that it might be called the "Golden Pagoda" tree. It blooms twice a year, in the spring and in the fall. It is not as spectacular in bloom as the three trees previously described, but its other features, as well as the greater resistance of its leaves to strong winds, make it a very desirable specimen tree.

Cassia splendida from Brazil is a smaller plant than those described above and is more shrubby in form, although it may attain a height of 15 feet or more. It has larger leaves and bears large golden-yellow flowers, possibly a little larger than those of *Cassia leptophylla,* in late November and December. One might call it "December Gold." There are probably other beautiful tree cassias still awaiting introduction into California.

Cassias belong in the *Leguminosae* family and are related to the pea and bean. Leaves of certain species are used medicinally as a cathartic (senna). Seed pods vary considerably in size; those of *Cassia multijuga* and *Cassia liebmannii* are somewhat flat, those of *Cassia carnaval* are cylindrical and about three or four inches long, and those of *Cassia leptophylla* are quite large, up to a foot in length. For some strange reason, commercial nurseries have been reluctant to make these plants available, saying there is no demand for them. They are easy to grow, hardy for average locations in Southern California, and rival in beauty anything the tropics have to offer. Perhaps if enough people ask for them, more nurseries will make them available, resulting in a more beautiful landscape. Even at the present time, some of these species can be found at certain specialty nurseries.

Samuel Ayres, Jr., is a medical doctor with a lifelong interest in plants. He was the prime mover in the creation of the Los Angeles State and County Arboretum and over the years has given to the garden hundreds of seeds of plant species of ornamental value. He is responsible for the introduction of several species of flowering shrubs and trees to Southern California. As a writer he has contributed to Lasca Leaves and other journals, and on the civic level he has been active in urban beautification.

PLANTS TO LOOK FOR

Frank Simerly

SPRING FLOWERING trees such as peaches, plums, and almonds have announced the arrival of spring and yet they are only the forerunners of things to come. Now is a good time to visit the gardens and here are some of the plants you can expect to find in flower.

Many trees will be in flower at the Arboretum. One of our largest plant collections, the acacias, will have several species in bloom, notably *Acacia cyanophylla, A. farnesiana, A. pendula,* and *A. verticillata.* The large red flowers of *Eucalyptus rhodantha* will be among the representatives of our extensive eucalyptus collection. A particularly beautiful tree to seek out is *Tabebuia ipe* whose flowers resemble the jacaranda in size, and in color. Of course, it is closely related to *Tabebuia chrysotricha* which was introduced by the Department in 1964 and has since become a popular tree for the home garden. Other trees that will be in flower include Cercis (Red Bud), Bauhinia (Orchid Tree), and Paulownia (Empress Tree). There are several species of these trees and all of them are worthy of your attention.

Outstanding shrubs will also be in flower. Many species and clones of leptospermum will reach their peak. *Viburnum macrocephalum* will display its large 'snow-ball' like flowers. This plant is 50 years old and was made available to the Southern California nursery trade in 1968. Another 1968 Arboretum introduction to be in flower is *Hibiscus huegelii.* We maintain it as a moderate size, rather tailored shrub and it rewards us with numerous lavender-blue flowers.

Flowering ground cover plants are encountered before you enter the main Arboretum plantings. Particularly outstanding is the lampranthus on Baldwin Avenue. Also, on the Baldwin Avenue approach you will see *Arctotheca calendula* and the trailing African Daisy (*Osteospermum fruticosum*). Both the arctotheca and the osteospermum are Arboretum introductions and they are quickly becoming accepted as dependable ground cover plants throughout the southland.

Many of the annual and bulbous plants will flower at all of our facilities. These would include the iceland poppies, pansies, delphiniums, and, if the weather hasn't gotten too warm, we should still see ranunculus and anemones.

DESCANSO

At Descanso Gardens, be sure and visit the old fashioned rose garden featuring a history of roses which is unique among rose gardens in the United States. The modern roses, including the All America Rose selections will also be coming into bloom, and will continue flowering throughout the year, while the old-fashioned plants bloom just once. In early April, the California native plant garden will have many plants in flower, too numerous to mention.

If the weather stays a bit on the cool side, some of the lilacs first developed at Descanso Gardens should still be in flower. There is a large planting of this eastern lilac that has been hybridized for our Southern California climate. Flower spikes are often in excess of 10″ in length.

Tabebuia ipe, a small (25-30 feet) tree from South America has spectacular lavender flowers.

Eucalyptus rhodantha, a showy, sprawling shrub with red flowers 2-4 inches across.

Osteospermum fruticosum (South African Trailing Daisy), an easy-to-grow, easy-to-maintain ground cover that blooms intermittently throughout the year.

Viburnum macrocephalum, a largely evergreen shrub from China that produces showy, white flowers in snowball-like clusters up to 5 inches across.

SOUTH COAST

Our newest facility in Rolling Hills has many plants in flower and this would be a particularly excellent time to visit South Coast.

A number of the erythrinas will be in flower for several months to come as will many of the cassias. Be sure to smell the flowers of *Virgilia divaricata* which has been likened to 'Kool Aid' in fragrance. Again, look for the leptospermums, the Pea Tree and the tropical hibiscus.

The native plant section with its many annuals as well as Fremontia, Arctostaphylos, Ceanothus, etc., will offer its usual spectacular display of color during the month of April.

We couldn't possibly list all the plants that are going to be in flower during the next two months, but we hope this guide will help you to visit the various gardens to find some of your favorites.

Frank Simerly is superintendent of the Los Angeles State & County Arboretum.

1003 by '73

The California Arboretum Foundation will celebrate the 25th anniversary of the signing of its Articles of Incorporation on February 20, 1973. By that date the Foundation hopes to have passed the thousand mark in its membership and this year is conducting a drive toward that goal.

All members as of March 1972 are listed below. In the June, September, and December issues of *LASCA LEAVES* we will publish the names of all new members and their sponsors. We hope every Foundation member will help us in this membership drive.

Memberships are available by writing or calling the California Arboretum Foundation, 301 North Baldwin Avenue, Arcadia 91006, or calling 447-8207.

MEMBERSHIP OF THE CALIFORNIA ARBORETUM FOUNDATION, INC. AS OF MARCH 1972

Adams, Mrs. Marion
Aitken, Miss Beatrice M.
Akebono Bonsai Society of So. Calif.
Aldridge, Mrs. Henry
Alexander, Mrs. Mary K.
Allen, Mr. and Mrs. Calvin H.
Allinson, Mr. and Mrs. C. B.
Allison, Mrs. Ernest M.
Aluminex Incorporated
American Begonia Society, El Monte
American Begonia Society, San Gabriel
American Begonia Society, National
American Institute of Architects
Amesbury, Fred E.
Anastos, Mr. and Mrs. Milton V.
Anderson, Charles G.
Anderson, Mrs. Kenneth B.
Anderson, Dr. Melvin W.
Aplin, William C.
Appel, Mr. and Mrs. William J.
Arcadia Garden Club
Arcadianns, The
Arozena, Mr. and Mrs. John
Armstrong Nurseries, Inc.
Armstrong, Mr. and Mrs. Paul L.
Assn. of Women in Architecture
Atkinson, Mr. and Mrs. John B.
Atsatt, Miss Sally
Ayres, Dr. and Mrs. Samuel, Jr.
Azusa Woman's Club
Babcock, Mrs. Willard G.
Backs, Edward P.
Baer, Mr. and Mrs. Joe R.
Baer, Rexford L.
Bailey, Dr. Wilbur
Baldwin, Mrs. Eugene F.
Baldwin, Mrs. Gates
Balfour, Mrs. Andrew N.
Ban, Mr. and Mrs. George
Ban, Mr. and Mrs. Paul
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Barber, John E.
Barbour, Mrs. A. K.
Barker, Mr. and Mrs. C. A., Jr.
Barry, David, Jr.
Bateman, Mrs. Walter C., Jr.
Bates, Russell K.
Bauer, Mrs. Harry J.
Bauman, Albert J.
Bee, David M.
Bel Air Garden Club
Belden, Joy
Belford, Helen
Belt, Dr. and Mrs. Elmer

Bennett, Mrs. Grace M.
Bennett, Mr. and Mrs. Walter R.
Bergsten, Edwin
Bernard, Mr. and Mrs. David J.
Betts, Ivan F.
Beverly Hills Garden Club
Bigelow, Mr. and Mrs. Frank
Binford, Mrs. Annabel
Bisgrove, Mrs. Marjorie E.
Bittner, J. Merrill
Blough, Mr. and Mrs. Clarence M.
Boadway, Walter M.
Bochte, Mrs. Willard
Bodman, Mrs. Edward W.
Boething Treeland Nursery Company
Boller, Judge and Mrs. Ardene D.
Bone, George Wallis
Bonner, Cleve B.
Boore, Mrs. Ross K.
Bornholdt, Mr. and Mrs. Kenneth
Bowen, Mrs. Patrick M.
Bowling, Mrs. Louise C.
Bradley, Mrs. Wilson
Bradshaw, Richard R.
Brandow, Mr. and Mrs. Peter D.
Brankey, Ruth W.
Brant, Mrs. Freeman
Braun, Mrs. C. F.
Braun, T. W.
Bray, Mrs. Ulric Bannister
Brayshaw, Mrs. James M., Jr.
Bretzius, Duane T.
Breuer, Rolf O.
Brewer, Mrs. Ann
Brown, Mr. and Mrs. Hillyer
Brown, Mrs. Philip S.
Browne, Mrs. F. Orville
Browne, Mrs. Francis E.
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Bryant, Miss Rosemary
Buck, Mr. and Mrs. Dennis W.
Bull, Mr. and Mrs. La Mar
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Burcky, Mrs. Frederic W.
Bushee, Mrs. Roy
Button, Mr. and Mrs. Gregory
Cabot, Samuel
Cactus & Succulent Society of America
Cactus & Succulent Society, San Gabriel
Caldwell, R. E.
Calif. Garden Clubs, Arboretum District
Calif. Garden Clubs, Orange County
Calif. Garden Clubs, San Fernando
Calif. Garden Clubs, State
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Camphouse, Mr. and Mrs. Don
Cannell, Mrs. S. B.
Carter, Mrs. George M.
Carter, Captain and Mrs. Paul N.
Carter, Robert Herrick
Castron, Mr. and Mrs. Gary
Cates, A. B., Jr.
Cathcart, Mrs. Micha
Chambers, Dr. and Mrs. Charles B.
Chandler, Mr. and Mrs. Harrison
Chandler, Mrs. Philip
Chandis Securities Company
Chapman, Mr. and Mrs. Edward N.
Chase, Mrs. M. M.
Checkal, Mary K.
Cheesewright, Mrs. Robert W.
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Ciesielski, Dr. and Mrs. Jan
Ching, Mr. and Mrs. Francis
Churchill, H. Byron
Clark, Mrs. Rufus W., Jr.
Clarke, Dr. and Mrs. Gilbert C.
Clayton, Mr. and Mrs. William
Cleminson, Mrs. James D.
Coffin, Mrs. Harry W.
Cohen, Mr. and Mrs. Arthur D.
Cohn, Mr. and Mrs. Alfred
Colby, Mrs. H. F.
Cole, Mrs. Richard
College Women's Club of Pasadena
Collins, Mrs. Boyd
Collins, Mrs. W. W.
Colvin, Hugh F.
Conners, Mr. and Mrs. William D.
Conrad, Ralph L.
Constantian, Mrs. Nelly
Copley, Mrs. Douglas
Cornell, Ralph D.
Cosgrove, Clarke
Coulombe, Mr. and Mrs. Joseph H.
Cramer, Mr. and Mrs. Duane S.
Cramer, Miss Frances L.
Cramer, Miss Louise

Cramer, Mrs. Yetta
Crandall, Mrs. Shannon, Jr.
Cranston, Mr. and Mrs. H. Stephen
Crews, Mr. and Mrs. Thomas W.
Crawford, Mrs. John S.
Crocker, Lady
Crockett, Mr. and Mrs. Harl D.
Crossett, Mrs. Edward
Crowe, Earle E.
Crozier, Mrs. Harold
Cruzan Gardens
Culver City Garden Club
Cunningham, Mrs. Howard
Curphey, Dr. and Mrs. T. J.
Curry, Mr. and Mrs. Byron V.
Curry, Mr. and Mrs. James P.
Curtis, Mrs. Daniel B.
Daniels, Victor E.
Dart, Mr. and Mrs. Justin
Davis, Henry R.
Day, Mrs. Norman
DeLong, Mrs. Eugene
deMille Trust, Cecil B.
Dean, Mrs. Walter S.
De Prima, Mrs. C. R.
DeVine, Mrs. Francis A.
Delio, Dr. Michael J.
Delkin, A. C.
Dennison, Paul
Descanso Gardens Guild
Deuel, Mrs. Wilson
Dewees, Scott MacD
Dickey, William S.
Diggers Garden Club of Pasadena
Dillon, Mr. and Mrs. John
Dimmitt, Miss Louise
Dix, Mrs. Inger A.
Doehring, Mrs. Carl F.
Doehring, Miss Mary Lou
Doerr, Mr. and Mrs. Albert E.
Doheny, Mrs. William H.
Dolson, Mrs. Hull P.
Dominick, Mrs. Lorgion
Donald, Mrs. Edward
Doolan, Mrs. Jerome K.
Dorsett, Mr. and Mrs. Charles L.
Dougherty, Mr. and Mrs. Michael H.
Douglas, Mr. and Mrs. Fred L.
Douglas, Mrs. J. F.
Douglas, Miss Neva B.
Douglas, Mr. and Mrs. Peter L.
Drake, Ted
Drake, W. G.
Drennan, Mr. and Mrs. P. S.
Dreyfuss, Henry
DuSoe, Mrs. Robert C.
Dube', Miss Lucille
Duffield, Mr. and Mrs. Jack
Dukes, Charlton A.
Dulin, Mrs. Garrettson
Ebell of Los Angeles, The
Eberwine, Mr. and Mrs. Bruce
Eckbo, Dean, Austin and Williams
Edwards, Mr. and Mrs. Robert H.
Eilau, Mr. and Mrs. William E.
Elliott, Mr. and Mrs. Caleb D.
Elliott, John C.
Ellis, Dr. Frank W.
Ellsworth, Mrs. Thomas T.
Enloe, Mrs. Ralph
Ensign, Mrs. Roy F.
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Fackt, Mrs. George P.
Fallas, Dr. and Mrs. Roy E.
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Fehrer, Mr. and Mrs. John N.
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Fisher, Dr. and Mrs. Jerome K.
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Fleming, Mrs. Thomas, Jr.
Fogg, Mrs. Philip S.
Fogwill, Mrs. William A.
Foley, Mrs. Edward T.
Foote, Mr. and Mrs. Stanley S.
Ford, Frank E.
Ford, John Anson
Forman, Mr. and Mrs. George L.
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Franks, Mr. and Mrs. Ralph C.
Freed, Arthur
Freeman, Mrs. Hallie Adams
Fregeau, Mrs. Margaret
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Friend O'Garden Club, El Monte
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Frizzell, R. B.
Froeschle, Dr. and Mrs. R. E.

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Garden Planners
Garden Study Club, Los Angeles
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Garrison, Mr. and Mrs. Walter E.
Gaskins, Mrs. W. W.
Gast, Ross H.
Gayman, Mrs. W. M.
Genung, Mr. and Mrs. Dale R.
Germain's, Inc.
Gerry, Mr. and Mrs. Vance
Gibbon, Thomas E.
Gilchrist, Mrs. Vincent T.
Gleason, Dr. Irene O.
Goodell, Dr. and Mrs. Robert
Gould, Mr. and Mrs. Howard J.
Gould, Mr. and Mrs. Richard S.
Graham, Mrs. Alva G.
Graham, Mrs. Richard H.
Grandin, Mrs. Henry B.
Graupe, Mrs. William
Green, Mrs. Arabelle H.
Green Thumbers of El Monte
Green, Dr. William F.
Greene, Mrs. Ray
Gregg, Mrs. Gene E.
Greiner, Mrs. C. W.
Gresham, Philip
Griffin, Freeman
Griffith, Mrs. E. S.
Griffith-Jones, Mrs. John
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Grove, Mr. and Mrs. Duane
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Gump, Miss Doris
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Haddock, Mr. and Mrs. William J.
Hagen, Willard
Hale, Mr. and Mrs. Robert
Hale, C. Russell
Haley, Mr. and Mrs. Ted
Hall, Mr. and Mrs. Lawrence C.
Halpern, Mr. and Mrs. William
Halvorsen, Mr. and Mrs. Frank
Hammond, Mrs. Paul B.
Hamson, Mrs. Carmen Lu
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Hanscom, Russell C.
Harlem, Art
Harman, Frank W., Jr.
Harmon, Mrs. Robert A.
Harper, Mrs. Wilma M.
Harrell, Mr. and Mrs. Lester F.
Harris, Mr. and Mrs. Robert S.
Harris, Dr. and Mrs. William S.
Hartman, Rudolph
Hartung, Mr. and Mrs. James
Harvey, Edmund H.
Harvey, Dr. and Mrs. James V.
Hassler, Mrs. Richard
Hastings Ranch Garden Club
Hayes, Mr. and Mrs. Donald E.
Hayslip, Mrs. Ralph S.
Hempkins, William B.
Henderson, Mrs. Jo
Henderson, Mrs. John
Henke, Mrs. Arthur
Herb Society of America, So. Calif. Unit
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Hernandez, Miss M. Dolores
Herrick, Mr. and Mrs. G. Richard
Herold, Mr. and Mrs. H. D.
Herscher, Dr. and Mrs. Herbert L.
Herzig, Mrs. Hans
Hester, Mrs. Myra
Hetherington, Mr. and Mrs. Ernest E.
Hewitt, Peter A.
Hiatt, Glenn
Hill, Mrs. Fred G.
Hilltoppers Garden Club of Altadena
Hines Wholesale Nurseries
Hirsh, Mrs. F. R., Jr.
Hoe Club of Santa Monica, The
Hoffman, Mrs. Frank H.
Holladay, Mrs. Collis H.
Holland, Mr. and Mrs. E. W.
Holland, Rowland F.
Holly, Geoffrey C.
Holmes, Mr. and Mrs. George B.
Holmes, Mrs. John R.
Home Garden Group
Hopson, Mr. and Mrs. C. R.
Hotchkis, Mrs. Preston

Hoxie, Mrs. James L.
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Kramer, Charles
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Lenz, Mrs. Edna B.
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Pasadena Junior League Garden Club
Pasadena Landscape Gardeners Assn., Inc.
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South Coast Garden Club
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So. California Garden Club
So. California Gladiolus Society
So. California Hemerocallis & Amaryllis Society
So. California Horticultural Institute
So. California Iris Society
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Sunnyslope Mum Gardens
Sunset Magazine
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Swedlow, Mrs. Mary Jane
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Year Round Garden Club
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Young, Mr. and Mrs. Scott T.
Zabriskie, Mr. and Mrs. Walter W.
Zinn, Mrs. C. Jack
Zinn, Mr. and Mrs. Forrest
Zweig, Mrs. George

BOOKSHELF

AN ISLAND CALLED CALIFORNIA. An Ecological Introduction To Its Natural Communities. Elna Bakker. Photographs by Philip Hyde. University of California Press, Berkeley, Los Angeles, London. 1971.

This is an excellent book, bringing something new and strong into its genre. Barring textbooks, it deals with more different habitats and draws from more disciplines in more depth than any other book on the subject I know of. An enormous number of facts are focused into concepts that enable the untrained nature explorer to understand what he sees.

It is a book for the general reader, for the professional whose work has been in a specialized field, and for the socio-political ecologist who wishes to add breadth and depth to his understanding of the complex adjustments of living things in communities apart from man's. Some readers may like to use it guide-book fashion, reading the pertinent chapters before visiting the areas.

The book's title refers to an intriguing geographical misconception of the 1500's. Curiously, the fantastic tale of "an island called California" comes nearer the truth from the modern ecological concept than does the geo-political fact. Although our author generously admits that California is joined on north and east to the continent, she maintains that "an area roughly the shape of an ovoid spearhead whose point is placed at Mt. Shasta and whose rounded base covers coast to mountain Southern California, is truly . . . a singular piece of country with extremes unknown in more temperate or less diverse regions. . . . Isolated by sea, mountain range and desert it has developed in its own way . . . evolutionary history here has woven numerous distinctive patterns of interaction between life form and the land."

The plan, then, is to take the reader across a transect from the vicinity of San Francisco to the Nevada border, then south through Death Valley and the more southern deserts. On the way he encounters communities of the beaches, the salt marshes, coast ranges (with strange patterns of grasses, stunted shrubs, tall trees, all puzzling until accounted for), then the riverine valleys, the great central valley (California's Kansas), and up in the Sierras, higher and higher, the digger pine — blue oak, yellow pine, lodgepole pine, timberline trees, bristlecone, and finally alpine tundra. Then, on the east there is a sudden drop to the limitless expanse of sagebrush.

In each of these, there are a number of communities — organizations of plant and animal life as interdependent and tightly woven as are man's cities, and far more vulnerable, of course, to fire, wind, heat, cold, drouth; in fact their characteristics have evolved in response to these forces.

In fact one feels, after a time, a sense of exigence. Here is not the leisure of a Charles Saunders, spending whole summers in the San Gabriels and interspersing his account of their natural history with genial anecdotes of human contacts in the wilds. Here is not quite the poetry in lyrical tone of some of the modern writers: Carson, Leydet, Nancy Newhall and other gifted writers of the Sierra Club series. In this book Mrs. Bakker does not take the time for such excursions. Many another writer's grasses bend gracefully in the wind. Almost a cliche, it is yet a well-loved figure. Mrs. Bakker's grasses bend in an *onshore* wind, but "they bend with grace and delicacy." She has already implanted the knowledge of why the wind is an onshore one, and its effects on the vegetation. This, I think, is how the book achieves its compactness. Almost every sentence does double duty, though unobtrusively.

As for animals, the book is completely free of "the pathetic fallacy," the ascribing of too human thoughts and feelings to animals. Mrs. Bakker has not attempted to get inside the consciousness of animals as has Sally Carrighar, for one; only to the extent of what they must do to live. Upon the rocky coasts "this approaching thing is dangerous; that one is harmless. This place is too dry to live in; over there is better," thus "it places itself in a community and sees its own world as one in which it lives with other creatures." This goes on where "beaches fringe a restless surf; headlands thrust obstinately into churning swells . . . these are the outposts of California, stubborn and steadfast."

The problem of the naturalist-writer who would communicate his sense of the values and beauties of nature to those not already aware of them, has always been difficult, and is becoming more so. So many live with no real contact with the earth and are so preoccupied with man's activities there is hardly a common language. This book, at least to some extent, may bridge the gap. One comes away with a bare-bones portrayal of creatures reacting as best they can with what they have, creatures moved by iron necessity, by varied exigencies; driven to fresh expedients, getting no quarter. Men struggling for a place in the economic world may find this view sympathetic. Indeed, one sometimes wonders why it is that man finds peace in contemplating Nature. It is not freedom from struggle; perhaps it results from a sense of balance, or of armistice, or simply that animals, in peril most of the time, don't seem to worry.

No one can doubt that the writer is conservation-minded, even if nothing is known of her arduous efforts to save some unspoiled spots of wilderness. But in this book she exercises restraint; for the most part, she makes no plea. She only says, "Look, it is like this. See. Understand." And leaves the rest to us.

The very beautiful photographs of Philip Hyde add much to this book and accord excellently with its subject matter.

The book is indexed, and in some cases furnishes the botanical or zoological names of species referred to in the text by their common names.

Marcella Juhren

RECENT ACQUISITIONS TO LASCA LIBRARY

BULBS by Jean Underwood Crockett. 160 p. Colored plates. Time-Life. 1971.

MERISTEM TISSUE CULTURE by American Orchid Society. 71 p. American Orchid Society Bulletin Press.

PLANTS POISONOUS TO PEOPLE IN FLORIDA AND OTHER WARM AREAS by Julia F. Morton. 116 p. Hurricane House Publication. 1971.

KEYS FOR THE IDENTIFICATION OF THE MOSSES OF THE PACIFIC NORTH WEST by Elva Lawton. 66 p. Hattori Botanical Laboratories, Japan. 1971.

PROTECTING SHADE TREES DURING HOME CONSTRUCTION by United States Department of Agriculture. 7 p. Home & Garden Bulletin No. 104. 1970.

THE HOME FRUIT GARDEN IN THE CENTRAL SOUTHWESTERN STATES by United States Department of Agriculture. Leaflet #221. Revised 1968. 7 p.

CLEANING AND PRESERVING BINDINGS AND RELATED MATERIALS by Carolyn Horton. 87 p. American Library Association, Chicago. 1969.

EMERGENCY TREATMENT FOR RATTLESNAKE BITE by Los Angeles County Health Department. 11 p. Entomology Section of Los Angeles Health Department. 1968.

PRAIRIE PLANTS OF THE CHICAGO REGION by Robert F. Betz. 14 p. Morton Arboretum, Lisle, Ill. 1965.

GENETIC AND CYTOLOGICAL STUDIES WITH CAMELLIA AND RELATED GENERA by William Ackerman. 115 p. Agricultural Research Service, United States Government Printing Office. 1971.

MANUAL OF THE VASCULAR PLANTS OF TEXAS by Correll & Johnston. 1881 p. Texas Research Foundation, Renner, Texas. 1970.

Calendar

April - May - June

ARBORETUM, ARCADIA

April 8 and 9
Baldwin Bonanza, California Arboretum Foundation Fund-Raising Sale
Sponsored by Las Voluntarias
Hours: Saturday preview (invitational to members and friends) 6-8 p.m.;
Sunday 9:30-4:30

April 15 and 16
Iris Show
Sponsored by the Southern California Iris Society
Hours: Saturday 1-5:30
Sunday 9-5:30

April 16 — 9 a.m.
Sunday Morning Garden Walk
"Demonstration Home Gardens"
Dr. Leonid Enari, Senior Biologist, Frank Simerly, Arboretum Superintendent

April 23 — 2 p.m.
Sunday Afternoon Lecture in Demonstration Home Gardens
"Gardening in Containers"
John Provine, Arboretum Horticulturist

April 29 and 30
Hemerocallis and Amaryllis Show
Sponsored by the Southern California Hemerocallis and Amaryllis Society
Hours: Saturday 1-5:30
Sunday 9-5:30

May 6 and 7
Rose Show
Sponsored by the Pacific Rose Society
Hours: Saturday 1-5:30
Sunday 9-5:30

May 14 — 2 p.m.
Sunday Afternoon Lecture in Lecture Hall
"Australian Plants in the Southern California Landscape"
George Spalding,
Botanical Information Consultant

May 16
Foundation Annual Luncheon Membership Meeting at 12 noon in the Demonstration Home Gardens

May 21
Epiphyllum Show
Sponsored by the Epiphyllum Society
Hours: 10-5:30

May 21 — 9 a.m.
Sunday Morning Garden Walk
"Australian Section"
Frank Simerly, Arboretum Superintendent, Dr. Leonid Enari, Senior Biologist

May 27 through 29
Bonsai Show
Sponsored by the Santa Anita Bonsai Society
Hours: Friday 1-5:30
Saturday 9-5:30
Sunday 9-5:30

June 1 through 18
Art Show
Lecture Hall
Sponsored by Las Artistas

June 11 — 9 a.m.
Sunday Morning Garden Walk
"Aquatic Garden"
Dr. Leonid Enari, Senior Biologist, Frank Simerly, Arboretum Superintendent

June 18 — 2 p.m.
Sunday Afternoon Lecture
Demonstration Home Gardens
"Plant Propagation for the Home Gardener"
John Provine, Arboretum Horticulturist
Don Fitch, Arboretum Nurseryman

June 24 and 25
Gladiolus Show
Sponsored by the Southern California Gladiolus Society
Hours: Saturday 1-5:30
Sunday 9-5:30

DESCANSO GARDENS LA CANADA

April 12 — 8 p.m.
Theodore Payne Foundation Lecture
"Cactus of the Americas"
Harry Johnson, Cactus Grower

June 4 — 9 a.m. - 4:30 p.m.
Art Festival
Sponsored by the Descanso Gardens Guild

SO. COAST BOTANIC GARDEN PALOS VERDES PENINSULA

April 19, May 17, June 21 — 8 a.m.
Bird Identification Training Series
Sponsored by El Dorado Audubon Society

April 22 and 23
Flower Show
Sponsored by the Silver Spur Garden Club
Hours: Saturday 1-5:30
Sunday 9-5:30

April 29 and 30
Bromeliad Show
Sponsored by the Bromeliad Society
Hours: Saturday 1-5:30
Sunday 9-5:30

June
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Lasca Leaves

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LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN

The Cover

Cassia excelsa (*carnaval*) owes its popular name, Crown of Gold, and its initial introduction to Southern California, to Dr. Samuel Ayres, Jr., a dermatologist whose avocation has been the introduction of flowering plants to Southern California. The tree is native to Argentina, grows rapidly to 25-30 feet, and is only briefly deciduous in this area. In the early fall, it is covered with a crown of brilliant yellow flowers in clusters a foot to a foot and a half long. Dr. Ayres gave seeds from his own specimen tree to the Los Angeles State and County Arboretum which in 1964, after a number of specimens were growing successfully on the grounds, introduced it to the nursery trade.

Editor
Donald S. Dimond

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Cover by Ralph D. Cornell

department notes

Sunday Lectures

THE JUST CONCLUDED spring series of Sunday afternoon lectures at the Arboretum were an SRO success, which is another way of saying that in presenting informative lectures on various aspects of horticulture in a pleasant, relaxed atmosphere, the Department was effectively responding to the needs and interest of the public.

If contemporary botanic gardens are more responsive to community needs than those of the past, it is probably because today's gardens are more closely concerned with our environment, whether it be matters of pollution or beautification. Within this Department the decision to undertake most projects rests in good part on an estimate of how meaningful the project may be to the community. There were thoughts along these lines when it was decided to present the Sunday lectures by members of the staff. Happily, the response showed that the time and effort spent in preparing and delivering them were well justified. Similar lecture series are now being considered for Descanso Gardens and South Coast Botanic Garden.

La Gran Bonanza Baldwin

THE EVENT is a memory but the profits linger on. The rewards of unselfish, untiring collective effort in the interest of a worthwhile cause were gratifyingly underscored when the balance sheet for Baldwin Bonanza II was issued following the April 9th event. Estimated net profit was tabbed at $6,163, a nearly 100 per cent increase over Bonanza I. The accounting also showed some other things: of the 20-odd sales categories, plants were far and away the best moneymaker, with "elegant junque" and antiques a distant second and third respectively. In our previous issue we promised to reveal the winner of what Mrs. Peter Douglas, CAF president, dubbed the "Gross Contest," or, who could come the closest to guessing the gross receipts. There's a story to it, of course. Helen Thompson, one of the most effective members of Las Voluntarias since its inception five years ago, met her husband, Tommy, on the seventh day of a month that shall remain unidentified. Mr. Thompson used this personal milestone as the cue for his estimated gross: $7,777.77. It proved to be the closest to the actual figure of $8,690.94. The Thompsons were the guests of the Bonanza chairman at the celebration luncheon on April 13.

Fiesta at South Coast

THE MAJOR EVENT each year at South Coast Botanic Garden is the Fiesta de Flores, a three-day affair that invariably attracts thousands of local and out-of-state visitors who come to see the exhibits and see how this young garden built over a landfill is progres-

F. Harold Roach, president of the Board of Governors, Los Angeles State and County Arboretum (left); Mrs. Peter Douglas, president of the Arboretum Foundation Board of Trustees; County Supervisor Pete Schabarum, and Francis Ching, director of the Department of Arboreta and Botanic Gardens, check out an epiphyllum following the Foundation's annual membership meeting May 16th held in the Demonstration Home Gardens. Over 200 attended.

Photo: Milton Bell

sing. This year's Fiesta is the 10th annual show and will be presented July 7th, 8th, and 9th. Judging from the 30-page program, the forthcoming show holds special promise. Under the leadership of General Chairman Florence Sullivan, a record number of professional and amateur exhibitors are expected to enter the five divisions which this year are bound together under the theme "Around Our Planet With Plants." Among the interesting programs to look forward to are Dr. Glenn Walker's presentations on herbs ranging from their practical use to their occult significance; a program on iris and a program designed especially for young people that offers tips on growing vegetables, both by Joe Littlefield; a program on indoor ornamental plants by Ed Hart; one on bromeliads and their companions by William Paylen; a program on dahlias by Fred McKelvey; and a program on what to do about insects in your garden by Armand Sarinana. Also, in addition to the usual plant sale, there will be each day an auction of rare plants.

New Members, Trustees

WE WISH TO WELCOME two new trustees of the Foundation: Mrs. Anson C. Moore, Curator of Design at the Pasadena Art Museum, and Catherine Mundy, Women's Editor of the Foothill Inter-City Newspapers. Both these ladies are longstanding friends of the Arboretum, Mrs. Mundy's membership in the Foundation going back ten years during which she has written numerous articles about the Arboretum; Mrs. Moore's going back almost to its beginning. A note in the autumn 1951 issue of Lasca Leaves about volunteer workers had this to say: "Mrs. Anson C. Moore has spent many mornings at the Arboretum devoted to masking and backing the many unmounted paintings of the Charles and Josephine Broughton memorial collection of flower paintings and plant illustrations. Besides this, Mrs. Moore has started making herbarium specimens of flowering plant materials growing at the Arboretum."

(Continued on page 44)

PLANTS TO LOOK FOR

Frank Simerly

WARM WEATHER is approaching and an excellent way to be refreshed during the heat is to use and enjoy the public gardens. Many people expect out-of-town guests and will find sharing a visit to the Arboretum an enriching experience, particularly if they can acquaint their friends with some of the plants of current interest.

Several trees bloom at the Arboretum during this time and in particular one should view *Cassia leptophylla*, the Gold Medallion Tree. The Arboretum introduced this plant to the Southern California nursery trade in 1964. A picture of the flower is found on the cover of the December 1971 issue of LASCA LEAVES. Two beautiful specimens are located on the south side of the Arboretum administration building and another excellent specimen can be seen west of the library building near the Gift Shop. The Gold Medallion Tree is native to Brazil and becomes a small round-headed tree to 25 feet high and almost as wide. The flowers are produced in large clusters and as the name suggests, they are a bright yellow. Don't miss seeing this tree in flower; it is unforgettable.

Many people are acquainted with the crape myrtle. A wealth of color is found in these trees, mainly various shades of deep rose, lavender and white. We have purposely collected as many colors as possible and have grown seedlings for further selection. However, this selection process is not just for floral color, but also for colorful fall foliage and for mildew resistance. After many years we have selected two plants that show promise and have propagated them for additional tests that include coastal planting. Our largest planting of crape myrtle is among the *Arctotheca calendula* ground cover north of the jungle area. Besides the species *Lagerstroemia indica*, there is *L. fauriei*, located in the same area. Like the *indica*, this species is also in bloom. It has small white flower spikes and a most attractive bark, both deserving your attention.

Perhaps the most useful flowering shrub for summer color in Southern California is the oleander which is planted liberally throughout the Arboretum. Oleander is native to the Mediterranean area and is noted for its profusion of white, pink, red and even yellow flowers. *Nerium oleander* is known to be poisonous (as some plants are in nearly everyone's garden) but there is no record of any deaths attributable to this plant in the long history of Los Angeles County.

An interesting and more unusual shrub to see is the *Plumeria rubra*, native to the tropical areas of Mexico and Central America. Visitors to Hawaii will remember the delicious fragrance of this plant which we commonly call frangipani. It is frost tender, but we have found that it grows well in tubs, thus allowing us to move it into protected areas in the winter. Specimens can be found in the Demonstration Home Gardens during the summer. The flowers vary from white to dark pink and would be considered lovely even if they didn't have their pleasant fragrance.

Many other flowering shrubs deserve your attention. Here are a few to seek out: *Abutilon megapotamicum, A. hybridum, Cassia corymbosa, C. surattensis, Cistus spp., Helianthemum spp., Pereskia sacharosa* (a curious member of the cactus family), *Punica granatum* and *Thevetia peruviana* (the 'Yellow Oleander'). Of course, this is a partial list.

SOUTH COAST

I have skipped the annual and perennial plants at the Arboretum so that you will be encouraged to see the fine plantings at our South Coast Botanic Garden in Rolling Hills. Annual plantings are a good way to get color into any garden and at South Coast there are some excellent plantings of marigold, petunia, candytuft, dwarf dahlia, lobelia and portulaca, to mention a few. The perennial plantings are especially worthy and include *Anigozanthos manglesii, Leonotis leonurus,* and several species of verbena, dianthus and begonia. Look for the daylilies which have been much improved in recent years; South Coast has a good selection of cultivars. Also, note the variety of agapanthus that are available in various shades of blue and white, and in dwarf and giant forms. One of the favorite plant combinations of landscape architects is hemerocallis (daylily) and agapanthus. These plants are both good companions for *Moraea bicolor* and *M. iridioides* which can also be seen at South Coast. Many people having *M. iridioides* are not aware that the flower stems are perennial and should not be removed from the plant.

South Coast Botanic Garden has contributed to the Department plant introduction program. An improved marguerite, *Chrysanthemum frutescens* 'Palos Verdes' is a striking plant that can be seen in flower now. This marguerite is an intense yellow that is more disease resistant and winter hardy than many other varieties. There are many other perennials such as coral bells, gazania, gamolepis and of course roses. In the Department of Arboreta and Botanic Gardens, however, roses are associated with the Descanso facility.

DESCANSO GARDENS

At Descanso Gardens there are two distinct kinds of roses covering nearly six acres. The old fashion rose planting includes roses that are recorded to have been cultivated as early as 1500. These plants are grown in chronological order up to about 1940. Beginning in 1940 the first All America Rose selections were designated and these constitute the other major kinds of roses grown at Descanso which are also arranged chronologically. The new A.A.R.S. award winners are announced each June and two of the hybrid tea roses, 'Electron' and 'Gypsy,' honored by the award this year, can be seen at Descanso.

'Electron' is a bright, rose-pink hybrid tea producing great quantities of large, fragrant flowers. The long, pointed buds open to high-centered, well-formed blooms of exhibition quality and are produced on stems of medium length. It is a bushy grower, well covered with dark green foliage.

'Gypsy' is a fiery orange red hybrid tea that is truly an outstanding flower which has dark red buds that unfurl to high-centered exhibition type blooms. It is one of the more colorful roses in the gardens, and it has been highly admired by all who have seen it. 'Gypsy' is the only hybrid tea in the red shades to win an A.A.R.S. award since 'Mister Lincoln' in 1965. The plant is husky and has rich green foliage.

Make a point to take visitors to each of the Department's facilities this summer. Knowing what plants to look for should make the trip more worthwhile and enjoyable.

Frank Simerly is superintendent of the Los Angeles State & County Arboretum.

Ralph D. Cornell

A UNIQUE LINK WITH Southern California's horticultural past was severed last April 6th when Ralph D. Cornell died at the age of 82 at his home in the Los Feliz area of Los Angeles. During a career that spanned more than half a century, Mr. Cornell was both a witness and instrument of a changing urban landscape that brought to California new plants and more color in keeping with the principles of landscape architecture, a subject he had studied at Harvard where he received a master's degree in 1917. He was a link, too, with many outstanding figures in the world of plants who had preceded him in history, like Theodore Payne, the promoter and propagator of native plants with whom he had roamed the California countryside and who was a lifelong friend.

Although the details of the slowly changing landscape, the anecdotes and memories that illuminate an era, are in great measure lost with his passing, there is of course the living evidence of his work, including his very first professional job. In 1912, when he was still a student at Pomona College where he received a Bachelor of Arts degree, magna cum laude, he was called on to landscape a small, private community in what was then an almost rural section of Los Angeles. The community was Fremont Place. It still stands today, very much as it was when young Ralph Cornell laid it out. The campus of Pomona College, it should be mentioned, was a very special project of Mr. Cornell's ever since his student days. There is probably not one square foot of ground there that has not received his attention. The same can be said for the UCLA campus where he became the consulting landscape architect in 1937. But much of his work, as he was at pains to point out, was accomplished with his partners in the firm of Cornell, Bridgers, and Troller, formed in 1955. It is enough to name a few clients to indicate the range and magnitude: Griffith Park Master Plan; Rose Hills Memorial Park; Los Angeles Civic Center Complex; the Music Center; early work at Century City. And the development of many campuses: UC Santa Barbara; several of the Claremont Colleges; Cal State Fullerton. And outside the state: The Nile Hilton Hotel in Cairo; the Ford Motors Building in Detroit; Jackson Hole Ski Corporation; the Davao Insular Hotel in the Philippines. And among all these varied projects a cornucopia of awards of merit, the most recent received in 1970: The American Association of Nurserymen's National Design Award for the UCLA Canyon Recreation Center; the California Garden Club Award of Merit for the Franklin D. Murphy Sculpture Garden.

Along with his professional activities Mr. Cornell found time to pursue his hobby, photography, and to give active support to the Arboretum. He was appointed to the Board of Governors of the Los Angeles County Department of Arboreta and Botanic Gardens in 1953 and served as president from 1960 to 1968. He was a founding member of the Board of Trustees of the California Arboretum Foundation and an Honorary Trustee since 1969. His wife, Vera, has graciously agreed to continue in this role. Mrs. Cornell, it should be noted, not only shared many of her husband's interests, but has for many years pursued her own special interest, a study of the notable women in California's history, a subject on which she has lectured widely.

To say that photography was a hobby of Ralph Cornell is to understate the case. The small credit in italics, "Photo by Ralph D. Cornell," may be found under literally hundreds of photos in a wide variety of popular and scientific publications including the cover of this issue. Mr. Cornell also wrote articles in his fields of interest and was an early contributor to Lasca Leaves, writing on "Points of Entry and Their Civic Value" in the 1954 spring issue. His most recent article was written for the September, 1970 issue. Titled "Horticultural Photography," it also includes a number of his typically outstanding photographs.

Everyone who knew Ralph Cornell was conscious of a certain old school aura that marked his bearing and manner, an aura that was in part, at least, a reflection of his own quiet courtesy. It probably would be a surprise for some to learn that this dignified man had a good bit of the Nebraska farm boy in him and that he liked social pastimes like dancing and attending the circus. He could recall with happiness his days on horseback, riding about the Nebraska prairies. Although the Cornells lived in a small town where Cornell senior owned a lumber yard, young Ralph had a passion for the countryside, for all farm animals, and especially for horses. It would be true to say that his religion was the outdoors — the mountains, the sea, the desert, all of nature in her many moods and guises. His feelings were expressed in a little verse by Lowell Angus Reese that he was fond of quoting:

"Here and there are set aside
A few old trees
With their arms still wide
To the winds of God,
And the reverent hear the whispering tongues
Of a thousand years."

Beneath the quiet facade, it is clear, Ralph Cornell was a man of diverse interests and great energy. Even the most casual reviewer of his work would see that he was forward-looking, professionally and philosophically, striving to bring about the kinds of environments that contemporary urban planners and sociologists hold up as models for today and tomorrow.

D. D.

BRUSH FIRES

BRUSH FIRES IN SOUTHERN CALIFORNIA: THEIR ECOLOGY AND RELATIONSHIP TO MAN

Kenneth R. Montgomery

SOUTHERN CALIFORNIA is a land of many contrasts. It is a land of torrential winter rains and long, dry summers; of high mountains and low desert valleys; of serene beaches and wind-swept canyons. But perhaps the most dramatic contrast of all exists between the growing Los Angeles megalopolis and the surrounding brush-covered foothills. These wildland areas are under tremendous pressure from urban development as more and more people move into the hills to escape crowded city conditions and as demands for recreation and other uses increase. A serious and quite unique confrontation between man and natural environment has resulted. Recurring, explosive brush fires pose an enormous threat to the homes, property and even the lives of hillside residents. Not only are these fires costly to man in terms of direct destruction, but they also produce large quantities of smoke and ashes which can contribute to air pollution. More important, burning of the vegetation on the mountain slopes sets the stage for devastating floods and mud slides during the rainy season that represent additional dangers to people living in the foothills and in the valleys directly below. To gain an understanding of these problems, it is first necessary to understand the nature of the wildlands and the complications resulting from man's presence in foothill areas.

Chaparral Vegetation

The characteristic brushy vegetation on the slopes and ridges of the Southern California mountains below the yellow pine forests is known as chaparral. The term comes from the Spanish word *chaparro* which refers to a shrubby type of oak. Chaparral is a complex plant association dominated by hard-leafed, evergreen shrubs which form dense, often impenetrable stands from 3 to 15 feet or more in height. Several distinct types are recognized according to what species occur as dominants and where the stands are found (north or south slope, high or low elevation, etc.). Despite these differences, the scrubby growth habit and general appearance is unmistakable. Mature chaparral is reminiscent of a forest in miniature and has inspired the popular name "elfin forest." Chamise (*Adenostoma fasciculatum*) is found in greatest abundance and often forms extensive pure stands. Chamise-chaparral is the predominant cover on dry, south-facing slopes. Other important chaparral species include scrub oak (*Quercus dumosa*), toyon (*Heteromeles arbutifolia*), mountain mahogany (*Cercocarpus betuloides*) and several kinds of manzanita (*Arctostaphylos*), mountain lilac (*Ceanothus*), buckthorn (*Rhamnus*) and sumac (*Rhus*). Mixed stands of many of these shrubs characterize the wetter north-facing slopes. At low elevations on extremely dry sites, chaparral intergrades with or is replaced by sub-shrubs of the coastal sage scrub community dominated by black sage (*Salvia mellifera*), sagebrush (*Artemisia californica*) and species of buckwheat (*Eriogonum*). Coastal sage species typically have soft, aromatic leaves and are partly or wholly deciduous under extreme drought conditions. The boundary

Fires, flooding and mud slides pose enormous threats to residential development in and directly below chaparral-covered hillsides.

separating these two communities is not distinct in most places, and broad areas of overlap frequently exist. Young stands of chamise-chaparral, for example, are rich with coastal sage species. Black sage often occurs as a co-dominant with chamise in such stands. Coastal sage has been termed "soft" chaparral to distinguish it from true or "hard" chaparral (Lewis 1961). Because of its low-elevation coastal distribution, the soft chaparral has been hardest-hit by urban development and is presently falling before the bulldozer at alarming rates.

THE CLIMATE of Southern California is classified as Mediterranean and is defined by a relatively short rainy season in winter and early spring, followed by a long, harsh dry season lasting in some years eight or nine months. Chaparral is well adapted to these seasonally dry conditions. The plants have deep, extensive root systems and are extremely drought tolerant. Coastal sage species, by contrast, are more shallow-rooted and evade drought by losing their leaves. It is only during and immediately following the rainy season, particularly in the warming temperatures of spring, that most of the species actively grow and bloom. As the soil dries out in summer they harden off and enter a period of dormancy to survive. Many of the plants are quite oily or resinous which may be a mechanism to aid in resisting water loss under the severe drought. The presence of these substances gives chaparral a very characteristic odor. The leaves and stems become extremely dry and brittle during the long months without water. Very soon after the rains return, however, the plants become green again and resume activity.

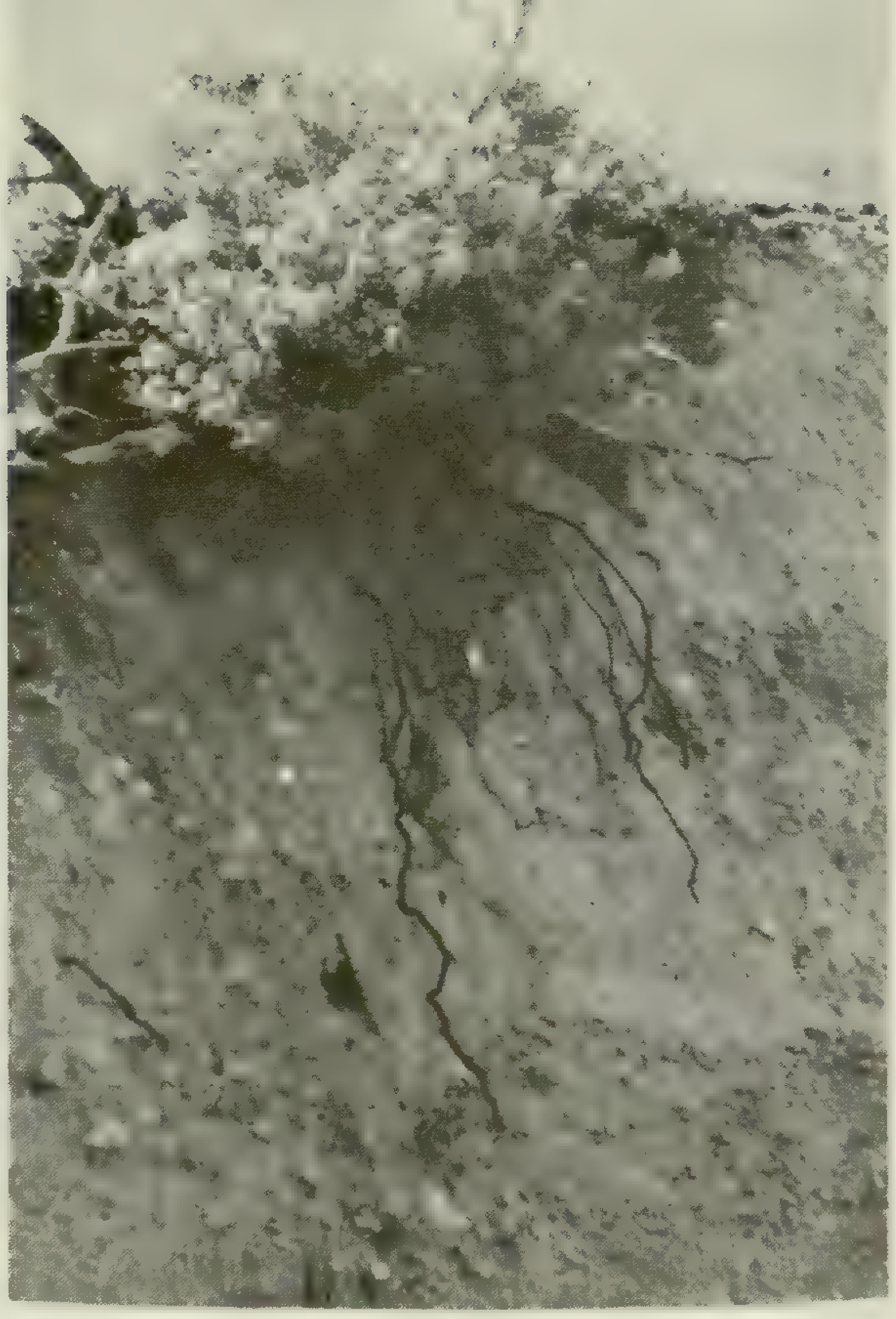
The coastal and transverse mountain ranges in which chaparral occurs are considered to be among the most unstable in the world. They are highly fractured along several major earthquake faults (including the well-known San Andreas Fault). The slopes are often very steep and treacherous. Soils tend to be shallow, of coarse texture and poorly developed into distinct layers. They are of low fertility and are subject to extensive water erosion during the rainy season and to the slow downward movement of soil particles (dry creep) throughout the year. Chaparral provides an excellent protective cover for the slopes to reduce water runoff during winter storms and to bind the soil, thereby controlling surface soil erosion and reducing the chances of landslides.

Fire in Chaparral

One of the most outstanding features of the chaparral is its high susceptibility to burning. Lewis (1961) has stated that the combination of a seasonally dry climate and density of the plant cover makes Southern California chaparral one of the most fire-susceptible vegetations in the world. The dry, oily nature of the plants and their erect, branching growth habit all contribute to a condition of high flammability. Chaparral is particularly flammable under the extreme weather conditions associated with Santa Ana winds. These so-called "devil winds" which occur sporadically during the fall and early winter of each year are characterized by dry, northeasterly winds that roar over the ridges and down the canyons toward the sea with gusts up to 100 miles per hour. Not only do the chaparral plants dry out and become extremely flammable during a Santa Ana, but also the high winds and low relative humidity make fires once started almost impossible to stop.

PERIODIC FIRES apparently have been an important environmental force in Southern California for the past two million years or longer (Axelrod 1958) and have undoubtedly played a major role in the evolution of the chaparral. Two important adaptations enable chaparral species to survive and recover after burning. Many long-lived shrubs such as chamise and scrub oak possess a protected crown area (burl) just beneath the surface of the soil and resprout following fire. Others, including some species of manzanita, ceanothus, and most coastal sage plants, are killed outright but propagate from heat-resistant seeds in the following rainy season. Because of these adaptations to fire, chaparral is considered to be a fire-type vegetation.

Chaparral vegetation in the San Gabriel Mountains of Southern California. Chaparral serves to cover and stabilize these steep slopes.



Most chaparral species have deep, extensive root systems as this laurel sumac bush illustrates. The exposed roots alone extend down more than 10 feet.

When a fire burns a stand of chaparral, a whole sequence of events is initiated. New sprouts from the crown of many of the burned bushes soon appear (often just a few days after the fire) and begin to grow. Later in the rainy season annual and perennial wildflowers and grasses germinate in great profusion from seeds that may have been dormant in the soil for many years. Seedlings of many shrubs also appear where there had been few or none at all before the fire. The annuals and perennials persist for only a short while and then largely disappear until the next fire — thus, in mature chaparral a cover of herbaceous plants is conspicuously absent. Short-lived shrubs and sub-shrubs are abundant in the stand for several years, but eventually they grow old and die leaving the long-lived, resprouting species as the dominant vegetation. Through this succession, the stand returns to approximately the same species composition as before the fire (Hanes and Jones 1967). As time passes, the stand becomes increasingly susceptible to another fire because of the increasing volume of fuel available for burning and the proportionately large quantity of highly flammable material such as dead wood and litter. Eventually another fire burns the stand and the process begins all over again. Although greatly simplified, this is the general idea of the natural fire cycle in Southern California chaparral, a cycle repeated countless times in the past and, without man's intervention, will undoubtedly be repeated in the future.

Effects and Significance of Fire

At first glance these fires appear to cause severe damage to the chaparral ecosystem. But as is often the case in our attempts to interpret natural phenomena, what may appear to be one way on the surface is, in reality, quite the opposite. Although there are some changes in the number and kinds of plants as a result of fire, chaparral as a vegetation type retains its identity and holds its ground despite repeated burning (Hanes 1971). Fire actually serves as nature's way of revitalizing and enriching the chaparral. Burning off the old, declining vegetation produces regrowth that is more vigorous and less susceptible to insect attacks and disease. Fire acts both to renovate the stand and to fertilize the soil with nutrient-containing ashes. Furthermore, the fires serve to 1) provide a temporary place for annual species to live on slopes normally dominated by long-lived shrubs, 2) crack (scarify) the impermeable seed coat of annuals and many shrubs, a necessary action before the seeds can take up water and germinate, and 3) destroy chemical substances (phytotoxins) produced by certain shrubs which accumulate in the soil and inhibit the growth of their own seedlings and the seedlings of other species.

The effect of fire on chaparral wildlife is easily misunderstood. There is no question that fire kills many individual animals, but one must keep in mind that the species of animals that live in chaparral areas have survived for a long time in a fire environment and have become remarkably well adapted to it. It is now evident that wildlife actually benefits either directly or indirectly from fire. Burning increases the amount and availability of food and ultimately provides more favorable places in which to live. Succulent new shoots from the shrubs, tender young seedlings, and the seed crop of annual plants comprise a rich resource for mammals and many species of birds who in turn provide food for a wide variety of predators such as coyotes, bobcats and hawks.

AFTER a fire, soil erosion inevitably increases from the slopes because the vegetative cover is no longer present to protect the soil from being washed away by winter rains. If torrential storms occur during the first critical year following fire, the rate of water runoff is high, and soil losses are very large. In a dry year, on the other hand, erosion may not be much of a problem. Increases in soil erosion are important, but they are temporary. Within two or three years under natural conditions the vegetative cover becomes sufficiently reestablished to stabilize the slopes, and water runoff and soil erosion gradually return to pre-fire levels.

There is a tendency in our society to view nature in an overly man-oriented way. Fire has been branded as an enemy, and many people conclude that the chap-

Site of a recent, low intensity fire in the San Gabriel Mountains.

arral because of its high flammability (and low direct economic value) is a "bad" vegetation. Little attention has been given to the ecological role of fire in chaparral, nor have we come to fully appreciate the tremendous value of chaparral as a vegetative cover on the mountain slopes. Most of us have been taught by Smokey the Bear that forest fires are a totally destructive force. It is true that many types of vegetation are harmed or even destroyed by fire, but others appear to need regular burning for their perpetuation. An example is the sequoia forests of California. It has been shown (Hartesveldt and Harvey 1967) that the giant sequoias cannot reproduce from seed if there is litter and undergrowth covering the mineral soil. Periodic ground fires have been vital in the past to get rid of this material and allow for germination. Such fires do not damage the established trees. To ensure sequoia reproduction, fires must continue to occur or their effect must be duplicated by artificial means such as hand-clearing the surface cover. Chamise-chaparral, so widespread in Southern California, is also and to a much greater degree fire-dependent. Chamise-chaparral as it exists today would not have developed without periodic burning, and without fires in the future it would stagnate into great masses of dead or dying material unable to reproduce itself and unusable as forage for wildlife (Hanes 1971). The mixed chaparral stands that dominate north-facing slopes are not so dependent on frequent burning, but occasional fires are still of major importance in their ecology.

To Burn or Not to Burn

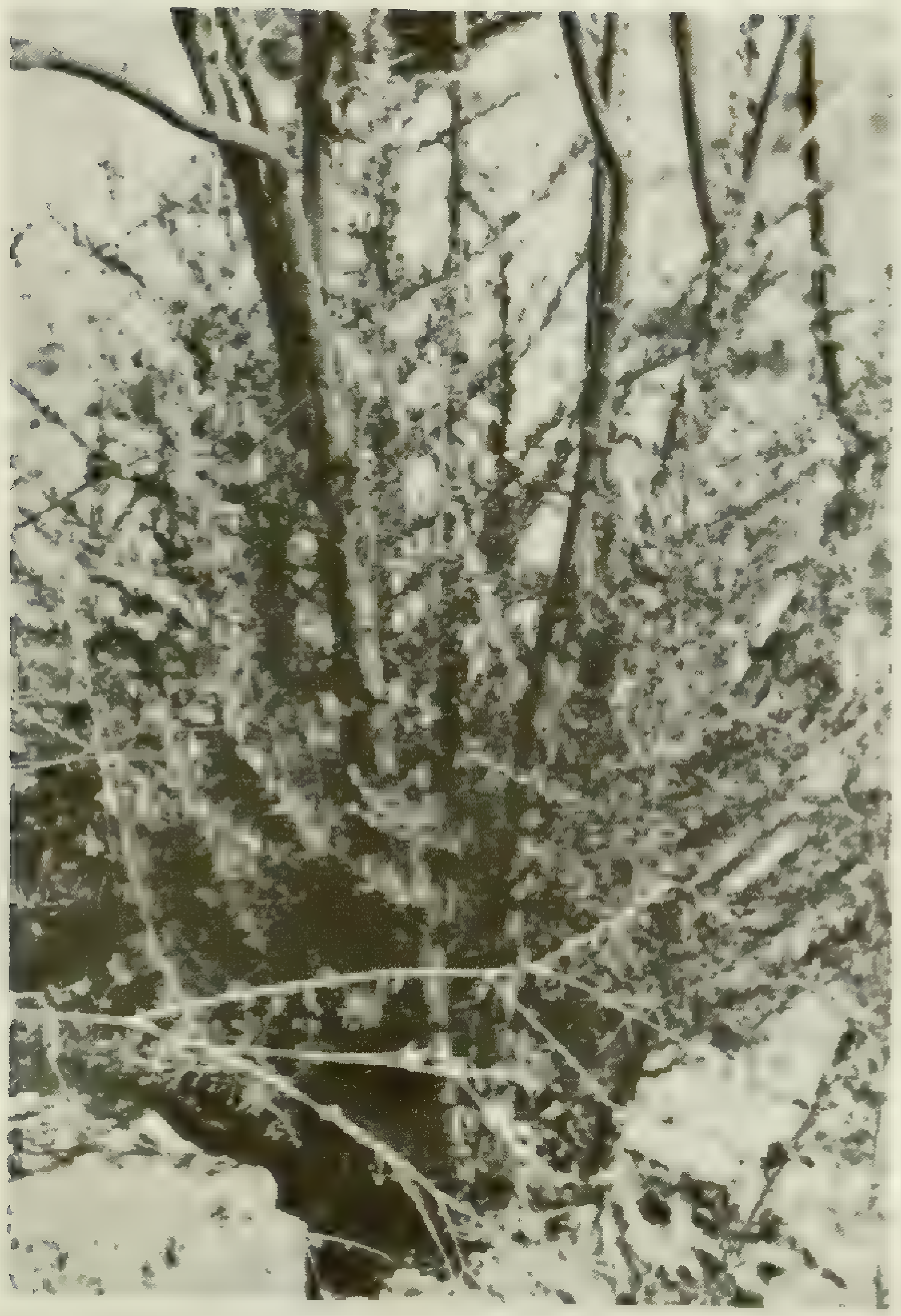
The fact remains that chaparral fires and the floods and mud slides which can result do pose enormous threats to man and urban development in Southern California. Cases such as the 1961 Bel-Air Fire that destroyed over 400 homes, the gigantic Malibu Fire less than two years ago, and the floods and mud flows of 1969 in Glendora and a number of other Southland communities (which followed fires in the fall of 1968) are etched in our memory. The approach that has been taken to eliminate such destruction, however, is in direct conflict with the nature of the chaparral. A rigid policy of fire exclusion in chaparral-covered areas has been followed for many years. To prevent and suppress all fires in chaparral for extended periods makes a fire when it does occur far worse and more destructive. In the words of Hanes (1971), "The fire-exclusion policy has one inherent weakness, i.e., its failure to reckon with time. Eventually, any stand of chaparral will catch fire and burn. Despite vastly increased expenditures there is no good evidence that chaparral wildfire can be prevented. . . . Chaparral fires are both natural and inevitable. A fire-exclusion policy does not prevent fire, it only forestalls fire. In chaparral stands where fire has been excluded for decades, the threat of fire is greatest. . . . " The more intense a fire in chaparral is, and this is related in part to the age of the stand and quantity of accumulated fuel, the longer it takes for the ecosystem to recover and for water runoff and soil erosion to return to normal. In very hot fires, for example, seeds normally scarified by heat may be killed and the burl of the resprouting shrubs may be destroyed, thereby delaying reestablishment of the cover vegetation.

OVER THE YEARS various proposals have been advanced as to what might be done about the fire problem. Several of these have suggested that chaparral should be replaced on a massive scale with ground cover plants that would not be as flammable. Large-scale conversion of chaparral, however, would not be a desirable step to take. To replace chaparral would drastically alter the ecological balance of the foothills and could set off a virtual chain reaction of uncertain environmental effects. Furthermore, to maintain converted areas against the natural tendency of the chaparral to restore itself is a major undertaking. Several years ago an experimental conversion program was undertaken at the San Dimas Experimental Forest in the San Gabriel Mountains. The purpose was to replace the brush with annual and perennial grasses to try to increase the amount of water from winter rains that would be available for human use during the dry season. Our mountain slopes and canyons with their vegetative cover act as natural reservoirs (watersheds) for holding rainfall and delivering it slowly to the valleys below via stream flow and seepage. Even though the water yield was increased from watersheds converted to grass, soil erosion also increased and the costs of establishment and of controlling brush regrowth were high. Other proposals to replace chaparral with exotic shrubs or ground-cover species almost invariably present the additional problems and expense of providing supplemental water to keep the plants alive during the long dry season. Such ideas are unrealistic when considering the total acreage in Southern California that would have to be irrigated. As Hellmers (1969) points out, "This idea of converting large areas of chaparral . . . to a grass, a prostrate, or a slow-burning species is an attempt to work against, instead of with, the ecological dynamics of the vegetation. Working contrary to the ecosystem is always expensive and difficult, especially so with chaparral species because they are adapted to an environment that is submarginal or detrimental for most species. . . . "

Prescribed Burning and Other Chaparral Management Tools

A better approach might be to accent chaparral as the best possible cover we can have on the slopes and then try to use fire to our advantage. A method that has been very widely used in this country and abroad to manage fire-type vegetations is the technique of prescribed or controlled burning. With this technique, vegetation is intentionally burned at

These chamise plants, burned in the Malibu Fire (Sept. 1970), have sprouted with vigorous new growth. In a few years the stand will be fully recovered.



Succulent new shoots in chamise and many other chaparral shrubs arise after a fire from dormant buds in the protected crown (burl).

specified intervals to keep the amount of flammable fuel below certain levels, thereby reducing the fire hazard. Prescribed burning would seem to be the ideal management tool to use in chaparral. However, the unplanned urban sprawl that fingers its way throughout the foothills and the notoriously unpredictable and explosive fire behavior of chaparral combine to make "control" of prescribed fires very difficult if not impossible. There is additional concern over the smoke from prescribed fires. To be acceptable to local residents burning would not only have to be safe but also carried out in a way that would not contribute substantially to urban air pollution.

DESPITE THESE difficulties, the feasibility of using prescribed burning, particularly in chamise-chaparral, should be more thoroughly investigated. It has been suggested recently (Hellmers 1969) that wide, horizontal strips might be burned safely on an eight-year rotational basis starting at the tops of the ridges and working downward. The strip burned one year would act as a barrier for the next year's burn. Such a plan might also reduce the problem of post-fire water runoff and soil erosion because only a portion of the slopes would be denuded at any one time — the vegetation above and below the burned strip would help stabilize the slope.

Where prescribed burning is impossible, for example, immediately adjacent to residential areas, the buildup of fuel could conceivably be reduced to safe levels by hand-clearing, utilizing work camp crews (M. C. Juhren, personal communication). In still other situations, hand-clearing might be used in conjunction with prescribed burning to produce low-intensity fires and to minimize the chances of having a fire escape and become a wildfire.

The existing network of U.S. Forest Service firebreaks in the mountains offers another potentially valuable management tool. These familiar bulldozed strips of land along the ridges serve to break up continuous stands of chaparral into large blocks. Within the blocks fires might be allowed to burn without attempts at suppression. Or the blocks could be treated as units in a prescribed burning program. Soil erosion on firebreaks has been a problem, and studies are currently under way for planting them with low-growing, drought-resistant species to produce what are termed "fuel breaks." The fuel-break idea could conceivably be applied to other wildland situations such as on mountain roadsides and around campgrounds to help reduce the staggering number of fires started indiscriminately by man either through carelessness or arson. The feasibility of irrigating fuel breaks using reclaimed sewage water is also being investigated.

Maintaining such irrigated areas in the mountains, particularly on the lower slopes adjacent to urban development, might be of value in fire hazard reduction. They would also serve to create new recreation areas and provide high quality wildlife habitat (Youngner 1970).

Direct Protection for Urban Development

Beyond the need to develop effective management techniques for use in chaparral, there is the demand to provide hillside residents with increased direct protection from fires, floods and mud slides. It is toward this goal that biologists at the Arboretum have been working for several years. We propose and enthusiastically support the creation of buffer zones or "green belts" for fire protection around homes and other structures in hillside residential areas (Montgomery and Cheo 1970). A green belt of this kind is formed by the localized removal of chaparral for 100 feet or more around a home followed by landscaping with ornamental plants of low flammability (fire retardant) that will help control water runoff and soil erosion from the slopes. At the heart of the green belt concept is the availability of water. With water a great variety of ornamentals with a high degree of fire retardance can be grown in the foothills. To be most effective the plantings need to be watered throughout the dry season and kept clean by occasionally pruning out dead material and removing litter and weeds to minimize the accumulation of burnable fuel. It must be emphasized that a green belt by our definition is a landscaped garden situation and differs quite distinctly from the wildland conditions of the surrounding foothills. Green belts are artificial barriers created and maintained in an effort to separate, and thereby protect, urban development from the chaparral.

WE HAVE RECENTLY published a brochure listing many low-growing, ground cover plants that have a greater or lesser degree of fire retardance

Following the Malibu Fire, numerous fire-dependent annual species have appeared on this slope.

Urban sprawl in the Los Angeles area that spreads and fingers its way into the chaparral has produced a serious confrontation between man and nature.

and which can be used in green belt landscaping. The brochure is entitled "Fire - Retardant Plants for Hillside Areas." Copies are available free of charge from the Arboretum or can be obtained by contacting the L.A. County Forester and Fire Warden, Forestry Division.

Green belts represent a potentially important tool for protecting urban development from brush fires, but they are not the whole answer. Efforts in the future must also be made to improve conventional fire fighting methods and to apply them effectively in hillside residential areas. In addition, zoning and building regulations must be strengthened to provide for more orderly and better planned development in the hills. Finally, rigorous fire safety ordinances need to be enacted. They would require for example, construction of homes using fire-resistant materials, installation of permanent irrigation systems on all property, and improvement of access roads to and from homes to facilitate the movement of fire equipment.

The relationships between man, fire and chaparral are extremely complex. Therefore, no simple answer or formula exists for dealing with the threats to human life and property associated with brush fire. A combined approach is needed. First, we must apply ecologically sound practices to the management of chaparral vegetation. Prescribed burning in one form or another may become important in this regard. Secondly, we have to provide effective, direct protection for people living in the foothills. Green belts seem to offer considerable promise for this purpose. Our ultimate goal must be to make the foothills as safe as possible for man while working with, not against, the basic nature of the chaparral ecosystem.

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Kenneth Montgomery is a biologist on the research staff at the Arboretum whose chief interest is in plant ecology. For the past five years he has pursued studies of flammability and fire retardance in plants and is currently engaged in work developing the green-belt concept as protection against brush fires.

A Specimen Cupaniopsis

Ross Goodrich

FOR A LONG TIME it has been Arboretum policy to let plants grow into their natural shape so far as possible. This usually means just enough pruning to keep them from becoming grotesque where forced out of shape by the nearness of other plants, or as a result of physical damage, or some inhospitable climatic condition.

There is a good point here. Some trees or plants in cultivation have been grown in only a highly restrictive shape. This is great for those who see a tree only as a straight trunk to six feet, with evenly spaced branches from there on up.

However, there are places where a tree left to grow in its natural form is more desirable and useful than one with a straight-up and out-branching shape. The beautiful *Cupaniopsis anacardioides* beside the Youth Education Building is a good example of this. Here, its natural, low branching habit has developed it into a canopy of green that shields an area of some forty feet across from the heat of the sun. It is more broad than tall — a distinct advantage in many landscaping situations — and in this location it provides an outdoor classroom during our warm-weather periods.

The tree was planted in 1950 and was left to develop as it would, with only the tips of the lower branches cut back at times to allow for the necessary foot passage beneath. It is very different from those grown to a single trunk with disbudding practiced from first upward growth. The appearance of the lower trunk is suggestive of the banyan tree; it is most interesting and attractive.

The tree does not change much in looks throughout the year. The rounding head of dark green shiny leaves is very regular in shape. Neither its blossoming nor

its seed-producing periods make much change. The flowers are small, and not showy. The seed capsules are similar to the pittosporums, opening in the same manner, but hanging on for only a short time. Heavy rains beating upon the tree have sometimes broken a branch or two, but the growth is replaced and the opening is soon filled in.

A word about the name. The correct name has always been *Cupaniopsis anacardioides,* but it has been known also as *Cupania,* a quite understandable abbreviation. The common name is carrotwood, derived from the flavor of carrots found in the peeled tip growth.

The sturdiness, appearance and usefulness of this specimen recommends it very much for planting in this area. It presents no troublesome disease or insect problems, and whether it is grown as a street tree or left to its natural shape, it is sure to bring pleasure to those who plant it.

Ross Goodrich is an Arboretum gardener responsible for the Asiatic-North American section.

(*Continued from page 29*)

We are also pleased to welcome the following new members of the California Arboretum Foundation:

John Paul Anderson
Mrs. R. Stanton Avery
Mr. and Mrs. Carroll M. Baker
Dr. Elaine M. Bascette
Mrs. Charles A. Blind
Mrs. D. C. Blindbury
Mr. and Mrs. Charles P. Bluth
Otis Booth
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C. Richard Bradley
Mrs. Betty Bridge
Gino J. Bruno
Mr. and Mrs. James L. Clarke
Mrs. E. L. Cline
Paul Colletti
Captain A. G. Davenport, USNR, Ret.
Mr. and Mrs. James L. Degen
Mrs. Henri De La Chapelle
Mrs. Allen Dragge
Mrs. Paul A. Erskine
Joseph N. Field
Floralia Guild — Chapter 20
Mrs. James H. Forgie
Mrs. William Freed
Mrs. H. C. Froeschle
Mrs. Henry G. Fry
Mr. and Mrs. O. B. Gains
Mrs. James C. Galloway
Mrs. Romelle Ganley
Mrs. E. H. Golisch
Ronald E. Gother
Mr. and Mrs. Ronald E. Gother
Mrs. R. M. Grua
Mrs. Julia Gunnoe
Mrs. Elenore R. Hamlin
Mr. and Mrs. B. Kenneth Hansen
Mr. and Mrs. Andrew T. Hardit
Mrs. Mary B. Hardy
Mrs. Kerstin Harenberg
Mr. and Mrs. Homer L. Hendrix
Mrs. H. G. Hinshaw
Mrs. Lathrop G. Hoffman
Mr. and Mrs. William F. Howe
Mrs. E. Eleanor Ingram
Mr. and Mrs. J. W. Johnston
Dexter D. Jones
Mr. and Mrs. Gordon H. Julien
Vincent Kanowsky
Mrs. Julius Kay
Laguna Beach Garden Club
Mrs. Harry E. Laughlin
Mrs. Clare R. Leonard
L. L. McDaniel
Mr. and Mrs. Sherman M. McFedries, Jr.
Mrs. Floyd McGowan
Mary L. Marshall
Mr. and Mrs. Everett Meek
Mrs. Howard L. Miller
Richard A. Miller
Edna E. Nelson
Charles J. Norona
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A. George Parker
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Harry F. Reilly
Mr. and Mrs. Henry L. Rice
Dr. Irene W. Roberts
Mrs. Harry W. Robinson
Miss Marlene T. Roth
Mrs. Jane E. Schott
Miriam Silinsky
Mrs. Edward Soza
Vera Joy Stephens
Mrs. Marilyn C. Stoke
Mrs. Charles Tackett
Mr. & Mrs. Robert B. Taylor
Miss Lois Van Aram
Mrs. John F. Verner
Mr. and Mrs. J. Richard Weidlein
Mrs. Eugene Woesner

A vote of thanks is due the following conscientious recruiters:

Don Camphouse
Mrs. Douglas Copley
Mrs. Daniel B. Curtis
Mrs. Peter L. Douglas
Mrs. Robert Edwards
George Forman
Mrs. Francis D. Frost, Jr.
Mrs. V. T. Gilchrist
Glenn Hiatt
Mrs. Alexander King
Mrs. C. G. Lanselle
Mrs. Leland Larson
Mrs. John R. Mage
Howard L. Miller
Frank Regan
Joseph Sprankle, Jr.
Mrs. Forrest Q. Stanton
Mrs. Charles Tackett

Photo: H. Byron Churchill

BOOKSHELF

PLANTS POISONOUS TO PEOPLE. By Julia F. Morton. Hurricane House, Florida, 116 pages, illustrated.

This recently published book deals with poisonous plants found in and around homes in Florida and other warm areas. 70 species are discussed in detail and 48 illustrated with full-page, good-quality color plates.

The author does not define what she considers to be a poisonous plant and includes in her lists species causing only a skin or respiratory irritation, such as chili pepper, lime, mango, cashew nut, cajeput tree (*Melaleuca quinquefolia*) and Brazilian peppertree (*Schinus terebinthifolius*). A poisonous plant is usually defined as one which under natural conditions contains a toxic substance in sufficient amount to cause illness or death in man or animal if eaten in sufficient quantity. Skin or respiratory irritations, no matter how severe, are not classified as poisoning by physicians. It seems to this reviewer that the book might more properly have been titled "Plants Hazardous to People."

As compared with fire, electricity, gas, matches, the content of the medicine cabinet, insecticides, chlorine bleaches and other common household hazards, poisonous plants generally are considered to be relatively harmless. Numerous case histories from the book, however, tell a different story.

The book is highly recommended to parents, teachers, youth leaders and homeowners who want to learn to recognize poisonous plants in their surroundings and to be prepared for possible emergencies. Although mainly written for Florida situations, the majority of the plants discussed are also found in Southern California.

Leonid Enari

BOUQUETS THAT LAST by Emily Brown. Hearthside Press, Inc., New York. 175 pg. 73 color plates.

This should be a lasting reference book for any flower arranger's library. The chapter on conditioning plant material covers all salient points as well as when and how to pick, and how to keep. Especially interesting is the complete list of plant material one can process and the list of commercial plants one can purchase to enhance any type bouquet.

Methods of plant preservation are gone into with great detail, plus many useful hints that the author has found to be of benefit. The chapter on the use of rocks, minerals, shells, and coral is a delight. It takes one on an arranger's hunt for these unusual forms that are used in creative design. The chapter on proper mechanics is well covered and should prove a handy guide for both the novice and experienced arranger.

Seventy-three color plates are beautifully done. The colors in plant material are almost true and make for beautiful reproductions. The alphabetical plant list is a must for any reference library. Each plant, with its botanical name, is described in detail together with suggestions for its most effective use.

Vi Brueckner

RECENT ACQUISITIONS TO LASCA LIBRARY

ECOLOGY OF TROPICAL AND SUBTROPICAL VEGETATION by Heinrich Walter. 539 p. Oliver & Boyd, Edinburgh. 1971.

A GARDEN BOOK FOR MALAYA AND OTHER TROPICAL COUNTRIES by Kathleen Gough. 422 p. 14 black and white plates. H. F. & G. Witherby. 1933.

INDOOR GARDENING FUN by R. Milton Carleton. 85 p. Reilly & Lee Books, Chicago, Illinois. 1971.

ECOLOGY OF LEAF SURFACE MICRO-ORGANISMS by T. F. Preece and C. H. Dickinson. 640 p. Academic Press, London, New York. 1971.

MESOPHYLL FIBRES IN EUCALYPTUS L'HERIT. AND ANGOPHORA CAV. by Stella G. M. Carr, D. J. Carr, and Lydia Milkovits. Extract from Annals of Botany, Volume 35 No. 139, 143-9 p. 3 black and white plates. Clarendon Press, Oxford. 1971.

GARDENING INDOORS UNDER LIGHTS by Frederick H. and Jacqueline L. Kranz. 242 p. Black and white photographs. The Viking Press, Inc., New York. 1971.

RESPIRATION RATE AND MITOCHONDRIAL ACTIVITY IN THE COTYLEDONS OF *PISUM SATIVUM L.* DURING GERMINATION by C. Kolloffel. Acta Bot. Neerl. 16 (3), September, 1967. 111-122 p.

ROOT-INDUCTION IN AVENA MESOCOTYLS BY INDOLEACETIC ACID by B. Huisinga. 123-124 p. Acta Bot. Neerl. 16 (3), September, 1967.

SMOG AND PLANT STRUCTURE IN LOS ANGELES COUNTY by Ruth Ann Bobrov Glater. 39 p. Black and white photographs. School of Engineering and Applied Science, University of California, Los Angeles. Report No. 70-17. 1970.

INTERACTIONS OF PHOTOPERIOD AND TEMPERATURE IN GROWTH AND DEVELOPMENT OF YOUNG TOMATO PLANTS by Trygve Kristoffersen. 98 p. Lund. 1963.

FUNGAL METABOLITES by W. B. Turner. 446 p. Academic Press. 1971.

FLOWERING AND SEEDING HABITS IN SOME SPECIES OF BANKSIA by S. T. Blake. Two black and white plates. Qd. Nat. 20 (1-3); 21-24 p. Queensland Herbarium, Brisbane. 1971.

TRANSPIRATION AND ITS CONTROL BY STOMATA IN A PINE FOREST by Paul E. Waggoner and Neil C. Turner. Bulletin of the Connecticut Agricultural Experiment Station, New Haven. 1971.

MECHANICAL PROPERTIES OF SOUTHERN SIERRA OLD- AND SECOND-GROWTH GIANT SEQUOIA by Robert A. Cockrell, Robert M. Knudson, and Alan G. Strangenberger. 14 p. California Agricultural Experiment Station. Bulletin 854.

METHODS FOR RESEARCH ON THE ECOLOGY OF SOIL-BORNE PLANT PATHOGENS by Leander F. Johnson and Elroy A. Curl. 247 p. Burgess Publishing Company. 1972.

SPONSORED FOUNDATION TOURS

Did you know that you can rent a whole tram? The cost is $1 per person, minimum 35 people. (Tram capacity: 45). A half hour film is available at no extra cost. Arrangements can also be made for lunch. Call the Foundation office (447-8207) for reservations at least two weeks in advance of the proposed tour.

FOR MEMBERS ONLY****

You may make advance reservations for seats on the tram by:

1. Calling the Foundation office (447-8207) the day before you wish to take a tour and requesting seats (number limited) for a specific time. Example: 4 seats for the 12:15 tour.
2. Picking up your tickets at the Foundation office on the day of your tour. Your tickets will be held for you until 15 mintues before departure time after which they will be given to the general public.

****We are very sorry, but this benefit cannot apply to group memberships.

Tram schedule: weekdays, 11:30-4
weekends, 10-4:45

Calendar

July - August - September

ARBORETUM, ARCADIA

July 1 through 4
Cactus and Succulent Show
Cosponsored by the Cactus and Succulent Society of America and California Arboretum Foundation

July 22 and 23
Begonia Show
Cosponsored by the San Gabriel Valley Begonia Society and California Arboretum Foundation

DESCANSO GARDENS LA CANADA

Bonsai Show
Sponsored by the Descanso Bonsai Society

July 9
Concert by the Monrovia Recorder Consort
(Call Gardens for time)

BIRDWALKS

Arboretum
Sponsored by Pasadena Audubon Society. 1st Sunday of each month, 8:30 a.m.

Descanso
Sponsored by San Fernando Audubon Society. 2nd and 4th Sunday of each month, 8 a.m.

South Coast
Sponsored by El Dorado Audubon Society. 3rd Wednesday of each month, 8 a.m.

SO. COAST BOTANIC GARDEN PALOS VERDES PENINSULA

July 7 through 9
Fiesta De Flores
Cosponsored by the South Coast Botanic Garden Foundation and the Department of Arboreta and Botanic Gardens
Hours: Friday 1-6; Saturday 10-6; Sunday 10-5.

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No. 3

Lasca Leaves

DEPARTMENT OF ARBORETA AND BOTANIC GARDENS
LOS ANGELES COUNTY

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Lasca Leaves

Published quarterly by the California Arboretum Foundation, Inc., for the Department of Arboreta and Botanic Gardens of Los Angeles County.

LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN

Editor
Donald S. Dimond

Cover photo by William Aplin

department notes

MEADOW BROOK

THE LATEST landscaping project at the Arboretum calls for a meadow with a brook running through it that starts at the foot of the Meyberg Falls and winds in a thousand-foot course to a terminal pond just across the road from the Upper Lagoon. The annual-perennial display garden and roads within this area, comprising approximately six acres, have already been cleared away.

The construction timetable calls for completion of contouring this month and planting in late October. Contouring will consist of shifting 7,700 cubic yards of existing earth into patterns of low rolling hills and valleys that will provide pockets for special gardens. Some very interesting and unfamiliar plants have been selected for the meadow brook area, and at this point it should be noted that the selection of these plants and the entire project is the imaginative work of the Department's contract landscape architects, Lang and Wood.

Among the many flowering trees to be planted are *Castanea mollissima,* the Chinese Chestnut that grows to 60 feet; *Chionanthus retusa,* known as the Fringe Tree, that grows to 30 feet; *Aesculus indica,* the Horse Chestnut, that grows to 60 feet; and the lovely, ornamental pear, *Pyrus calleryana,* variety "Bradford', that reaches 50 feet and has a 30-foot spread. Other trees to look forward to are five species of maple, three catalpas, and a number of dogwoods. A representative garden of magnolia is also on the planning board.

The entire area is intended to have a natural look about it The stream will be no more than eight feet wide and no more than three feet deep, measurements that take into consideration the capacity of recirculating pumps and other plumbing requirements. Visitors will come across different vistas as they stroll through the area: an open meadow at one turn, flowering trees and shrubs, wild flowers, deciduous and evergreen trees at others. The project, funded by the County and the California Arboretum Foundation, will unquestionably prove to be a major attraction. We can hardly wait.

SUNDAY LECTURES

WE WROTE ABOUT it in our last issue and we do so again, since success breeds both comment and repetition. Beginning January 14th of next year and continuing through June and picking up again in November following a summer hiatus, the Department will offer a total of twenty-one Sunday afternoon lectures and Sunday morning garden walks at all three facilities, thus enabling plant and nature lovers to enjoy the specialties of each of our gardens. A forthcoming announcement brochure will be mailed to all Foundation and Guild members.

NEW PRESIDENT

At a meeting of the Board of Trustees of the South Coast Botanic Garden Foundation last June 9th, Paul L. Saffo was elected president of the Foundation, succeeding Ove Hoyer. According to Foundation bylaws, Dr. Saffo, a medical doctor who has been a member of the Board since its inception in 1961, will serve for a term of one year. Among the new president's objectives are an increase in membership and a broadening of the organizational base so as to involve more members in Foundation activities.

SOIL SCIENTIST

Dr. Wade L. Berry, a specialist in soil science, has joined our research staff to lead a project aimed at recycling the millions of tons of sewage water and sludge produced by our industrial cities.

The project expects to achieve this worthy objective by determining the capacity of plant roots to absorb the pollutants in effluent water and by determining the horticultural practices that will make it possible to use quantities of sludge in the growth of selected plants.

Dr. Wade L. Berry

Dr. Berry comes well equipped to take on these tasks. A graduate of the University of California at Berkeley, his most recent work was in the Department of Plant Sciences at U.C. Riverside where, as Assistant Professor of Plant Physiology and Assistant Plant Physiologist, he divided his time between research and teaching, with major emphasis on research.

The new project, a joint effort of two County departments, Arboreta and Botanic Gardens and Sanitation Districts, will use 17 acres of land near Whittier Narrows as the field test site, and the research facilities at the Arboretum for the laboratory work. As Dr. Berry points out, oceans and landfill sites are limited in their capacity to absorb sewage water and sludge. If the work is successful, these pollutants can be safely reintroduced into the land on a continuing basis.

MEMORIAL BOOK FUND

Some of the most eloquent photography of the late Ralph D. Cornell is contained in the colorful booklets depicting the flowering plants of Southern California published jointly by Los Angeles Beautiful, the California Arboretum Foundation, the Southern California Horticultural Institute, and the Theodore Payne Foundation.

The publications committee for these booklets, led by Dr. Samuel Ayres, Jr., has long been striving to publish a single, hardcover book covering the many aspects of the subject. At a recent meeting, the committee decided that it would be appropriate to dedicate this projected book to Mr. Cornell. To bring it to reality, the California Arboretum Foundation has established a memorial book fund to which Mr. Cornell's many admirers are invited to donate.

PLANTS TO LOOK FOR

FRANK SIMERLY

FALL IS NOT the best time for flowers, but even so each of the Department's facilities will have blooms to attract the garden visitor. At the Arboretum some rare and beautiful trees are in flower during this season. Outstanding among them is *Chorisia speciosa* or Silk Floss Tree. The common name refers to large, avocado-like fruit that is filled with large quantities of kapok which surrounds the relatively small seeds. The trees don't develop much fruit in our area, especially in relation to the number of flowers. The flowers are so numerous that the tree resembles a huge candy floss cone during the fall when it is in peak bloom. The flower color varies from light to dark rose-pink, and individual blooms are often more than three inches in diameter. The Arboretum has selected and grafted plants that have a large dark pink flower which have been planted on Baldwin Avenue just south of the Foothill (210) Freeway. Several of these plants are likely to flower this year despite their small size. In fact, many of the plants flowered when they were still in containers in the Arboretum nursery. The parent plant that furnished the scion wood for grafting is on top of Tallac Knoll. It is one of several outstanding specimens of *Chorisia speciosa* growing at the Arboretum and is one of the older specimens that are well over forty feet in height. The Arboretum has tried an interesting experiment intended to cause the plant to grow with more restraint. An inverted graft is performed on the tree and the end result is a Silk Floss Tree with a moderate growth habit. You may see one of these small trees in flower at the east end of the main parking lot. More grafts of this sort are planned for the future.

Eucalyptus erythrocorys, north end of library building, Arboretum.

There are several other fall flowering trees. The fascinating *Eucalyptus erythrocorys* will display its numerous flowers made up of many yellow stamens covered prior to opening by a scarlet cap. The sharp contrast can be startling. Of course, it is among the Australian plantings. Also, *Cassia excelsa* (C. carnaval) will be in bloom during the early fall months and can be seen in several locations: outside the Gift Shop, south of the Research

Building, and on Tallac Knoll. This plant has been used successfully in La Cañada as a street tree and is destined for widespread use in Southern California according to many plantsmen. Another favorite among those who know plants is *Erythrina humeana var. raja.* This is one of the most beautiful of the coral trees. The Arboretum has an excellent specimen on the approach to the Demonstration Home Gardens.

SOUTH COAST

Erythrina humeana var. raja can be seen at our South Coast Botanic Garden and *Cassia excelsa* (C. carnaval) is an attraction there as well. This illustrates that some trees are so outstanding that duplicate plantings at our various facilities is by design. South Coast Botanic Garden has an excellent display of bougainvillea varieties to attract the visitors' attention. This kind of display helps in making a selection for home planting, since there are so many different varieties in nurseries to select from. At South Coast Botanic Garden you can view the many color varieties of bougainvillea and also see the growth habits, which may be anything from dwarf compact plants to large growing vines. Roses will be another early fall feature at South Coast, but our largest rose garden is in La Cañada.

DESCANSO GARDENS

At Descanso Gardens, in La Cañada, you will find modern roses in flower until Thanksgiving. This includes roses that have received the A.A.R.S. award, termed modern since the award was established in 1939. Descanso also has old-fashioned roses, but they flower at another time. The plants that are most associated with Descanso Gardens are camellias and they will begin blooming by October. The first blooms to be evident will be *Camellia sasanqua, C. hiemalis, C. oleifera, C. saluenensis* and varieties and hybrids of these species. It is among these species that we find camellias of infinite landscape use. There are low-growing groundcover types, such as *C. hiemalis* variety Showa-no-sakae, and every conceivable form from that extreme to the taller shrub types such as *C. oleifera.* Flower colors also vary from white through light pink to rose pink and many have a light fragrance.

Ginkgo biloba, at entrance to Herb Garden, Arboretum.

Some plants are found at all three facilities. For example, note the autumn flowering chrysanthemums in flower beds and in containers. Varieties such as 'Marble Top', 'Ann Lady Go', 'Magic Snow', and 'Magic Sunshine' will be just a sample of the many varieties on display. You will also find fall foliage at all facilities. Specimens of *Gingko biloba,* crape myrtle and some of the deciduous oaks are particularly prominent.

Make an effort to visit all of the Department's facilities this fall and you'll be surprised at how many flowering plants you will see.

Frank Simerly is superintendent of the Los Angeles State & County Arboretum.

Junipers for All Purposes in Southern California

William Hawkinson

THE GENUS JUNIPERUS is widely distributed throughout the northern hemisphere and below the equator in North Africa. It is a large genus containing approximately sixty species and hundreds of horticultural forms. Horticulturists and nurserymen have made numerous selections from various species, their mutations, and hybrids. Junipers are extremely valuable in landscaping because of their diversity of form and color, their hardiness, and their ability to withstand both low temperatures and hot dry conditions. They are adaptable to container growing, and many are amenable to pruning, shaping and shearing.

Junipers have been used for purposes other than in the landscape. Distillers use the fruit of *J. communis* to flavor gin. Oil distilled from the wood of *J. oxycedrus* is known as 'Oil of Cade' and has been used in medicine for the treatment of skin disease. Leaves and shoots of *J. sabina* are distilled to produce 'Oil of Savin' which has been used in medicine for its powerful diuretic properties. Oil distilled from the wood of *J. virginiana* is fragrant and is used for scenting soap and perfume.

The wood of various species has been used as lumber, but the most widely used is *J. virginiana,* its wood being used in cabinet making, for fence posts and other utilitarian purposes. Another American species used for making fences is *J. occidentalis. J. bermudiana, J. excelsa,* and *J. procera* are used as a source of lumber in the regions that they are native to, namely, the West Indies, the eastern Mediterranean, and East Africa. *J. recurva,* or Coffin Juniper, is a favorite wood for constructing coffins in Burma and is also burnt as incense in the Buddhist Temples of the Himalayas.

Of all the shrubs available to the homeowner, the junipers are without doubt one of the most unique and practical group of plants for home landscaping. Consider their uses: The prostrate forms are particularly valuable as ground covers, bank plantings, as a lawn substitute, as a cascade over retaining walls, in rock gardens, and as a subject to be used in low planters and in parking strips. The semi-upright vase and fountain-shaped forms are useful as accents among large groups of creeping types, in large planters, in foundation plantings, and in shrub borders. Tall, upright-growing columnar and pyramidal forms are useful in situations where accent plants and tall hedges are needed.

Growers of bonsai have found that many of the junipers are adaptable to their art. Junipers will grow in shallow containers, are relatively easy to train, and take on an appearance of venerable age. Some of the commonly used junipers in the art of bonsai are: *J. chinensis 'Torulosa'*, *J. c.* 'Femina', *J. c.* 'San Jose', *J. procumbens* 'Nana', and *J. scopulorum.*

When container growing suits your purpose, many of the junipers are suitable for growing in pots, tubs and hanging baskets. For tub growing the following forms of *J. chinensis* are easily trained: *J. c.* 'Mint Julip', *J. c.* 'Pfitzeriana Glauca', *J. c.* 'Robusta Green', and *J. c.* 'Torulosa'. Creeping forms of *J. horizontalis,* such as *J. h.* 'Wiltonii' and *J. h.* 'Bar Harbor', are worth trying in hanging baskets.

Junipers may be successfully grown in most light or heavy soils. Although they will tolerate alkaline conditions, a pH of 5.0 - 6.0 is desirable. Incorporation of an organic soil amendment is in order for most soils, and mulching after planting

J. virginiana 'Manhattan Blue'

View of juniper garden looking east.

would be advantageous for water-holding capacity of the soil and to reduce the weed population. Good drainage is a must and should be provided for in advance of planting. Junipers are light feeders and a light application once or twice a year of 16-4-4 fertilizer will satisfy their needs. Excessive amounts of nitrogen produce elongated internodes and care should be taken not to overfeed. Sometimes junipers are subject to attack from aphids; this can be controlled with malathion. Twig girdlers may cause browning of foliage and dying branch tips. This problem can be controlled by spraying with Sevin.

Recognizing the value of junipers in horticulture, the Arboretum set out to create a planting where horticulturists, homeowners, landscape students and others would be able to observe and study the many different types of junipers in a landscaped setting. To accomplish this objective, the Arboretum selected a prominent location north of the Peacock Pavilion for the garden. The area was graded, a retaining wall was constructed out of broken concrete, and the soil was amended with organic materials. The Arboretum gathered all the juniper varieties in the nursery trade in the greater Los Angeles area. Over one hundred and thirty specimens were planted and are now on display in the garden. For ease of identification, the plants have been provided with fiberglass labels.

To provide accent and contrast among the lower-growing forms and to create height and background in the plantings, the columnar and pyramidal shaped forms were used in groups and as single specimens. A few examples of this type used for accent were: *J. chinensis* 'Blue Point', a formal pyramid to eight feet with blue-gray foliage, and *J. chinensis* 'Columnaris Glauca', a twelve-foot columnar form that has blue foliage.

The semi-upright vase and fountain-shaped forms, useful in the landscape as accent plants, were used among the prostrate forms and in the foreground of the taller-growing types. A sampling of the selections used includes *J. chinensis* 'Blue Vase', which is vase-shaped to three feet with blue foliage, and *J. chinensis* 'Armstrongii', a semi-erect closely-knit shrub to four feet with light green foliage.

Prostrate forms are planted throughout the garden. The low growing *J. horizontalis* 'Bar Harbor', which has foliage that is blue in summer but turns purple in the winter, is planted so as to cascade over the concrete retaining wall. Another popular juniper used was *J. sabina* 'Tamariscifolia', a mounding spreader to eighteen inches in blue-green.

To further enhance the Arboretum's juniper garden and to completely utilize the area for its educational values, the Arboretum obtained all the ground cover types of sedums available in the nursery trade of the area. These sedums were planted in large drifts and they present an interesting contrast with the junipers. The following sedums were used: *S. album, S. anglicum, S. dasyphyllum, S. moranese, S. oaxacanum, S. spurium* and *S.* 'Utah'.

The Arboretum will continue to develop and expand its juniper collection as the young plants currently being grown in the nursery and other new varieties become available. A visit to this garden will help the homeowner in selecting the right juniper for his landscape situation and the following chart should assist further in the selection process.

William Hawkinson is assistant superintendent at the Los Angeles State & County Arboretum. A plantsman with a wide range of horticultural interests, Mr. Hawkinson's specialty is aril iris.

SHRUB-TYPE JUNIPERS

GROWTH HABIT	FOLIAGE COLOR
SEMI-UPRIGHT BUSHY:	
Juniperus chinensis 'Armstrongii'	light green
J.c. 'Aura Gold Coast'	green, golden tipped
J.c. 'Fruitlandii'	green
J.c. 'Hetzii'	frosty blue
J.c. 'Maneyi'	bluish cast
J.c. 'Robusta Green'	green
SEMI-UPRIGHT SPREADING:	
Juniperus chinensis 'Mint Julep'	mint green
J.c. 'Pfitzeriana'	gray-green
J.c. 'Pfitzeriana Aurea'	gray-green, golden tips
J.c. 'Pfitzeriana Glauca'	silvery blue
J. sabina 'Arcadia'	green
J.s. 'Blue Danube'	greenish-blue

SHRUB-TYPE JUNIPERS

GROWTH HABIT	FOLIAGE COLOR
J.s. 'Variegata'	deep green with creamy white speckling
J. scopulorum 'Table Top Blue'	silver-blue
J. squamata 'Meyeri'	gray-green
INFORMAL UPRIGHT:	
Juniperus chinensis 'Torulosa'	green
J.c. 'Torulosa Variegata'	green, accented yellow
PYRAMID:	
Juniperus chinensis 'Ames'	blue-green
PYRAMID:	
J.c. 'Blue Point'	blue-gray
J.c. densaerecta 'Spartan'	green
J.c. 'Iowa'	bluish-green
J.c. 'Keteleeri'	dark green
J.c. 'Wintergreen'	green
Juniperus excelsa 'Stricta'	gray-green
J. scopulorum 'Blue Haven'	blue
J.s. 'Chandler's Silver'	silver-blue
J.s. 'Colegren'	forest green
J.s. 'Moffetii'	blue-green
J.s. 'Pathfinder'	blue-gray
J.s. 'Platinum'	silvery-blue
J. virginiana 'Cupressifolia'	green
J.v. 'Manhattan Blue'	blue-green
COLUMNAR:	
J. chinensis 'Columnaris Glauca'	blue
J.c. 'Hetzii Columnaris'	green
J.c. 'Obelisk'	blue-green
J. sabina 'Cupressifolia Erecta'	green with undertones of blue
J.s. 'Gray Gleam'	gray-blue
J.s. 'Staver'	gray-green
J.s. 'Welchii'	silvery-green
GLOBE:	
J. sabina 'Lakewood Globe'	blue-green
VASES	
J. chinensis 'Blaauwi'	deep green
J.c. 'Blue Vase'	blue
TREE:	
J. chinensis	silver-blue, turns to dark green
J. pachyphlaea	bluish green

(Continued on page 67)

VEGETATION TO REDUCE AIR POLLUTION[1]

George P. Hanson and Linda Thorne

TREES and other forms of vegetation have long been employed to make man's surroundings more accommodating, but it is only recently that we have begun to realize the importance of plants in the alleviation of pollution. Air pollution is a serious problem of large urban centers. "Smog" is a term early used to describe the composition of Los Angeles air. An understanding of the chemical processes involved in the formation of smog is due to the pioneer work of Dr. Arie Haagen-Smit, Professor of Chemistry at the California Institute of Technology and member and former president of the Board of Trustees of the California Arboretum Foundation. The Los Angeles State and County Arboretum is among the earliest institutions that sponsored air pollution research concerning the effect of smog on plants and served as headquarters for experimental plant work by the County since 1953.

Early studies by Juhren et al. (1957) and by Noble and Wright (1958) established *Poa annua* and *Petunia hybrida* "Rosy Morn" as indicator plants to monitor pollutant concentrations throughout the Los Angeles air basin. These monitoring stations provided the data necessary to pinpoint major polluters. Noble, a keen observer and avid photographer, compiled hundreds of photographs of plant damage from air pollutants and assembled lists of smog-sensitive and tolerant plants. Such lists allowed homeowners to select for landscaping those plants which showed some air pollution tolerance. Studies by Juhren showed the effect of air pollutants upon the growth of roots in tissue culture and added to our knowledge of how damaging air pollutants are to plant growth. With air pollution becoming more of a problem to plantsmen, Noble and Juhren attempted to find a chemical which when sprayed on plants would enable the plants to better withstand the damaging properties of the pollutants. Many chemicals were tested including ascorbic acid, gum guaiac, and propyl gallate, and some were shown to partially protect the plant. Because of the various side-effects of these chemicals and the cost of application, however, none were recommended for general usage.

Another approach toward protecting a plant species from air pollution is to select within the species for those indi-

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[1] *The experimental data described in this article has been submitted for publication in the scientific journal, Environmental Pollution.*

viduals which possess some tolerance to the pollution. Most plant species retain a great wealth of genetic variability with respect to air pollution tolerance and breeders are actively breeding for increased tolerance in economically important plants. With the cooperation of John Mondry, a local petunia breeder for Bodger Seeds, Ltd., the authors initiated some studies to determine the mechanisms by which tolerant plants are able to resist the damaging effects of ozone, a major air pollutant in the Los Angees area. During subsequent fumigation experiments we noted that the plants were removing considerable quantities of ozone from the air in the exposure chamber. Recalling the work of our former director, William S. Stewart and his assistant D. H. Wilken (1966) who detected a significant reduction in the level of ozone beneath shade trees, we decided to determine the importance of vegetation as a natural "air pollution sink." This article reports some of our current findings and attempts to relate our laboratory data to field situations.

Trees are able to reduce the concentration of air pollutants in several ways depending upon the kind of pollutant involved. Dust and smoke particles settle out of the air as they pass through the foliage and are later washed into the soil by rain. Fluorides are rapidly absorbed by leaves and translocated to the leaf tips and margins where they accumulate and ultimately kill the tissue. Most other gaseous pollutants are adsorbed onto the leaf surfaces or are absorbed through tiny pores in the leaf known as stomates. Once inside the leaf, the pollutant often kills the cells with which it comes in contact.

Although little notice has been made in the United States of the proficiency of trees to reduce levels of air pollutants, scientists and city planners in the U.S.S.R. have promoted the use of trees for this purpose for several years. In fact, Novoderzhkina, et al. (1966) consider the planting of greenery to be "one of the most effective methods of combating air pollution." Pryakhin (1966) denotes these planted areas as "sanitary protective zones." He has set up rules for locating forest strips in such zones so as to minimize the effects of the pollutants on the neighboring residential areas. A major determinant for the placement of the trees is the direction of prevailing winds.

Our studies at the Los Angeles State and County Arboretum have been concerned with obtaining a quantitative estimate of the effectiveness of plants as air pollution absorbers and with identifying the conditions necessary to obtain maximum removal of the pollutants. Under laboratory conditions we have found that vegetation can remove up to 100 percent of the pollutant. To achieve high pollutant absorption it is necessary to have a very low rate of air exchange and large quantities of vigorous, rapidly growing plant material.

We find that a given type of vegetation under specified growing conditions is able to absorb a predictable percentage of the pollutant and further, that the percentage of the pollutant which the vegetation is able to absorb is relatively independent of the concentration of the pollutant in the ambient air. For example, air containing 0.50 ppm (parts per million) ozone which is passing through foliage of a Pasadena oak may have its ozone concentration reduced to 0.40 ppm (a 20 percent reduction). Similarly, air containing 0.20 ppm ozone would contain 0.16 ppm after passing through the same foliage under similar conditions.

A plant's rate of transpiration provides a rough index of its ability to cleanse the air (Thorne and Hanson, 1972). Gaseous air pollutants enter the leaf primarily through the stomates (see Hanson and Thorne, 1970), and it is through the leaf's stomates that water vapor is lost by transpiration. Thus, conditions which favor open stomates also favor rapid pollutant absorption.

We measure pollutant uptake in units of diffusion resistance, which is a measure of how long it takes a particular gas to diffuse a given distance. The resistance to diffusion is important, because if a plant is to remove an appreciable quantity of pollutant from the air, its resistance must be low enough to allow quantities of the pollutant to enter the stomates, yet not so low as to allow so much pollutant to enter that the plant would be seriously injured.

Table 1 gives values for the ozone diffusion resistances of several species. These data are laboratory determinations of average uptake rates and as such can provide only a general indication of what we may find in the field. Briefly, the data suggest that 1) tomato absorbs faster than the other species tested, 2) *Chrysanthemum* absorbs three times as fast as *Bougainvillea,* and 3) *Bougainvilea* absorbs twice as fast as mature *Camellia* foliage.

Our data suggest that the more sensitive is the species to ozone injury, the more efficicent is the plant as an absorber (the lower its diffusion resistance). Conversely, the more ozone tolerant the species, the less efficient it is as a pollution sink. Presumably less air pollution is entering the leaves of tolerant species.

Table 1. Ozone diffusion resistance for the various plant species tested under laboratory conditions. (The lower the figures the greater the absorption of ozone).

Species	Diffusion resistance (min/cm)
Herbaceous	
Lycopersicon esculentum (Tomato)	.071
Petunia hybrida	.073
Osteospermum fruticosum (South African Trailing Daisy)	.078
Chrysanthemum morifolium	.102
Woody	
Bougainvillea spectabilis	.333
Ginkgo biloba	.500
Quercus Engelmannii (Pasadena Oak)	.526
Camellia japonica	.667

$$\text{Diffusion resistance} = \text{cm}^2 \text{ leaf surface area} \quad \frac{(\text{ambient Oz concentration})}{(\text{flow of Oz into leaf})}$$

These distinctions appear to be true only when comparing species which differ greatly in their sensitivity to ozone. When several varieties of a given species of plant with lesser differences in ozone sensitivity are compared, their differing sensitivities are often uncorrelated with their absorptive capabilities. We suspect that there may be two basic mechanisms of ozone tolerance which plants can employ —functional tolerance and physiological tolerance.

Functional tolerance to ozone is concerned with the mechanical restrictions by which a plant prevents ozone entry into the leaf tissues. Mechanisms which would lend functional tolerance to ozone include size, frequency, and location of stomates. Size and frequency of stomates determine the percentage of interior leaf surface area which is potentially exposed to the pollutant. The location of the stomates also determines whether or not the pollutant can readily enter the leaf; stomates may be on only one or on both leaf surfaces, or they may be sunken in shallow or deep depressions below the level of the epidermal cells. In general, plants with stomates on both leaf surfaces are more sensitive than plants with stomates only on the lower surface. Sunken stomates provide for an airspace immediately outside the stomatal pore which is protected from air movements; thus the diffusion path length component of gas diffusion resistance is increased and the leaf is protected. One would expect a positive correlation between sensitivity and ozone absorption rate among plants which differ in tolerance due to functional mechanisms.

Mechanisms of physiological tolerance to ozone include: 1) extreme ozone sensitivity of guard cells which cause stomates to close upon contact with pollutant (Engle and Gabelman, 1966), 2) a higher fatty acid content in tolerant varieties which allows cell membranes to retain proper function longer in the presence of ozone (Tomlinson and Rich, 1969), and 3) a higher ascorbic acid content in tolerant varieties which provides an increased antioxidant defense against ozone (Hanson et al., 1970). Excluding mechanism 1) one would not expect to find a correlation between sensitivity and ozone absorption rate among plants which differ in tolerance due to physiological mechanisms.

In order to obtain some feeling for the magnitude of the absorptive effect of trees which one might expect, let us look at a couple of examples. It must be noted that these examples employ laboratory data which have yet to be adequately tested in the field. Assume that a city was to plant an additional 20,000 shade trees and wanted to estimate the trees' effect on the level of air pollutants. We may look at the problem in two ways—the trees' effect on the pollution level of the city as a whole, or the pollution level in the area immediately beneath the trees. If one wished to absorb the greatest total amount of air pollutants and be primarily concerned with the city as a whole, the trees should be widely spaced from each other and from existing trees. If, on the other hand, one were primarily interested in reducing the pollution level in a relatively restricted area, the trees should be planted so that their canopies are contiguous.

We calculate that the 20,000 trees well spaced from one another would absorb 90 lbs of ozone per day. To make this calculation we assume the following: 1) each tree has an average leaf area of 4×10^6 cm^2 (4300 square feet, a conservative estimate for a shade tree), 2) an average ozone concentration of 0.17 ppm per 8-hour day (typical pollution level during the summer in the San Gabriel Valley), and 3) an ozone diffusion re-

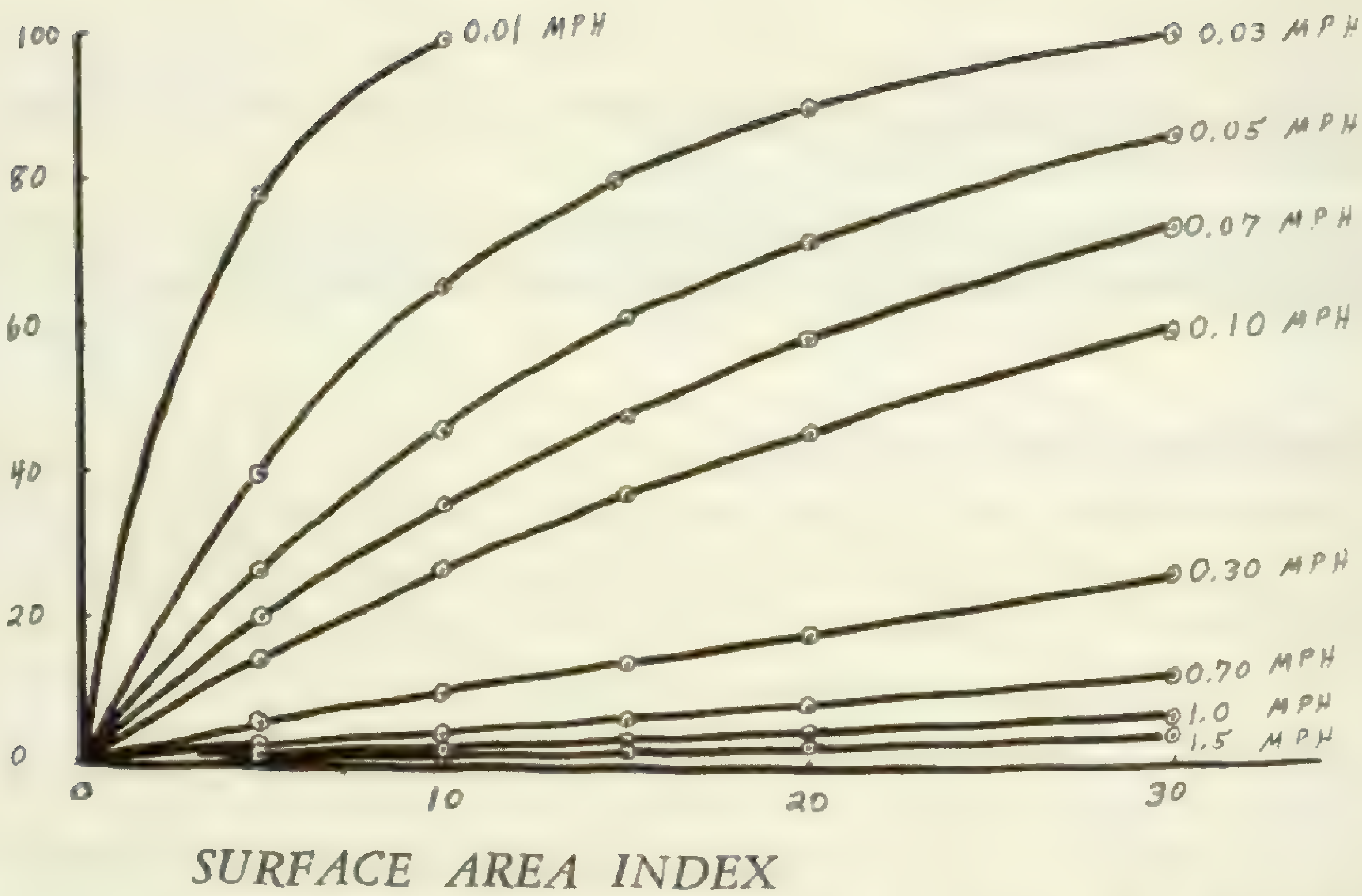

Figure 1. The percent reduction in ozone concentration in a protected area as a function of wind speed and density of vegetation (surface area index). These calculated values assume a diffusion resistance of 0.12 min/cm.

sistance of .33 min/cm (.33 min/cm is a conservative rate of absorption for a vigorous shade tree). If we consider the trees' ability to absorb the primary pollutants, NO_x and hydrocarbons, we might expect an even greater reduction in the ozone burden of the city each day. When compared with the several hundred tons of ozone which are present in the Los Angeles air basin, this reduction of 90 lbs. seems insignificant.

It would be interesting, however, to calculate what would be the ozone burden in the same air basin if all trees, shrubs, and other vegetation were not present. The pollution level would then be significantly higher. For instance, the data of Hill (1971) show that each square mile of soil covered with a plant like alfalfa will absorb nearly 900 lbs. of ozone per day. We estimate that a square mile of *Osteospermum fruticosum* "Snow White" (a widely used Arboretum plant introduction) would remove 760 lbs. of ozone per day. Thus, our existing vegetation is probably absorbing massive quantities of air pollutants and we would do well to maintain as much vegetative cover as possible.

If the 20,000 trees were planted in such a way as to provide a complete vegetative canopy over a portion of the city, we might expect a significant reduction in pollution levels experienced by the inhabitants of the protected area. The protected area in this instance must have a canopy and vegetation density sufficient to prevent polluted air from moving into the canopy from the top at a velocity greater than 0.1 mile per hour. In addition, the area beneath the trees should be occupied by various ground covers, shrubs, and other vegetation. If these conditions are met and if the plants absorb in nature at a rate comparable with that found in the laboratory, we would expect the ozone level to be reduced about 27%. Thus, on a day when the ozone concentration reaches the Los Angeles County school alert level (0.35

ppm), a person within this protected area should be experiencing a more tolerable 0.26 ppm. This prediction is obtained from the values in Figure 1. Data for this graph were calculated by assuming an average diffusion resistance for the vegetation of 0.12 min/cm. Representing the surface area index of the vegetation by 10 for the example above, it can be seen from the graph that if the surface area of the vegetation per unit of soil surface is increased, or if the rate of polluted air movement into the protected area is reduced, the amount of ozone present in the protected area will decrease. The percent-ozone-reduction values predicted by this graph agree fairly well with the limited field data we have obtained thus far.

Through funds obtained from the Environmental Protection Agency, we have purchased equipment and obtained the technical assistance necessary to make preliminary tests of our hypothesis that vegetation in proper planting arrangements can serve to significantly reduce the concentrations of air pollutants within the protected area of a heavily polluted city. We hope to soon be able to provide quantitative data to substantiate the "sanitary protective zone" concept of the Soviet workers.

For some time, the Los Angeles State and County Arboretum has advocated the establishment of green belts to help protect hillside residents from the ravages of brush fires and mud slides. These well-watered-and-maintained 100-foot belts of fire-retardant vegetation around residential areas are designed to slow the spread of a fire and make it less likely to consume homes (Montgomery and Cheo, 1970). We believe that a different kind of green belt planting will in another way help protect inner city residents from another environmental menace—air pollution.

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Dr. George Hanson, senior biologist at the Arboretum, is engaged in a long-term study of the relationship between plants and air pollution. He has been assisted in this work by Linda Thorne, a student research aid.

Oleander nerium cultivars Dwarf Pink (Cover) and Dwarf Salmon

Oleander *(Nerium oleander L.)* is one of the best general ornamental shrubs available for areas with wild winters and long, hot, dry summers. Probably no other ornamental shrub found in Southern California gardens can withstand more underwatering, overwatering, neglect, drought, poor drainage, and high salt content in soil, as this species from the Mediterranean region.

In cultivation it occurs in numrous forms differing mostly in the flower color, which can be white or shades of pink, salmon, red or yellow. Approximately 50 forms (cultivars) offered by various nurseries in the United States are listed in the Sixth Edition of the Plant Buyers Guide. They all are vigorous sturdy shrubs reaching a maximum height of 8 to 12 or even 15 ft.

The standard *Nerium oleander* is an evergreen shrub which grows up to 15 (20) feet tall. Leaves are simple, narrowly elliptic to oblong-elliptic, entire, up to 1¼ (1½) inches wide, glabrous, dark green above, paler beneath, thick, leathery. Flowers are white, pink or red, up to 2 (3) inches across(pediceled, in many-flowered terminal clusters (cymes). There are 5 sepals forming a 5-lobed calyx and 5 petals forming a 5-lobed corolla, 5 stamens (the anthers with long appendages at the apex and two tails near the abse), and one pistil. Fruits dry, of 2 follicles.

In 1968, Maurice Machris, a member of the Board of Governors of the Department of Arboreta and Botanic Gardens and a trustee of the California Arboretum Foundation, presented to the Arboretum cuttings of dwarf oleanders he had brought back from the Nairobi Botanic Garden, Kenya, which had developed single plants of each type. The cuttings were rooted and test-planted at different sites on the Arboretum grounds. They proved to be gentic dwarfs, flowering profusely when only to or three feet tall, a height they seldom exceed. There were two color forms, pink and salmon. Both forms were released to the Monrovia Nursery in 1971 as *Nerium oleander* cv. Dwarf Pink and *Nerium oleander* cv. Dwarf Salmon.

Cultivation of the dwarf oleanders should be very much the same as those of the standard forms, except being smaller and having weaker root systems they probably are more affected by adverse growing conditions than their more vigorous counterparts. For this reason, regular watering during dry periods would be advisable.

To keep the plants in healthy condition, attention should be paid to aphids and scales. The aphids are controlled with malathion in the spring and the scales with malathion, cygon, diazinon or sevin in the summer.

Propagation is by cuttings of mature leading shoots which can be rooted in sand or water and afterwards carefully planted in soil.

All parts of the oleander plant are poisonous, if eaten. Children may be poisoned by sucking on flowers, leaves, or stems. For this reason, oleanders should not be planted in areas where they are in easy reach of small children.

Leonid Enari, Ph.D.
Senior Biologist
Los Angeles State and County
Arboretum

(Continued from page 59)

GROUND-COVER TYPE JUNIPERS

GROWTH HABIT	FOLIAGE COLOR
LOW SPREADERS:	
Juniperus chinensis 'Sargentii Glauca'	gray-green
J.c. 'Sargentii Viridis'	green
J. horizontalis 'Emerald Spreader'	emerald green
J.h. 'Emersons Creeper'	silver-blue
J.h. 'Hughes'	jade green
J.h. 'Jade Spreader'	gray green in summer, plum in winter
J.h. 'Plumosa compacta'	turquoise green
J.h. 'Turquoise spreader'	green with bluish cast
J.h. 'Webberi'	blush green
J. procumbens 'Nana'	green
J. sabina 'Buffalo'	dark green
J.s. 'Scandia'	silvery-blue
J. virginiana 'Silver spreader'	
LOW TRAILERS:	
J. conferta 'Blue Pacific'	blue-green
J. horizontalis 'Bar Harbor'	plum in winter, silver-blue in summer
J.h. 'Wiltonii'	silver-blue
MOUNDING SPREADERS:	
J. sabina 'Broadmoor'	green
J.s. 'Tamariscifolia'	blue-green
PROSTRATE 2 FEET TO 3 FEET TALL	
J. chinensis 'San Jose'	sagegreen
J. Procumbens 'Variegata'	gray-green, high lighted creamy white
J.p. 'Variegata Golden'	gray-green, high lighted gold
J. squamata expansa 'Parsonii'	gray-green

ARBORETUM WEATHER

Long. 118°02'59" W.
Lat. 34°08'48" N.
Elev. 571.28ft.

Weather season: Oct. 1 to Sept. 30

	June	July	Aug.
Highest Temperature	99	106	104
Lowest Temperature	50	53	57
No. of days above 90°F	7	22	16
No. of days above 100°F	0	6	2
Average Maximum	84.7	92.9	88.7
Average Minimum	58.5	61.3	63.9
No. of clear days	12	21	16
No. of partly cloudy days	15	9	11
No. days of rain	3	0	2
Rainfall	.13	0	.29
Rainfall measured from Oct. 1, 1971	7.65	7.65	7.94

NEW FOUNDATION MEMBERS

	NAME	SUGGESTED BY
A	Adams, Mr. and Mrs. Gordon O.	Dr. James Ayres, Jr.
A	Allen, Mr. and Mrs. William A.	James Curry
A	Armstrong, J. Awdry	Men's Garden Club
A	Breckenridge, Mr. and Mrs. G. R.	Mrs. Donald Kagy
A	Bromberger, Mr. and Mrs. F. S.	Foundation Office
A	Bryant, Mrs. J. B.	Mrs. Miriam P. Kirk
C	Bucklin, Mrs. William N., Jr.	Mrs. Peter L. Douglas
A	Burrows, Mrs. Mary	Mrs. Edna Lenz
A	Clement, Mrs. Norman P., Jr.	Mrs. Peter L. Douglas
A	Crowe, Mrs. Arthur L., Jr.	Mrs. Jerome K. Doolan
A	Davis, Mrs. George A.	James Curry
A	Dellwo, Mr. and Mrs. Fred H.	Special Monthly Tram Tour
S	Doty, Walter L.	Francis Ching
A	Earl, Mrs. Joseph B.	Las Voluntarias
A	Eldridge, Charles R.	Mrs. Forrest Q. Stanton
A	Garneau, Mr. and Mrs. Leon H.	Home Gardening Class
A	Gunther, W. J.	San Diego Floral Association
A	Hagerty, Mrs. Joyce C.	Foundation Office
A	Hansen, Mrs. Marie A.	Mrs. Harry W. Coffin
A	Harper, Mrs. R.	Mrs. Miriam P. Kirk
A	Hartman, Mrs. Myrtie P.	Rudolph Hartman
A	Hays, Miss Christine Marie	Mrs. Stephen Howard
A	Hayward, Mr. and Mrs. Gary K.	Foundation Office
A	Jagels, Mr. and Mrs. George	Mrs. Jerome K. Doolan
A	Jones, Mrs. Nelson	Mrs. Robert Cheesewright
A	Lawson, Mr. and Mrs. Bruce M.	Dr. Samuel Ayres, Jr.
A	MacDonald, Mr. and Mrs. Arthur D.	James Curry
A	Massey, Curtiss A.	Foundation Office
A	Meyer, Mrs. Robert G. H.	Francis Ching
A	Moyer, Mr. and Mrs. Glenn W.	Dr. Samuel Ayres, Jr.
A	Pagone, Mr. and Mrs. Joseph J.	Foundation Office
C	Papay, Dr. and Mrs. Lawrence T.	Special Monthly Tram Tour
A	Patty, Mrs. Frank	Mrs. Miriam P. Kirk
A	Pearson, Mrs. Lloyd	Mrs. Miriam P. Kirk
A	Phillips, Dr. and Mrs. C. Stanley	Foundation Office
A	Pillsbury, Joseph W.	Foundation Office
A	Rancho de Duarte Garden Club	Mrs. Ted Hansen
A	Rigby, Mrs. John	Mrs. Alexander King
A	Rinebold, Miss Judy Ann	Foundation Office
A	Robinson, Mr. and Mrs. John H., Jr.	Men's Garden Club
A	Sandage, Mr. and Mrs. Allan R.	Foundation Office
A	Schlinger, Mr. and Mrs. William	Mrs. Norman Day
A	Schneiders, Mr. and Mrs. E. F.	Men's Garden Club
A	Snyder, Mr. and Mrs. William E.	Mrs. C. H. Perier
A	Strohmaier, Mrs. Erwin	Mrs. John Fehrer
A	Tapper, Robert	Foundation Office
A	Templeton, Dr. Bonnie C.	Foundation Office
A	Thompson, J. E.	Foundation Office
A	Voight, Mr. and Mrs. Allan	Foundation Office
A	Wallien, Mr. and Mrs. William	Foundation Office
A	Wallis, Mrs. John	Foundation Office
A	Wegge, Mrs. William A., Jr.	Foundation Office
S	Weiler, Ralph J.	Mrs. Forrest Q. Stanton
A	Wheeler, Mr. and Mrs. Marshall A.	Mrs. L. R. Sloan, Jr.
A	Wood, Mr. and Mrs. Richard B.	Don Dimond

A — Annual Membership

C — Contributing Membership

S — Sustaining Membership

od Ducks, Lasca Lagoon, Los Angeles State and County Arboretum Photo H. Byron Churchill

BOOKSHELF

MAN IN THE LIVING ENVIRONMENT: Report of the Workshop on Global Ecological Problems. Workshop Coordinator, John Kadlec; Editor, Linda Weimer; illus. by Paul Fuchs, U. of Wisconsin Press, 1972.

WORLD ECO-CRISIS: International Organizations in Response. Editors A. K. David and E. B. Skolnikoff, U. of Wisconsin Press, 1972.

Appropriately printed on recycled paper, these two books stand out among the profusion of writings on environmental science for the breadth of their treatment of the subject. Rather than focusing simply on pollution, the scientists, each of high rank in his field, present "the interactions among living organisms and the properties of whole ecosystems." Although these are complex indeed, the presentation is clear and the writing non-technial.

The two books differ in plan. "Man In The Living Environment" is the product of a workshop of some fifty scientists divided into four task groups.. There are sections on population in connection with resources, the cycles of essential elements, ecosystems for human benefit such as self-maintaining natural systems, intensively and less intensively managed agricultural systems, alternate possibilities, aquatic resources, etc.

Many excellent diagrams are provided wherever a graphic presentation seems helpful.

A brief conclusion and a recommendation follows each chapter. Readers who are already familiar with much of the data may wish to skip to the recommendations. In fact, the book might be read for the recommendations alone, though they have more cogency if the preceding material has been read.

Participants in the workshop, drawn from many sectors, included lawyers, economists, English professors and science writers. Scientists came from Mexico, Australia and Canada as well as from U.S. universities. Besides the latter, institutions such as the Smithsonian, Oak Ridge, Woods Hole, the Forest Service, National Youth Council, and U.S. Department of Agriculture were represented. (Feminists may note the complete absence of women scientists; possibly of high-ranking ones there may not be one in fifty).

WORLD ECO-CRISIS consists of individual articles dealing with the practicalities of a global effort toward environmental control.

Two contributors, D'Arge and Keese, offer a table showing the calculated change in income resulting from the imposition of environmental controls on the five leading industrial nations.

Araujo-Castro, a career diplomat, presents the case for developing nations with bitter sarcasm and complete mistrust.

The difficulties which would be encountered by the developing nations are also considered by D'Arge and Keese and by Brian Johnson, who suggests financing of controls in the poorer nations by the richer ones. Johnson holds out hope that global control will so promote the "One World" feeling that wealthy nations will be more willing to relieve poverty wherever it exists. Not all controls would be costly, either, for some of the erosion control and land management schemes would have good effects in a very short time.

Commitment to the policy of demanding immediate action on environmental issues is sometimes slowed by the split in the scientific community between those who wish to take time for further study and those who feel that action now is of utmost urgency. Johnson explains this on the ground that the "reductionist" is usually a specialist who sees problems singly and calls for time to examine a particular phenomenon. The activists "see the problems and solutions in a more integrated framework . . . for instance, they link population growth projections with figures on raw material scarcities."

Population growth is of course one of the thorniest issues. The questions it raises are religious and philosophical as well as emotional and, to the extent that they are so, cannot be resolved by scientific enquiry. Without some cessation of population increase, however, none of the scientists involved in this study can foresee a solution of the problem of non-renewable resources nor, for that matter, a likelihood of the solution of many other problems.

Since these books were prepared in time for the 1972 U.N. Conference on the Human Environment, the reader may wonder which of the recommendations may have had some success there. In much of the popular press the Conference was described as a fiasco because of so much political wrangling. This was not quite the case. The actual work was done quietly, much of it in small committees which simply reported to the Conference. Some results are these:

Approval of a monitoring plan called "Earthwatch," which is to be an international system covering air quality, aquatic habitats, soils, animal life, and food contamination by chemicals;

Commercial taking of whales is to be discontinued for a period of ten years;

An international registry of chemicals will monitor the use and transfer of toxic materials.

According to Time magazine, there was progress in achieving agreement to minimize the release of toxic materials into the atmosphere and to reduce the production of synthetic materials while increasing the manufacture of non-polluting substances. In essence, the moderate view was subscribed to, that while cessation of economic development would be disastrous, there can be a definite shift to kinds of development that have minimal effect on the environment.

A resolution was passed that the richer nations would pay expenses faced by poorer, developing nations in curbing environmental pollution. The U.S. refused to pay any share of this, and even opposed compensation for damage suffered by poorer nations through the activities of wealthy ones, (for instance the damage by mercury to Peru's fisheries). The U.S. also refused to contribute its full share to "Earthwatch." It did, however, promise $40 million over the next five years toward a U.N. environmental fund.

There was a feeling that little of actual importance will be accomplished without support from the U.S. But it was pointed out, not to say rubbed in, that the U.S. cannot be a leader in the preservation of the environment while engaging in a war which devastates enormous amounts of land and causes much irreversible damage.

—Marcella Juhren

THE GARDENER'S YEAR, by Karel Capek, translated from the Czech by M. and R. Weatherall. Illustrated by Josef Capek. (Allen and Unwin, 1931. Reprinted in paperback by Macmillan).

If perusal of such books as those reviewed above has left you weary, *The Gardener's Year* should restore you. Capek, best known for his famous satire, R.U.R., which introduced the word "robots" into the English language, (Rossum's Universal Robots) writes here in good-humored, somewhat whimsical vein. There are plenty of chuckles in the unpretentious little book, which is pervaded with a subtle wit and much pure beauty. Credit should go to the translators for following what can only be the original style and finding the simple words that seem so exactly right. The book is still timely and should remain a minor classic. It may be read in the Arboretum Library and in the Altadena Public Library.

Purportedly, we have here the spontaneous outpourings of a man totally possessed by the passion of gardening, carried along on gusts of amazement and bemusement with a W. C. Fields-air of bumbling. Few who garden with their own hands will fail to recognize some of their own boners and impasses. The gardener (is it the author?) nevertheless perseveres.

He succumbs to the magic of names, for "a flower without a name is a flower without a metaphysical idea; in short, it has not a right and metaphysical reality." And names he gives us, in and out of parentheses, and he assures us that one who has not cultivated all these flowers "has not seen the most graceful thing which this harsh earth has produced in a moment of tenderness (which lasted only a few thousand years)."

It is likely that Capek had the political as well as the horticultural world in mind when he says, "There is a lot going on underground. The future is not in front of us, for it is here already in the shape of a germ. We don't see germs because they are under the earth. We don't see the future because it is within us . . . if we could only see how many fat and white shoots are pushing forward in the old tilled soil, which is called the present day . . . we should say that our melancholy and distrust was silly and absurd." (Brave words, but Capek, sent to prison in winter, died of the "pneumonia" so prevalent among outspoken political writers of his day).

If there is one facet of gardening about which the gardener of this book is more enthusiastic and more eloquent than any other, it is that of composting a good soil. It is done, he says, with such things as dung, leafmold, sod, straw, baby powder, knocked-out pipes, water, beer, burnt matches, dead cats— I am mentioning less than a third of them, but phosphates are included. Then you will end with a soil "puffy like pastry, warm, light, and good like bread, and you will say of this that it is beautiful, just as you say so of women or of clouds."

So we the readers return again to the environment, and to recycling, though in pleasanter vein. Any gardener who maintains a compost pile may consider himself a good conservationist and may avail himself of his bit of the 90-year supply of phosphate, since none will be lost. If ever the science fiction tales come true, in which a daring adventurer returns from an underground support system to the ruined surface of the earth, he will likely find small hospitable places on it, more agreeable, yielding and productive than the rest. They will usually be square or circular in form. For these will have been the gardens.

—Marcella Juhren

Calendar

October - November - December

ARBORETUM, ARCADIA

October 28 and 29

Fall Flower and Garden Show
Cosponsored by the California
Arboretum Foundation and the
Pasadena Star News
Hours: Sat. 1-5; Sun. 9-5:30

December 9 and 10

Early Camellia Show

December 14

Holiday Open House at
Santa Anita Depot
Hours: 7 p.m.-9 p.m.
Refreshments

DESCANCO GARDENS
LA CANADA

October 28 and 29

Chrysanthemum Show in
Hospitality House
Cosponsored by Glendale
Chrysanthemum Society and
Descanso Gardens Guild

December 2 through 12

Christmas Decorations Exhibit

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1972
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No. 4

Lasca Leaves

DEPARTMENT OF ARBORETA AND BOTANIC GARDENS
LOS ANGELES COUNTY

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CALIFORNIA ARBORETUM FOUNDATION, INC.

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LOS ANGELES STATE & COUNTY ARBORETUM — DESCANSO GARDENS — SOUTH COAST BOTANIC GARDEN

Editor
Donald S. Dimond

Cover photo by William Aplin

department notes

NEW GOVERNORS

THE GOVERNING body of the Department of Arboreta and Botanic Gardens is the 25-member Board of Governors appointed by the Board of Supervisors for three-year terms. We are pleased to welcome three new members: Dr. Jenny L. Batongmalaque, appointed by Supervisor Kenneth Hahn; Marilyn C. Stoke, appointed by Supervisor Pete Schabarum; and Merrill J. Cate, appointed last July by the late Supervisor Burton Chace.

25TH YEAR

ON FEBRUARY 20, 1948, articles of incorporation were signed establishing the California Arboretum Foundation and marking the beginning of the Los Angeles State and County Arboretum. Twenty-five years later, on the same date, a party will be held in the Mediterranean Room at the Brookside Clubhouse in Pasadena celebrating that signing in a number of ways. Honorary life memberships will be bestowed on the founding fathers and on longtime supporters. A history of the past will be available in a limited edition, hard-cover book and will also appear in the March issue of *Lasca Leaves*. The party is being held at the Brookside Clubhouse because the Arboretum lacks facilities large enough; even so, attendance will be limited to the first 350 who respond to the announcement, due after the first of the year. As the Foundation approaches its 25th anniversary the many activities planned for 1973 mark its identification with the new emphasis on the theme: the Arboretum is for people. Among the activities every supporter is looking forward to are Baldwin Bonanza III, another Queen Anne Frolic, field trips to Santa Cruz and Anacapa Islands, and the Hugo Reid Roundup.

MEADOW BROOK

CURRENT visitors to the Arboretum are having a fine time watching the work on the Meadow Brook, an exciting project described in our last Department Notes. Of particular interest is the construction of the 1,000-foot stream bed consisting of, first, a layer of heavy polyethylene film, then pumped concrete, then the placement of 300 tons of large rocks and 50 tons of cobble stones, and finally a layer of colored cement to give a completely realistic look which, indeed, it does have. The project is being financed by the County and by matching funds raised by the California Arboretum Foundation from two past fund-raising events, the Queen Anne Frolic and Baldwin Bonanza II.

NEW GATEHOUSE

GROUND WILL be broken this month for a new gatehouse located just to the east of the hitherto practically unused steps to the rotunda. The old gatehouse will be used by Las Voluntaries who have been looking forward to having a home on the grounds of their own. Financing is again being handled through matching funds by the County with the California Arboretum Foundation raising funds through special events. The new gatehouse will alter the traffic flow, directing entering visitors up through the rotunda within easy reach of nearby attractions like the Demonstration Home Gardens, ground cover and juniper display gardens.

NEW SUPERVISORS

LASCA LEAVES extends felicitations, greetings, and a subscription to new members of the Board of Supervisors: James A. Hayes and Baxter Ward, both of whom have expressed interest in the magazine and its purposes.

Supervisor Baxter Ward

Supervisor James A. Hayes

LIVING CHRISTMAS TREES

THIS SEASON'S greeting from the Arboretum carries the message: Make this the year of the living Christmas tree. The concept has ecological, practical, and esthetic advantages. To begin with, there is the possibility of greater variety—trees like junipers, cypress, Japanese black pine, Aleppo pine, and *Podocarpus macrophylla,* to name a few, each having its own distinct form, each suggesting original decorative ideas, yet all in keeping with Christmas tradition. Living trees have less leaf or needle fall and retain their fragrance longer. And when the new year arrives, they can be planted out in the yard instead of tossed into the alley for the sanitation men, or they can be left in their containers, moved outside and saved for one to several years. In support of its Christmas message, the Arboretum will have 15 different living trees on display in the rotunda before and during Christmas week, many of them decorated. And for visitors who find a tree they like there will be information leaflets available telling how to transplant and care for them following the holidays.

GARDEN FOR ALL SEASONS

IN THE horticultural world few ideas are more attractive than having a garden that in one or more parts is blooming or bearing all seasons of the year. The one absolute requirement in bringing such an idea to reality is a climate in which seasonal changes are mild to nonexistent. Clearly, Southern California qualifies. With the financial assistance of the Ortho Chemical Company, producers of a number of different kinds of garden books, the Arboretum has started such a garden just north of the Demonstration Home Gardens and the Juniper Display Garden. Tended entirely by members of Las Voluntarias, the new all-season garden is in two parts: a free-form section in which vegetables and flowers are mixed together, and a "cutting" section containing flowers like ranunculus and daffodils, and vegetables like lettuce and broccoli, all of which can be cut for table or kitchen. Flowers currently growing in addition to the two mentioned, are iceland poppies, violas, pansies, daylilies, stocks, tulbaghia (wild onion). The current vegetables are similar to those growing in the display vegetable garden, but in different variety. It should be mentioned, too, that the latter garden is the product of a professional staff, whereas the all-season garden is an experimental project manned by hard-working volunteers who wish to be "involved," yet who have no particular expertise.

PASSING

THE CALIFORNIA Arboretum Foundation and the Arboretum lost two longtime friends and supporters recently in the space of just three days. Mrs. Jerome K. Doolan, a member of the Foundation Board of Councilors from 1959 to 1967, and from that date forward a member of the Board of Trustees, died in Santa Barbara on August 29th. In addition to her close association with the Arboretum, Mrs. Doolan was a member of the Pasadena Garden Club and the first resident of the West Coast to be elected president of the Garden Club of America, an office she held for three years.

September 1st marked the passing of the well known and widely acclaimed chronicler of the Southern California scene, historian and author William Wilcox Robinson. Mr. Robinson's association with the Arboretum goes back to its earliest days when he became the first secretary of the California Arboretum Foundation Historical Committee. From that time forward, Mr. Robinson was always available as a reference source on matters concerning the local scene. It was he who prepared the chain of title for Rancho Santa Ana that was published in one of the first issues of this magazine. Mr. Robinson had been a member of the Foundation since 1956.

CONTRIBUTIONS BOOK

SINCE ITS inception, the Arboretum has been the beneficiary of numerous and varied gifts which have contributed enormously to making it the institution it is today. A public record of these gifts and their donors has at long last been created in the form of a handsome, hand-bound Book of Contributions, itself the gift of a member of the Board of Trustees, which will be on permanent display in the library and which will also list all future gifts and donors.

XII International Botanic Congress June 23-30, 1975

The XII International Botanical Congress, intended to facilitate interdisciplinary communication among botanists, will meet in Leningrad in 1975 at the invitation of the Academy of Sciences of the U.S.S.R.

All special interest groups wishing space and time during the Congress should write as soon as possible to the secretary-general, Dr. Oleg Zalensky, Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., 2, Prof. Popov Street, Leningrad 197022, U.S.S.R. Postcards announcing the Congress will be mailed during the last months of 1972. Those wishing further information should return their cards by March 1, 1973 so that they will be placed on the information mailing list.

A. Takhtajan
Chairman, Organizing Committee

(Continued on page 91)

PLANTS TO LOOK FOR

Frank Simerly

MANY consider winter the time when gardens rest and consequently do not look for flowers during this period. However, flowers do bloom in the winter in Southern California and this can be one of the most rewarding times to visit your Arboretum. For example, acacias are one of the early flowering groups. The Arboretum has the most extensive collection of acacias in the United States (more than 150 species and varieties), and many of them are outstanding landscape specimens. Among the early flowering acacias you will find *Acacia baileyana* in the Australian plantings and as part of the Santa Fe Depot landscaping. Other acacias to look for in the north part of the Australian Section are *A. cultriformis, A. dealbata* and *A. podalyriaefolia.* The latter is a small grey-foliaged tree with large lemon-yellow flowers which make it one of the most attractive of the genus. The thorny *A. farnesiana* will be found in the South African plantings. One wonders if the large thorns are an effective deterrent for browsing animals.

The Arboretum also has a large collection of leptospermum plants that begin flowering in the winter. The collection consists of 15 species and 11 varieties and cultivars. You will find the collection bordering a large grass meadow in the western portion of the Australian Section. The most showy plants to flower will be *Leptospermum scoparium* cultivars. They include 'Pom Pom' with numerous small pink flowers, 'Red Damask,' 'Martin,' and 'Ruby Glow' with their dark red blooms. The dwarf growing *L. scoparium* 'Boscawenii' grows less than 18" high but is covered with pink flowers during this period.

SOUTH COAST

South Coast Botanic Garden also has many acacias in flower. But creating a bigger splash of color are the early pink-flowering peach trees, nearly 400 of them planted in a grove just south of the lake. An uncommon plant to look for is *Thevetia thevetiodes,* a small tree that bears numerous yellow or apricot oleander-like flowers. It is located in the east part of the garden. Shrubs to look for should include *Cassia artemisiodes, Brachysema lanceolatum* and *Salvia spathacea.*

DESCANSO GARDENS

If you have not visited Descanso Gardens at this time of year you are in for a real treat. Descanso is noted for its unique and extensive camellia and azalea plantings. Nearly 30 acres of shade provided by California live oaks create a perfect situation for shade plants. It is estimated that Descanso has 100,000 camellia plants most of which will be in flower beginning now. The Camellias are mostly *C. japonica* cultivars and many of them are more than 30 years old. Among the special camellias to seek out is a Department introduction *C. japonica* 'Mrs. D. W. Davis Descanso.' It is relatively new and is certainly an outstanding camellia.

Frank Simerly is superintendent of the Los Angeles State & County Arboretum.

PERFORMANCE OF INTRODUCED SPECIES IN WILDLAND PLANTINGS 1957 - 1971

Marcella Juhren

THE Arboretum's effort to help heal the scars on the mountainsides that ring the Los Angeles basin has gone on for about fifteen years. It now seems time to assess the success of these efforts. The scars have been caused partly by the natural slippage of steep slopes, partly by fires, but chiefly by the construction of roads, dams, and firebreaks. By 1957, it had become clear that some plant species from other continents performed more reliably than our own natives. (*Lasca Leaves,* Vol. 6, No. 2, pg. 26) This led the Arboretum to set out large numbers of these exotics in various sites for long-time observation.

At first thought, it seems hardly possible that anything could be better suited to our terrain than the shrubs and trees that have evolved here over so many millions of years. They had begun to develop adaptations of root and leaf structure back in Miocene times, when the climate first began its change to the present one. It had been tropical before that, the flat landscape covered with evergreen figs, cinnamomums, and avocados. Then, as the climate grew cooler and drier, this tropical vegetation drifted southward; the avocados left 15 million years ago. Still, it was moist enough for redwood forests around what is now Santa Barbara.

But in the drier inland and more southern coastal areas, the ancestors of the group of plants we collectively call chaparral were beginning to appear. These survived even when, toward the end of the Pliocene, the summer rains stopped. This they did by going dormant in summer, as in the northern forests trees go dormant in winter, except that they did not drop their leaves; they simply closed the stomates so as to stop the loss of water they had stored in their tough tissues. It was an advantage to retain their leaves, for the fogs condensed on them and dripped down, and the drip was absorbed by the wide-spreading root systems which reached out far beyond their crowns. All this time the mountains slowly rose, and with their rise came high winds and lightning fires. But the seeds of these species, grown hard and tough-coated in the drouth, germinated all the better after fire, and the shrubs themselves resprouted from dormant buds beneath the soil.

The mountains also provided special habitats, differing in soil and exposure; and the species sorted themselves out according to where they would thrive best. The plant communities became as they are today—chamise on the south-facing slopes, big-cone spruce on the north-facing slopes, pines on the flats, and manzanita in special soils.

For awhile there may have been an equipoise; as if the earth drew a breath. But for the past twelve thousand years the climate has been getting drier. The limit of drouth endurance may have been reached by the chapparal. The area covered by it, even where undisturbed, is smaller than formerly.

Other lands have the same history. Around the Mediterranean, on the west

Fig. 1 Sketch of the Angeles Crest Highway fuel-break plot. Dark spots represent various species of Cistus. To left of fuel break, C. purpureus; to right, C. villosus. Above small trail leading off to right, are C. villosus, and below it, C. ladaniferus; also Baccharis pillularis and rosemary. These were set out from potted stock. Cistus bushes around the edges of small clearings and the bushes to the left of the fuel break came from broadcast seed.

coasts of Chile, in southern Africa, and in Australia, dryness has increased, mountains have pushed up, and fires and high winds have become prevalent. There, too, vegetations especially adapted to these conditions have developed. The plants belong to different genera, even families, but the adaptations are similar. And the mild climate attracts man.

Man arrived in the Mediterranean area and eastward to Iran, and began practicing agriculture and sheep-raising at least 10,000 years ago. He ploughed and eventually overgrazed the meadows and cut down the woodlands; the soil structure was broken down so that it was less penetrable by water, held less air, and was hard for seedlings to take hold in.

But at least he was slow about it. What we have done in a few years with bulldozers and power equipment, he took thousands of years to do, proceeding slowly with small clearings and much reverence for certain groves. There the plants had time to adapt to the new conditions. Certain species of Cistus, for instance, were able to live in the cutover woodland, then in the bigger, more barren and windy stretches that had been grazed bare. Rhus, Pistacea, Arbutus and other shrubs could live on after the trees that had once shaded them were continuously cut until they disappeared. And after even these shrubs were destroyed, thyme, sages and lavender could still hold out, providing a cover for the soil.

Here, our mechanization has produced greater disturbances of the soil mantle in a much shorter time and our plants have not yet shown a capacity to thrive in the new conditions. It has seemed that some of the Old World plants that had learned to live under similar conditions, might succeed better than our own.

In the early 1940's, Gus Juhren, who had succeeded in stabilizing the Palomar Mountain roadslopes, experienced more trouble with the San Gabriel Mountains where the U.S. Forest Service pushed an effort to combine engineering and planting to control erosion and generally increase the plant cover. The likeliest of native plants, grown in special containers for long roots and set out after rains, would grow for a few years, then die out. Part of the trouble was lack of winter rains; the 10-year average of the annual rainfall had to be revised downward. Rodents, on the increase with the prevalence of bare soil, ate young pines as well as seeds. But Spanish-broom, introduced many years before, always seemed to keep its hold. Other Mediterraneans — Ciscus, thyme, rosemary — promised to be successful also. The Arboretum made further introductions and joined in a cooperative program. Between 1957 and 1961 over 120 plots were set out by the Arboretum in cooperation with various agencies and individuals, using species which had been previously tested for inflammability. A watch was kept on their performance.

In the summer of 1971, Ken Montgomery, Bob Gonderman and this writer selected 14 of the plots for more intensive study. Two of these were on the coast, three in the mountains at 3,000, 4,000, and 6,000 feet. Three others were foothill plots, and the remaining six were on the faces of earth-fill dams, all at or near 1100-feet elevation. Nearby gauges gave us a record of rainfall and other weather conditions which the County Hydrology Department compiled and made available.

Several species of rockrose (Cistus) survived in all conditions and all locations and were able to reproduce in most of them. In some places they were able to naturalize, spreading beyond the original plot. None of the other kinds of plants could do this. Rosemary proved hardy in a number of sites, and original plants are still there, but it has not reproduced itself. No seedlings of it have ever been seen. The same is true of the saltbushes (Atriplex) which grew very well by the coast for 10 years, but then became sparse-leaved and woody, and were broken down by deer, probably for their salty leaves.

The small native *Baccharis pilularis* also survived on some of the sites, but did not reproduce. Psoralea, a legume, survived only a short time even where it was watered in summer. However, on Lannon Dam where it was watered throughout the year, it spread. For reproduction, then, Cistus was the only species which might maintain itself without replanting.

Cistus laurifolius, the most beautiful of the genus, grew vigorously on Mt. Disappointment, both in the shelter of pines on a steep slope, and in the open on a wind-swept hogback at 6,000 feet. Here, on a level space, it has naturalized. This species will not tolerate the heat existing at altitudes lower than 3,000 feet. But at this level the rose or pink-petaled *Cistus villosus* can take over. The boundaries of the two species overlap somewhat, and *Cistus ladaniferus,* the gum rock rose, has an altitudinal range wider than either. It proved hardiest of all.

This Cistus is the one from which gum ladanum, used in medicine, is extracted; the industry was an important one in Spain. Along with the gum there is a fraction of the exudate which contains inflammable oils which other Cistus does not have; however, in burning trials here, either purposeful or inadvertent, it has not proved as flammable as our natives, or at worst, no more so than *Rhus laurina,* which is considered one of our least flammable natives.

On the Dillon Divide plot, where 1000 plants of this species were set out, the Limerock Fire died out where it reached the planting. A distinct line can be seen there today. A quantitative study of this plot is under way and will be reported on later.

Fire also reached plots on two of the

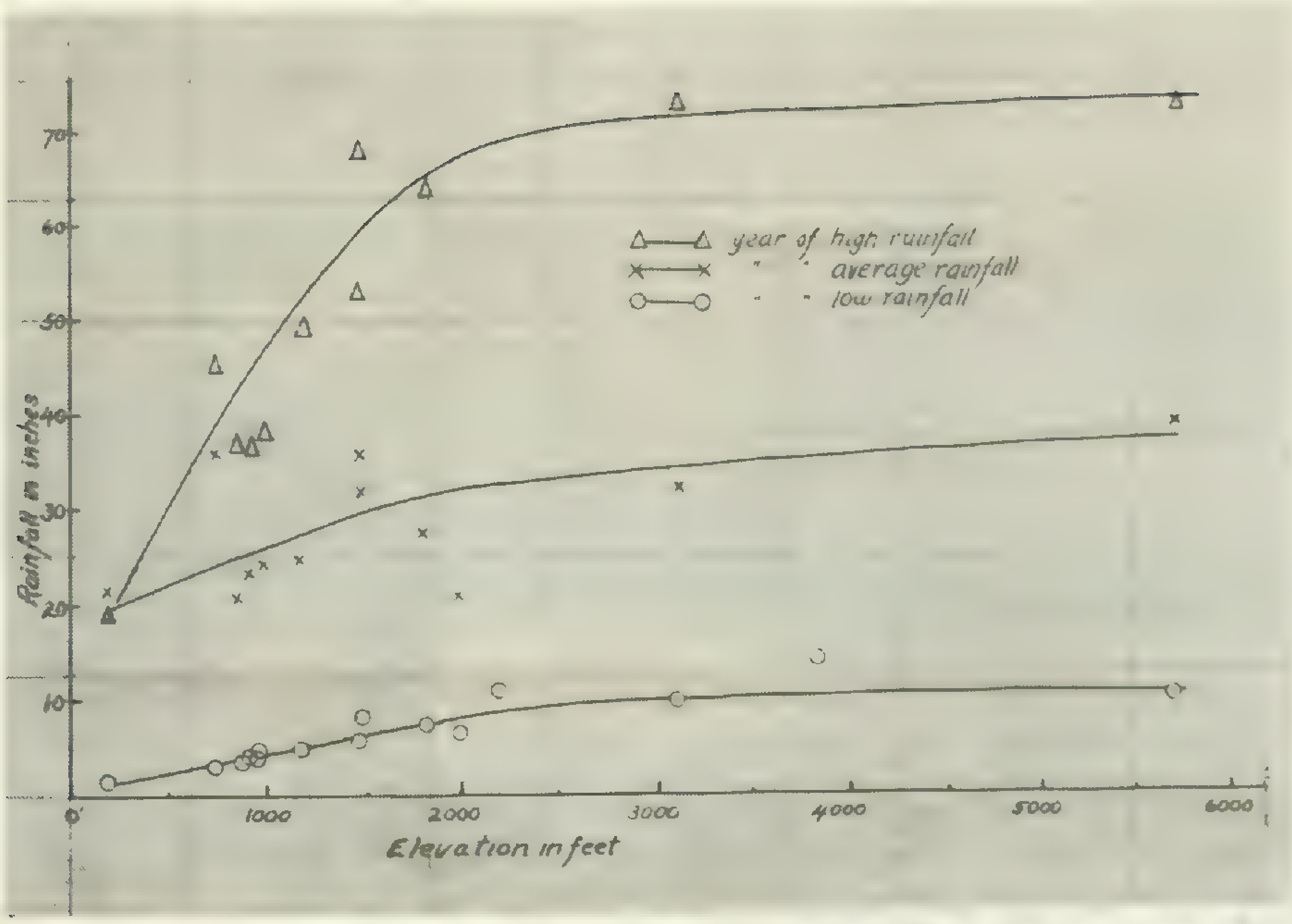

Fig. 2 represents a wet, dry, and normal year's rainfall at the various elevations.

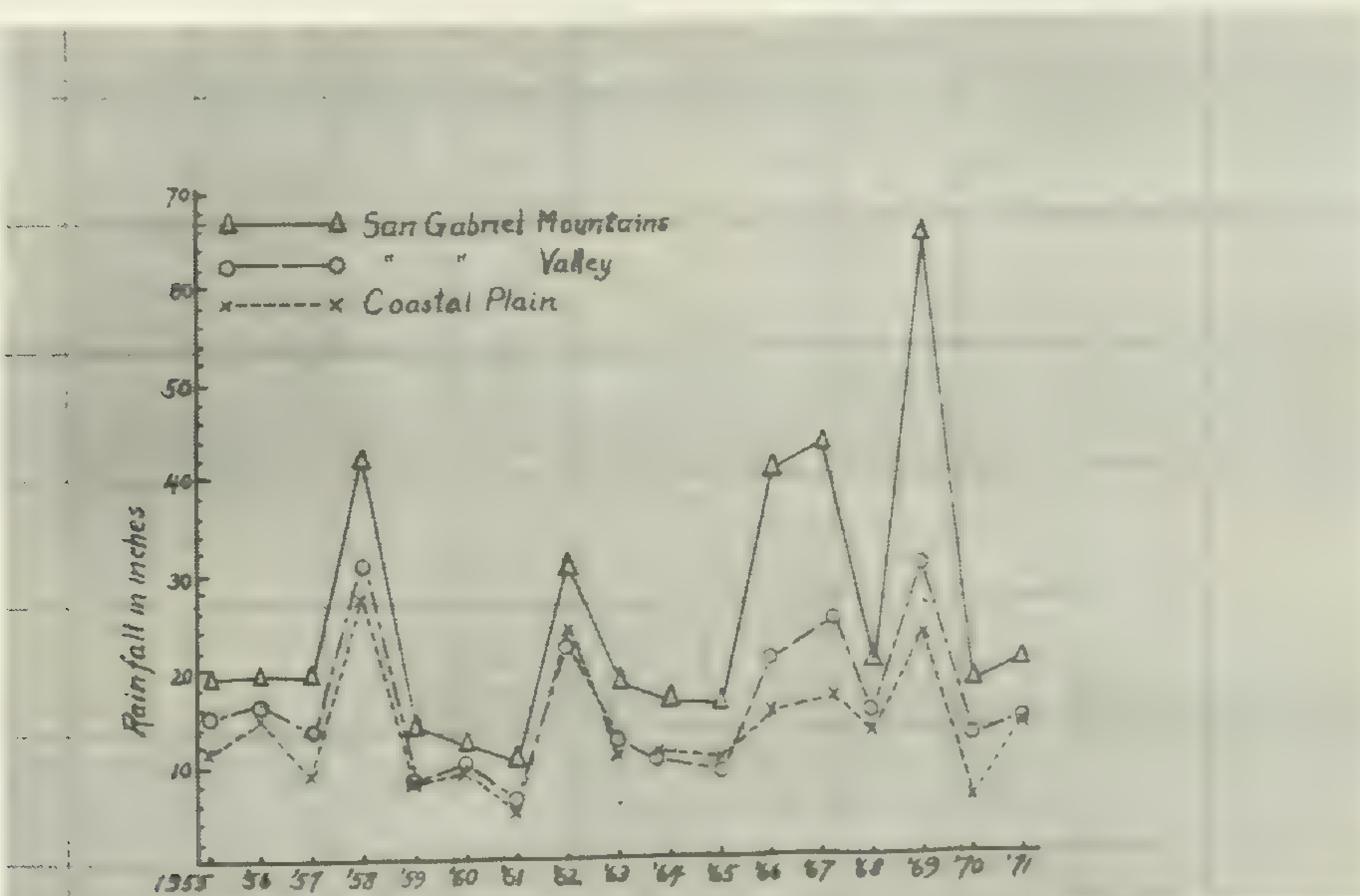

Fig. 3 Annual rainfall in various parts of Los Angeles County, 1955-1971. As shown, the mountain areas received the heaviest rainfall; the least rain fell in the coastal areas in 14 of the 17 years. Figures obtained from the Hydrological Department, Los Angeles County.

dams, Carter and Bailey. The plot on Carter did not burn. On Bailey Dam the fire swept across the dam between the rows of Cistus, apparently carried through by weeds which had filled in the spaces. The spacing of 5 by 5 feet, it was concluded, is too far apart. The branches of each bush should touch those of its neighbors. An old *Cistus ladaniferus* will have more than a five-foot spread, but a smaller, compact form is being developed which will have less woody material. Before the young shrubs are reaching their ultimate size, one of the small succulents could be used as fire retardant ground cover.

In Southern California, the least rainfall comes along the coast. Below Santa Barbara, the coast curves in, and the mountain ranges which chill the clouds in winter, are transverse; precipitation is highest at the mountain tops, with a rather sharp break at the 3,000-foot level. Thence rainfall peters out South, east of the mountains, and toward the lower reaches and the coast. (There is a saying among weather men that storms stop at the Tehachapis.) All plantings grew most vigorously at the 3,000-foot elevation in the mountains; even the altitude-loving laurel-leaved Cistus persisted there. But what of the Malibu and Zuma plots, at 350 feet and 75 feet, respectively?

There, Cistus resorted to what Mooney has called the last line of defense for a Mediterranean-type shrub—summer dehiscion of its leaves. Time and again observers reported it dead but found it alive again the following winter. This is a habit which is noted also in the hotter parts of Italy. (The native plants in this area are distinguished from the other types of chaparral, although they intergrade with it and form part of it on the drier sites and are known as "coastal sage." The environment is considered more difficult even than the desert, since the desert gets summer rains most years). It was here that the Atriplex did best at first, but it was *Cistus villosus* and *Cistus purpureus* (hybrid of *villosus* and *ladaniferus*) that held out in the end, and reproduced. These species performed better here than did *Cistus albidus* or *Cistus hirsutus*.

To say that good reproduction occurs, does not mean that the stand of Cistus is maintaining itself in the exact spot and in the same thickness. For this, some form of management may be necessary. Seedlings do not thrive within the stand as well as below it, away from it, and on flat places. Even on level ground the young seedlings do not attain much growth until the parent bushes are old enough to have long drooping branches and sparse leaves; in most places this is after about 15 years. By this time there is quite a lot of dead woody material, and controlled burning would greatly benefit the stand. If this is not practicable—and there is still much fear that a given burn may get out of control—chopping and cleanup will accomplish the same purpose safely. (Labor is a problem, but with the new interest of youth in ecology and revolt against working necessarily in business or industry, the problem should not be insoluble; ideally it should present many of the young idealists with a challenge). Such practices have long been successfully carried on in the heath vegetations of Europe.

To test whether the failure of seedlings directly under the parent bushes was due to lack of light, we measured the light intensities there, and set up outdoor experiments in which equivalent light intensities were secured with seran cloth of one, three, and five layers. The difference in growth of seedlings was very striking. Most died in the heavily shaded flats; none died in full light. The increase in growth and survival was proportional to the amount of light the seedlings received.

Broadcast seed showed much the same tendencies. On the Angeles Crest plots, seed of mixed species of Cistus was broadcast on all sides of a small peak, separated by the highway from the main mountain. A firebreak crosses this peak. A fire in the preceding fall had burned off the good chaparral cover of oak, ceanothus, and buckwheat. At 3,000 feet this was expected to resprout rapidly, so it was sprayed to hold it back and give the seedlings a chance. However the rains were not good that year; the next year they were even scantier. The seed did not germinate. The effect of the spraying wore off and the chaparral shrubs resprouted. In 1965 and '66 there were two years of good rains. The Cistus seed germinated, and the new bushes became established all along the edge of the firebreak on the upper side of a trail going around the peak and around the edges of small clearings here and there.

New seedlings have appeared on the firebreak itself from time to time. The firebreak is terraced somewhat, with small drainage channels to lead off the water; it is here in these channels that most seedlings become established.

On Los Piñetos also, seedlings tend to come up around the outer circumference of older bushes, and where oak and ceanothus has come into the stand, under them. This suggests that the Cistus seedlings are benefiting from the drip as well as by light intensity. It is well known that fog-drip keeps grasses alive and green in between rains in the San Joaquin Valley grazing lands, and many indications show its importance here.

Summer water did not help the plots on the dams. These are at fairly low elevations and face south. Cistus germinates whenever it gets water and the temperatures are moderate to hot. The last watering was given in August; seedlings could not survive until the winter rains came, usually in November. As has often been stressed by the Arboretum, winter water is preferable to summer watering, since rains have been less than desirable most years. Survival of even mature Cistus bushes was poor on the dams; however these were sprayed with weed-killer and Diesel oil which was aimed at the weeds, but also affected the Cistus. If summer watering is practiced, it should be continued until rain comes.

Too much rain, or rather, too much all at once, was disastrous to the El Prieto plots. Here, 3,000 plants were set out in loose soil disturbed by the construction of small check-dams in series along a narrow, winding canyon. Two of these were of the crib type, which hold back boulders and trees but not water. The torrential rain of February 11, 1963, washed out the loose soil and all but ten per cent of the plants. Cistus, Spartium, and a little Rosemary persisted on the lower sites, and Cistus is reproducing on the gentle slope below the lowest dam.

This area had been burned over before the planting was made, but is naturally a good area for chapararral. This has come back so competition and shading may be a factor in the poor survival of the introduced plants as well as the wash-out.

Against good thick cover of chaparral, Cistus does not hold out as a stand. This is good or bad, depending on one's attitude toward chaparral. Many Californians are very fond of it, especially the more beautiful species like toyon, manzanita, bush poppy, and mountain lilac. It has never been the intention to replace it with introduced species, but only to use them where the chaparral fails, or is too much of a fire hazard. The hazard, as discussed in the last issue of *Lasca Leaves,* can be reduced by fuel clean-up. With this in mind, it is good to know that Cistus does not threaten chaparral with competition. On the other hand, if a stand of Cistus is preferred, some form of management seems advisable.

A fine plot can be seen easily, without ant-bites, beside the road leading to the Nike site, going out of Sunland and turning left at the fork at the Bear Saddle Ranger Station. In spring, the showy rose-colored or white large flowers border the road, and to the left, where the road enters the reserved area and there is a small guard-station, both kinds, *Cistus ladaniferus* and *Cistus villosus* of both tall and compact forms, may be seen forming a dense stand and spreading.

Marcella Juhren is a plant scientist with a special interest in the vegetation of arid lands. She has worked periodically as a Research Associate at the Arboretum since 1958.

RELATIVE AIR POLLUTION SENSITIVITY OF SOME LOS ANGELES ARBORETUM PLANTS

George P. Hanson

Considerable genetic variation exists between and within plant species with respect to air pollution sensitivity. Anyone who has visited a ponderosa pine forest in or near the Los Angeles Air Basin has observed that ponderosa pines are more sensitive to air pollution than are incense cedars, sugar pines, or giant sequoias. Although giant sequoia trees as a group are more "smog" tolerant than ponderosa pines, there exists a vast reservoir of genetic variation in air pollution tolerance within each species. This plant to plant variation in tolerance allows breeders to select clones, cultivars, or varieties which excel in air pollution tolerance.

On an evolutionary time scale, air pollution at the levels currently being experienced have not been present for very long. Thus plants have not had time to adapt to this menace. From the few studies which have investigated the mechanisms of air pollution tolerance in plants, we have identified some factors which may lend tolerance to plants: small stomate size, low stomatal frequency, ability to close stomates upon contact with air polluants, high concentrations of carbohydrates, free amino acids, ascorbic acid in leaf tissue, increased fatty acids in cell membranes, defective root system, and slow growth rate.

Many of the proposed air pollution tolerance mechanisms would be detrimental to a plant competing with other plants in a pollution-free environment and the plant would probably lose out in the struggle for survival. The ponderosa pines which have evolved as the dominant vegetation in many forested areas are suddenly finding themselves at a severe disadvantage by their inability to cope with a drastically altered air composition. The incense cedars and giant sequoias previously handicapped because of the genetic restraints upon their growth and development now find themselves better able to compete in the polluted air.

Just as there is much variation in tolerance to air pollution between native species of plants, so there is between introduced species of ornamentals. During the past two smog seasons a survey was made of a number of woody species growing on the grounds of the Los Angeles State and County Arboretum in Arcadia, California. The response of the plants was similar each year and the lists which follow are based upon the presence or absence of visible symptoms of air pollution injury. Common symptoms included fleck (figure 1) in which the leaf is flecked with numerous small white areas, necrosis (figure 2) where the leaf turns white or brown in spots or in its entirety, stipple (figure 3, represented in this photograph by the tiny black spots) in which the damaged leaf areas develop a heavy red or brown pigment, chlorosis in which the leaf chlorophyll is lost and the leaf appears yellow, and leaf abscission (figure 4) which may or may not be preceded by visible leaf symptoms.

Recognizing that considerable plant to plant variation must exist within each species observed and that very few plants of each species were studied, we nevertheless believe that the following lists provide an indication of the general sensitivity of each species to photochemical air pollution such as occurs in the Los Angeles area.

Fig. 1

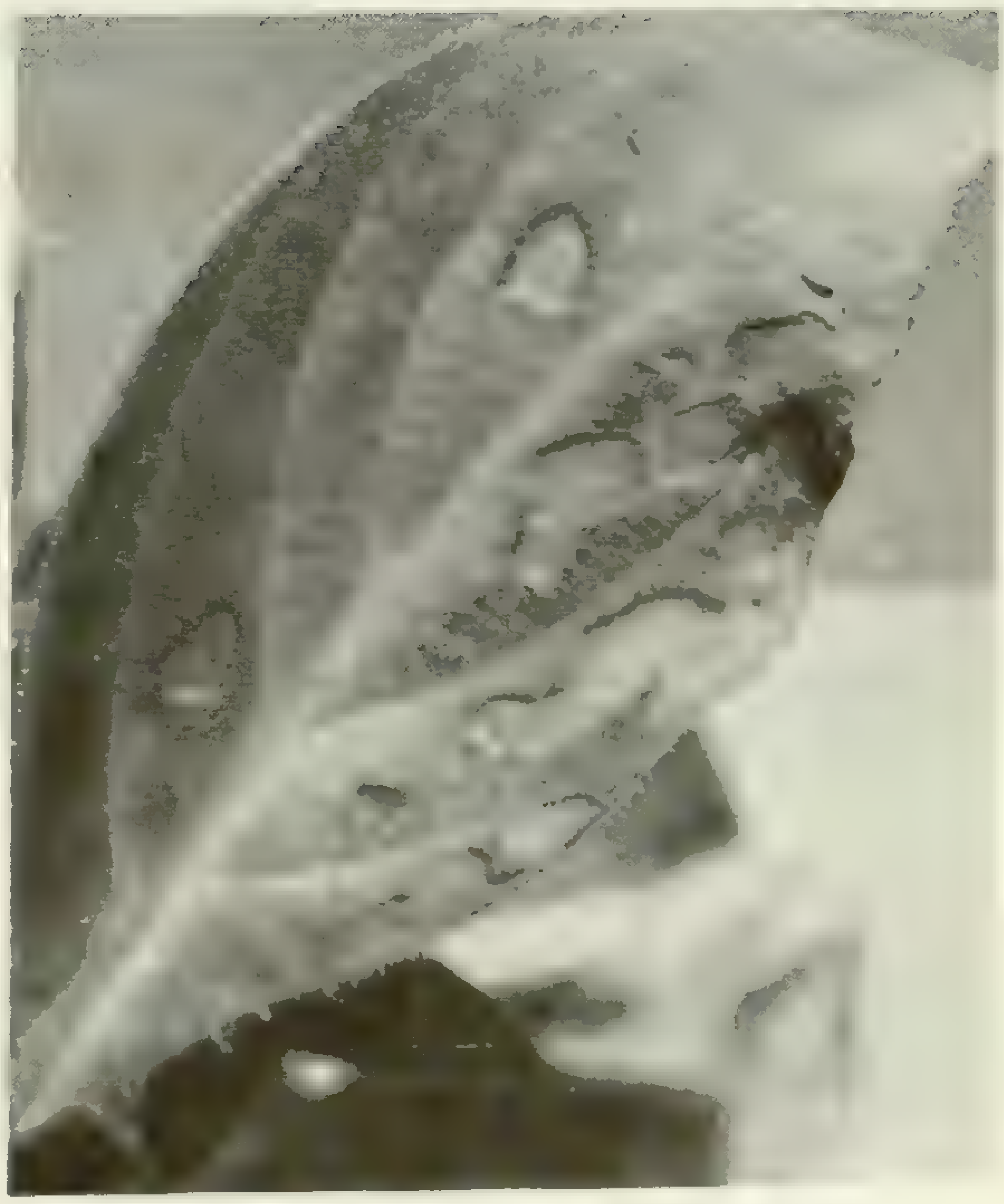

Fig. 2

Fig. 3

Fig. 4

Air Pollution Tolerant

Acacia argyrophylla
A. brachybotrya
A. burkitti
A. cardiophylla
A. cyanophylla
A. greggii
A. longifolia sophorae
A. notabilis
A. plumosa
A. retinodes
A. stricta
Albizzia kalkora
Araucaria angustifolia
A. heterophylla
Bauhinia vahlii
Bombax malabaricum
Bougainvillea 'Barbara Karst'
Brachychiton populneum x acerifolia
Bursaria spinosa incana
Callistemon citrinus
C. pallidus
C. rigidus
C. salignus
C. shiressii
C. viminalis
Callitris gracilis
C. murrayensis
C. preissii
Cassia coronilloides
C. helmsii
C. nemophylla coriacea
Casuarina cunninghamiana
C. campestris
Cedrus atlantica "Glauca'
C. deodara
Chamaelaucium uncinatum
Chorisia insignis
Citrus aurantium

Cordia myxa
Cotoneaster amoena
Cryptomeria japonica
Cupressus lusitanica
C. nevadensis
C. sargentii

Elaeagnus multiflora crispa
Erythrina vespertilis
Eucalyptus astringens
E. burdettiana
E. corrugata
E. eremophila
E. erythrocorys
E. eudesmioides
E. incrassata costata
E. lindleyana
E. longicornis
E. melliodora rosea
E. microtheca
E. nubilis
E. oleosa
E. pruinosa
E. sepulcralis
E. stricklandii
E. stuartiana
E. tetraptera

E. torquata
E. viminalis
Gleditsia caspica
Grevillea robusta
Juniperus scopulorum
Leptospermum 'Snow White'
Lonicera nitida
Melaleuca decussata
M. halmaturorum
M. linariifolia
M. monticola
M. styphelioides
M. teretifolia
Myoporoum acuminatum
Ochna atropurpurea
Peltophorum africanum
Pinus cembroides
P. glabra
P. massoniana
P. occidentalis
P. oocarpa
P. pinaster
P. pinea
P. sabiniana
P. moluccanum
P. rhombifolium

Podocarpus falcatus
Salix babylonica 'Crispa'
Schinus molle
S. polygamus
Schotia brachypetala
Sempervivum horizontalis
Strelitzia nicholai
Viburnum burkwoodii
V. propinquum
V. tinus
Vitex lucens

Air Pollution Sensitive

Acacia falcinella
A. implexa
Aesculus indica
Broussonetia papyrifera
Calodendron capense
Casuarina decaisneana
C. helmsii
C. leuhmannii
C. suberosa
C. torulosa rosea
Catalpa speciosa
Cladrastis lutea
Combretum glomeruliflorum
Cotoneaster frigida

C. salicifolia
C. wardii
Cussonia paniculata
Dais cotinifolia
Dalbergia sissoo
Dodonaea peduncularis
Elaeagnus orientalis
Eremophilla decipiens
Erythrina coralloides
Eucalyptus caesia
E. calophylla
E. macrandra
E. megacornuta
E. orbifolia
Eucalyptus sideroxylon
E. spathulata
E. torquata x E. woodwardii
E. woolsiana
Firmiana platanifolia
Fontanesia fortunei
Fraxinus americana
F. floribunda
Greyia sutherlandii
Koelreuteria integrifoliola
Liquidambar orientalis
Lonicera maackii
Malus sikkimensis
Metasequoia glyptostroboiodes
Olea africana
Paulownia fortunei
P. tomentosa
Phellodendron lavallei
Picea abies
Pinus caribea
Pinus coulteri
P. douglasiana
P. elliottii
P. lumholtzii
P. mugo
P. patula
P. palustris
Pinus psuedostrobus
P. strobus
P. sylvestris
P. taeda
P. torreyana
P. wallichiana
Podalyria calyptrata
Polygonum cuspidatum
Potentilla fruticosa
Pyrus calleryana
Scolopia crenata
Sophora japonica
Styrax japonica
Viburnum dasyanthum
V. lantana
V. trilobum
Zanthoxylum simulans

Dr. George Hanson, senior biologist at the Arboretum, is engaged in a long-term study of the relationship between plants and air pollution.

BOOKSHELF

THE NEW CREATIVE DECORATIONS WITH DRIED FLOWERS, by Dorothea Schnibben Thompson; Hearthside Press Inc., 1965, 1972.

Mrs. Thompson's *Decoration With Dried Flowers* is an excellent how-to-do-it for the home gardener who is primarily interested in developing a related hobby. Each section, each paragraph, each sentence contains specific practical information worth remembering or worth experimentation.

She does not burden one with lists of elaborate supplies and equipment. Her instruction is general but clear, and her manner is straightforward and optimistic. She gives one a positive point of view and on this basis, success is to be expected.

The use of a silica gel compound is largely responsible for Mrs. Thompson's unique success with dried flowers. She recognized its usefulness several years ago when the product appeared on the commercial florist market. She wrote a popular article in a home magazine on the process and her book, first published in 1965, was the result of her experiments.

Other drying processes described include the use of hot paraffin was and porcelainizing as well as pressing and antiquing plastic flowers and fruit.

In this book the emphasis is on methods of preservation and drying techniques rather than on creation of artistic arrangement using dry plant material, or the joys of botanic collection and gathering it.

Several recently published books on the subject have a wider range of interest including design. Two of these come to mind. *Creative Designs with Dried and Contrived Flowers* by Esther Veramae Hamel and Emily Brown's *Bouquets That Last.* Each of these includes creative design using dried plant material and flowers while Mrs. Thompson's book is basically concerned with processing and using dry plant material as decoration. This is exactly what the title of the book implies and for this purpose it is explicit.

Esta Stough

RECENT ACQUISITIONS TO LASCA LIBRARY

EVERGREENS by James Underwood Crockett, 1972, Time-Life. 160 p. Color photographs.

FLOWERING SHRUBS by James Underwood Crockett, 1972, Time-Life. 160 p. Color photographs.

LANDSCAPE GARDENING by James Underwood Crockett, 1972, Time-Life. 160 p. Color photographs.

TREES by James Underwood Crockett, 1972, Time-Life. 160 p. Color photographs.

GUIDE TO INDEX KEWENSIS by Ernest Rouleau, 1970, Herbier Marie-Victorin, University of Montreal, 370 p. Illustrated.

BIOCHEMICAL AND PHYSIOLOGICAL EFFECTS OF BUDS AND LEAVES ON ADVENTITIOUS ROOT INITIATION IN PEAR STEM CUTTINGS by Mostafa Mohamed Said Fadl, 1966, University Microfilms, Ann Arbor, Mich., 177 p.

WILD AUSTRALIA BOOK by Michael K. Morcombe, 1966, Lansdowne Press, Melbourne, Australia, 112 p. Color and black and white photographs.

TREE MAINTENANCE by Pascal P. Pirone, 1972, Oxford University Press, 574 p. Black and white photographs.

THE CARBOHYDRATE ECONOMY OF CACTI by Herman A. Spoehr, 1919, Johnson Reprint Corp., 79 p. Illustrated.

PELARGONIUMS by Derek Clifford, 1970, Blandford Press. 350 p. Color and black and white photographs.

THE FERN WORLD by Francis G. Heath, 1908, Everett and Co., London. 399 p. 12 colored plates.

LEXICON OF PLANT PESTS by Merino-Rodrigues, 1966, Elsevier Publishing Co., 351 p. No illustrations.

THE BOOK OF SPICES by Frederic Rosengarten, 1970, Livingston Publishing Co. 489 p. Black and white color photographs.

BIOCHEMISTRY OF FRUITS AND THEIR PRODUCTS by J. C. Hulme, 1970, Academic Press, 2 vol. Illustrated.

THE LANDSCAPE MANAGEMENT MANUAL by James Griffin, 1970, Calif. Landscape Contractors, 287 p. No illustrations.

(Continued from page 78)

Arcadia Tribune Photo

QUOTA

The California Arboretum Foundation goal of 1,003 members by 1973, announced last March, was reached in October, two months ahead of schedule. The three new members who cracked the thousand mark were greeted by director Francis Ching, right, They are, from the left: David W. Barnard, a Los Angeles stockbroker and enthusiastic gardener who grew up in Arcadia. He has been appointed an honorary member of the Board of Trustees and will serve as membership chairman; Robert Bullock a design and art teacher at Citrus College who knows the Arboretum well from bringing his classes to study on the grounds; and Mrs. Jean Bruce Ward, curator of El Molino Viejo in San Marino, headquarters for the California Historical Society. A new goal of 2,000 members by 1974 has been set with excellent progress to date. The newest members and their sponsors are listed below.

NEW FOUNDATION MEMBERS

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A	Broome, Richard D.	Foundation Office
A	Bullock, Robert	Mrs. Peter Douglas
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A	Haggard, Mr. and Mrs. James J., III	Clear Day
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A	Heston, Miss Mae	Las Voluntarias
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Studying pond ecology

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A	Williams, Mr. and Mrs. Robert L.	Fall Flower Show
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A	Wood, Mr. and Mrs. Paul I.	Las Voluntarias
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A	Wright, Mr. and Mrs. L. M.	Arcadia Garden Club
A	Yanda, Mrs. R. L.	Foundation Office

A — Annual Membership
C — Contributing Membership

Coleus blumei cultivar Pegasus (Cover)

Coleus blumei Benth is an evergreen perennial herb or shrub up to 3 feet tall. Leaves are simple, ovate, toothed, up to 2½ inches wide, petioled, opposite, hairy (at least on the midrib) and variously colored yellow, red or purple. Flowers are blue to white, up to ½ inch long, pediceled, in spike-like terminal clusters. Five sepals form a 5-lobed calyx. Five petals form a bilabiate corolla. Four stamens are didynamous (two pairs of different length). Filaments at the base are united into a short tube free from the corolla. There is one pistil and fruits (nutlets) are smooth.

As now understood, it is not a single species, but a group of hybrids of *Coleus bicolor, C. laciniatus, C. atropurpureus,* and perhaps others.

Numerous forms of *Coleus blumei* are used mostly as indoor-outdoor container plants and may also be grown as an annual in gardens in Southern California. They need rich, well-drained soil, ample water, and regular feeding. They look best in filtered light. Pinching the growing points encourages branching and a compact growth habit. Removing flower buds, which in most cases are not showy, helps keep plants growing vigorously. When old plants become leggy, lose their leaves, and lack brightness of color, they should be replaced.

Cuttings can be rooted in sand or water and afterwards planted in pots. Propagation by seeds is advisable only when new colors or leaf-forms are wanted. Pests are occasionally a problem. Mealybugs are controlled by metasystox-R (MSR), aphids by malathion, and slugs or snails by metaldehyde bates.

Coleus blumei cv. Pegasus is distinguishable from other forms by its black-purple stems and yellow-green leaves with dark purple markings. The original plant was received in May, 1960 from from the United States Department of Agriculture, Glendale, Maryland. It was made available to the nursery trade by the Los Angeles State and County Arboretum in July, 1961.

ARBORETUM WEATHER

Long. 118°02′59″ W.
Lat. 34°08′48″ N.
Elev. 571.28ft.

Weather season: Oct. 1 to Sept. 30

	Sept.	Oct.	Nov.
Highest Temperature	100	95	85
Lowest Temperature	52	41	38
No. of days above 90°F	8	2	0
No. of days above 100°F	1	0	0
Average Maximum	84.8	76.1	70.7
Average Minimum	59.2	52.8	45.3
No. of clear days	12	14	18
No. of partly cloudy days	13	7	6
No. days of rain	3	2	5
Rainfall	.16	.28	3.56
Rainfall measured from Oct. 1, 1971	8.10		
Rainfall measured from Oct. 1, 1972		.28	3.84

Calendar

January - February - March

ARBORETUM

(Note: Sunday lectures and walks and the minicourse series are sponsored by the California Arboretum Foundation which also serves as cosponsor of flower shows and Theodore Payne Foundation lectures.)

December 1972
Spring semester Youth Education classes begin in February. Write now for information.

January 7 — 2 p.m.
Sunday Afternoon Lecture
"Herbs For The Kitchen"
Glenn Walker, Garden chairman, Herb Society of America

January 12 — 8 p.m.
Theodore Payne Foundation Lecture
"Desert Plant Adaptions"
David Havens, biology instructor

January 16 — 9 to 12 noon
Minicourse on "Propagation" begins.
Don Fitch, nurseryman
Write Foundation for information on courses.

January 20 and 21 — 8 to 5 p.m.
Iris Show
Sponsored by So. Calif. Iris Society

January 21 — 9 to 11 a.m.
Sunday Morning Garden Walk
"Greenhouse and Nursery"
Leonid Enari, senior biologist, and
Frank Simerly, superintendent

January 27 and 28 — 8 to 5 p.m.
Bonsai Show
Sponsored by Baikoen Bonsai Kenkyukai Society

February 4 — 2 p.m.
Sunday Afternoon Lecture
"Vegetable Gardening"
Tak Niiya, education specialist

February 5
Beginning of spring semester,
Adult Education Classes,
Write Adult Education for schedule.

February 6 — 9 to 12 noon
Minicourse on "Pruning Ornamental Plants" begins.
Frank Simerly, superintendent

February 16 — 1 to 6 p.m.
Conference of California
Historical Societies

February 17 and 18 — 8 to 5 p.m.
Camellia Show,
Sponsored by Temple City Camellia Soc.

February 20
California Arboretum Foundation
25th Anniversary Dinner

February 27 — 9 to 12 noon
Minicourse on "Orchids" begins.
Earl Ross, orchidist

March 3
Field Trip to Anacapa Island
(Write Foundation for information)

March 9 — 8 p.m.
Theodore Payne Foundation Lecture
"Nature's Struggle For Survival"
Mrs. Roy Raymond, photographer

March 11 — 2 p.m.
Sunday Afternoon Lecture
"Container Gardening"
John Provine, horticulturist

March 18 — 9 to 11 a.m.
Sunday Morning Garden Walk
"Historical Complex and Herb Garden"
Leonid Enari, senior biologist, and
Frank Simerly, superintendent

March 20 — 9 to 12 noon
Minicourse on "Hanging Baskets" begins.
John Provine, horticulturist

March 24 and 25 — 8 to 5 p.m.
Aril Show
Sponsored by Aril Society

March 31 — 8 to 5 p.m.
Third Annual Baldwin Bonanza
Sponsored by C.A.F.

DESCANSO GARDENS

December 13 through January 31
Glendale Art Association Exhibit

January 13 — 1 p.m.
Annual Rose Pruning and Planting Program

January 21 — 1:30 p.m.
San Fernando Audubon Society Program

February, entire month
Floral Water Color Exhibit by
E. Margaret Wilson in Hospitality House

February 14 — 8 p.m.
Theodore Payne Foundation Lecture
"Wild Flowers in Their Natural Areas"
Mrs. Ada Gates, photographer

February 25 — 9 to 11 a.m.
Sunday Morning Garden Walk
"Camellia Forest"
Mark Anthony, superintendent, and
George Lewis, assistant superintendent

March, entire month
Highland Art Guild Exhibit

March 3 and 4 — 8 to 5:30 p.m.
Annual Camellia Festival
Sponsored by Los Angeles Camellia Council

March 10 and 11 — 8 to 5:30 p.m.
Annual Daffodil Show
Sponsored by So. Calif. Daffodil Soc.

SOUTH COAST BOTANIC GARDEN

March 11 — 9 to 11 a.m.
Sunday Morning Garden Walk
"Native Plant, Nursery, and Adjacent Areas,"
Armand Sarinana, superintendent

March 18 — 2 p.m.
Sunday Afternoon Lecture
"Container Gardening"
Edward Hartnagel, assistant superintendent