

The major part of the Department's research activity is conducted at the Arboretum. Here, a staff representing the principal botanic divisions—physiology, pathology, taxonomy, genetics, entomology—is engaged in various programs seeking answers to some plaguing questions of the day: air pollution damage to plants, the hope of reducing the fire hazard in open areas through the study and cultivation of fire-retardant plants, and seeking to enrich the urban environment through the introduction and breeding of ornamental plants adaptable to the climate of Southern California.

Air Pollution

The investigation of air pollution in relation to plants, the effect of one upon the other, constitutes a significant and continuing part of research activity at the Arboretum. In the 1963-5 period, a project was carried out under a grant (AP 00137-04,05) from the National Institutes of Health to explore means of protecting plants from that combination of compounds known scientifically as peroxyacetyl nitrates (PANS), or popularly as smog. A powder, gum guaiac, and a liquid, propyl gallate, were shown to be effective in providing protection from damage caused by ozone.

In the biennium covered by this report, an investigation supported by another grant (AP 00137-06,07) from the National Institutes of Health examined the effect of shade trees on smog. Results in this investigation indicated that air in areas of shade contained considerably less smog than air in sunlight; that according to the degree of air movement, the reduction of smog in the shade varied from nearly complete elimination to no difference whatsoever when there was a breeze.

Other observations during the past twenty-four months showed that: (a) plants in an enclosed chamber were effective in reducing the ozone concentration by as much as 60%; (b) in the field no corresponding effect could be observed, although shade trees, or any source of shade, had an effect in reducing the naturally occurring atmospheric oxidant concentrations; (c) gum guaiac was not effective in reducing oxidant concentration when used in several kinds of commercial air conditioners, although in the laboratory in air scrubbing columns it was very effective in eliminating photochemical smog.

The project suffered a great loss by the death on March 13, 1966 of Mr. W. M. Noble, Research Assistant.

Chemotaxonomic Study on Cotton Pigment

This study, directed by Dr. C. P. Parks, formerly staff geneticist, now assistant professor of botany at North Carolina State University, was carried out under National Science Foundation Grant GB-3900 and completed in this biennium. Dr. Parks' review of the study follows:

"Chemical constituents of plant tissue can be very useful in the classification of the plants which contain them. Much such classification has been done in the general area of chemotaxonomy using the procedures of paper chromatography. From our studies, it has been observed that some consistent errors can result if paper chromatographic analysis of crude plant extracts are the only basis for comparison. Our first objective has been the development of a suitable modified extraction and analysis procedure.

"These studies have been carried out on the flavonoid pigments found in cotton flower petals. The diploid cottons native to the New World (mostly Mexico) have been our basic plant material. A collecting trip to Mexico resulted in the introduction of Gossypium trilobum into cultivation. (This cotton species has not been grown in the United States previously.)

"We have found that a preliminary column-chromatographic separation of the crude alcoholic pigment-petal extract, followed by two-way paper-chromatographic separation of fractions from the column, better separated the pigments present in the original mixture. The pigments are characterized by the column fractions in which they occur, their paper-chromatographic behavior, and their ultraviolet spectrum with and without the addition of certain reagents to the pure pigment.

"Using this procedure, all of the species of the New World diploid group have been analyzed, and a paper on this study as well as one on the basic method is being submitted for publication. The results of the chemical study of these wild cottons are being compared to results of a study on their gross morphology determined from herbarium specimens."

Plant Pathology

Oak root-rot fungus remains a major problem for home gardeners in this area. This fungus is capable of infecting almost all ornamental woody plants, including certain herbaceous plants. Fumigants such as carbon disulfide and methyl bromide are helpful for soil sterilization and in eliminating the source of infection, but their effectiveness is limited by moisture, clay pans, rock, large roots and living plants in the treated area.

The Arboretum research project seeks systemic chemicals for possible control of oak root fungus. These chemicals seem to be transported internally in a similar way as plant growth hormones. It is believed that systemic chemicals having specific inhibitory effect to Armillaria mellea may be used to prevent the fungus infection and to curb further advance of the disease. So far, 20 systemic chemicals have been

evaluated in preliminary medium assay. Three of these are effective in curbing the growth of the fungus mycelium below 50 ppm level.

Studies on plant viruses have been in progress since 1966. This has been made possible by acquiring a Spinco Model L ultracentrifuge for virus preparation and the charcoal smog filter for the virus greenhouse to eliminate smog damage to the virus assay plants.

Particular attention has been directed to the study of the reaction of plant species to tobacco mosaic virus infection. It has been demonstrated that plant tissue exhibits a defense mechanism against virus infection by producing antiviral substances during the course of virus multiplication. Studies at the Arboretum involve investigation of this reaction on various host species, correlated symptom development, virus concentration, and possibly the production of antiviral substances for each species studied. Also being studied is the effect of herbicides and growth hormones on virus multiplication in plant tissue.

Herbarium

More than 5,000 herbarium specimens were collected or otherwise added in this biennium. Current total holdings of the LASCA (Arboretum) Herbarium are now in excess of 30,000 sheets together with supplementary reference materials.

Approximately 500 specimen sheets were received on exchange from the California Academy of Sciences, the Morris Arboretum, and the U.S. National Arboretum. Nearly 1,500 exchange sheets were distributed to five cooperating institutions. Several hundred other sheets were prepared for referral to specialists for consideration.

Over 500 sheets of the American diploid cottons, in support of taxogenetic studies of *Gossypium* currently nearing completion at LASCA, were secured by loan arrangements with eight domestic herbaria.

A long-anticipated series of field collecting trips was started with the aim of acquiring for the herbarium a thorough sampling of woody ornamentals in cultivation along coastal and Southern California. This long-range effort is designed to provide relatively complete herbarium representation of the subtropical ornamental flora within California horticulture. Three extensive field trips were completed in the 1965-7 period, one to the San Francisco Bay area, another to the Carpinteria-Santa Barbara region, both proving exceptionally productive.

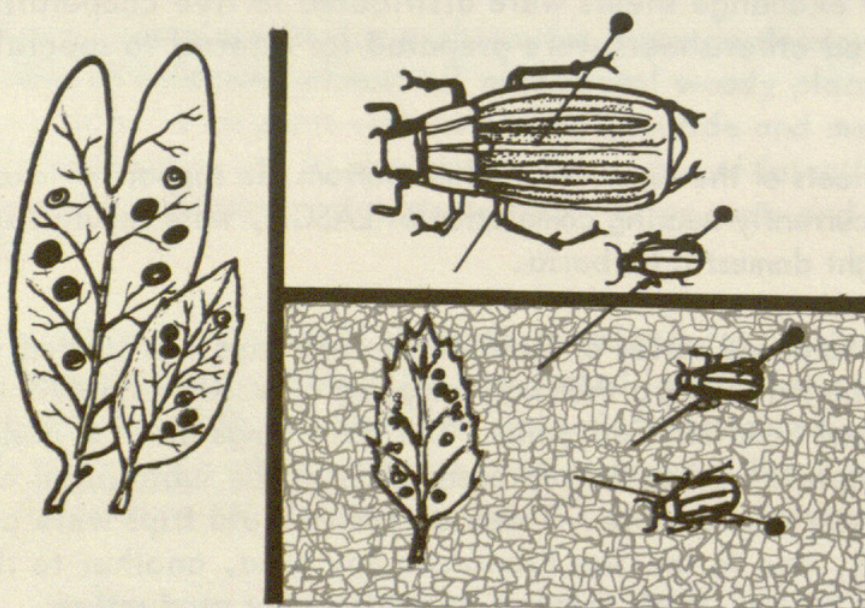
Major effort in the herbarium has been directed towards processing raw field collections. This work suffered a great setback in December of 1966 with the death of volunteer assistant, Vernyce I. Turner. Miss Turner's dedicated service and high competency contributed in a most significant way to the development of the LASCA Herbarium. Her loss leaves an irreplaceable void in staffing the facility.

Entomology

Having established that aphids are one of the most prevalent and injurious groups of insect pests present on the wide range of host plants growing at the Arboretum, a survey was begun in April of 1966 to relate the different species of aphids with their host range and seasonal distribution and, also, to determine which species of plants are normally free of aphid attack.

So far, 2,032 samples of aphids have been collected from 1,202 species of host plants, the collection data recorded, the plants labelled, and the aphids sent to specialists for identification. The work is proceeding with the valuable assistance of Dr. M. D. Leonard, Insect Identification Branch, Agricultural Research Service, U.S. Department of Agriculture, Washington, D. C. Although the survey is incomplete, it has already yielded significant information; for example, aphids have been found on 80 of the 183 species and subspecies of eucalyptus examined, on 35 of the 40 species of pines, and 38 of 50 species of viburnums. It has also indicated that Myzus persicae is the most common and widely distributed of the aphids found.

In addition to the work on aphids, thrips, grass leafhoppers, and scarab beetles have been collected and sent to specialists for identification.



Fire-Retardant Plants

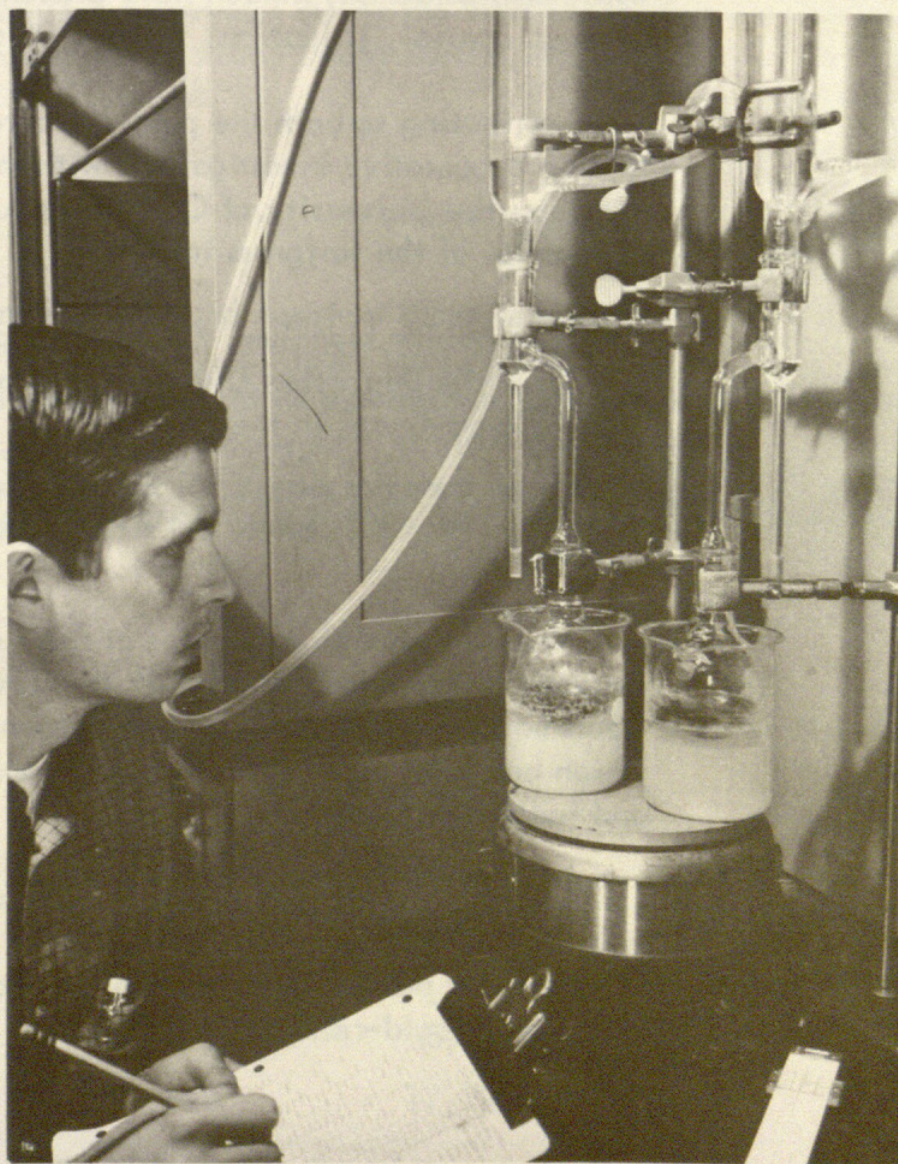
In 1953 the Arboretum joined the fight against the fire hazard presented by Southern California's arid mountains and foothills by engaging in part-time cooperative tests and studies with the U. S. Forestry Service. Since that time, the Department's role in the struggle has expanded to its current status as a full time research and public service project headed by a staff plant physiologist.

Research has centered on selecting plants that are slow burning, or relatively non-flammable, and testing them in a controlled temperature muffler furnace. The Cistus, or rockrose, was the first plant to substantiate fire-retardant promise. The list has since grown to include today some 20 plants with proven, though varying, fire-retardant qualities.

Part of the research project involves a comparative study of the significance of moisture content and moisture-holding capacity in fire-retardant and non-fire-retardant plant species.

Here, using a benzene distillation method, Kenneth Montgomery, Biology Assistant, is recording total water content in plant tissue samples.

Public Service and public information activity have taken the form of publications, lectures, and a wide showing and loaning of a documentary film, "Greenbelt, U.S.A.," to which the Arboretum contributed writing and editing services. In the 1965-7 period lectures were given before the Los Angeles City Fire Department; Burbank Chamber of Commerce; Los Angeles City Planning Commission; Board of Fire Commissioners; Naval Ordnance Test Station; and U.S. Atomic Energy Commission.



Turfgrass

The Arboretum is the only botanic garden in the country with a significant program in turfgrass research and education. It is conducted in recognition of the responsibility and problems associated with 60,000 acres of residential lawns in Los Angeles County valued at \$280 million which require at least \$80 million a year to maintain.

Major aspects of the program are the maintenance of variety and test plots for display and research, and various public information and service projects. These latter include answering inquiries from home gardeners, staging expositions at the Arboretum and throughout the county, giving formal lectures, and disseminating technical information to community groups, professional societies, and college classes.

Activities in this biennium were similar to those of the 1963-5 period, but considerably expanded. Five "Operation Green Carpet" home lawn exhibitions were conducted at the Arboretum and South Coast Botanic Garden; thirty-seven lectures and training sessions were given before municipal, professional, and home garden groups; approximately a thousand telephone and personal conferences were conducted with home gardeners; sixteen field-problem calls were answered covering such matters as weed control, irrigation, varietal selection, and over-all turf management.

Contributing to both the public and research aspects of this program are the continuing cooperative investigations with the Los Angeles County Agricultural Extension Service, the University of California Agricultural Experiment Station, and various companies of the turfgrass industry.

In the coming biennium, the turfgrass program will be conducted under the administration of the Education Division, a move calculated to widen public knowledge of scientific advances in the field.

Camellia

Camellia research activities at the Arboretum have been summed up in a series of six articles that will appear in the 1968 issue of the American Camellia Society Yearbook. These activities embrace an extensive project which began in 1961 and which has been carried on since in cooperation with a number of scientific societies and individual specialists.

The basic aim of this research is to study the inheritance and gene pattern of flower color and fragrance. The resultant data is expected to pave the way for the breeding of new color possibilities. Complementary to this effort is the emphasis given to the breeding of cold-resistant camellias.

Hibiscus

From 1957 to the present day, the breeding, observation, testing, and selection of hibiscus hybrids, followed by the distribution of seed, plant materials, and publication of resultant information, has been carried out at the Arboretum by two research associates, Ross H. Gast and Joseph Staniford. Details of this work, for which the Arboretum gratefully has extended its facilities, may be found in publications catalogued in the Arboretum library.

The underlying objective of Mr. Gast's and Mr. Staniford's research project may be simply stated as the development of plants with root systems tolerant of wet, cold winters which will at the same time return high quality flowers with good commercial prospects. The greatest promise in achieving this goal has come from hybridizing the best existing varieties with species and varieties from all over the world which appear to have the desired characteristics.

Accomplishments in the 1965-7 period include: 401 successful crosses resulting in 5,500 seed, a good part of which is marked for distribution to other research groups; planting of 175 seedlings expected to be ready for nurserymen during the 1968 blooming season; and seed distribution to collaborators in Mexico, South Africa, Australia, New Zealand, and New Britain.

Plant Records Unit

The Plant Records Unit consists of a Plant Recorder and Assistant Plant Recorder responsible for accessioning and for recording the history, cultural data, nomenclature and disposition of all plant or seed acquisitions arriving at or leaving the Arboretum. The unit is also responsible for receiving, cleaning, packaging, storing and issuing of seed used for planting at the Arboretum, and for preparing seed for exchange with other arboreta and botanic gardens throughout the world.

Seed and Plant Control Statistics

	<u>1963-5</u>	<u>1965-7</u>
Accessions	3,206	3,346
Seed planted	2,154	2,835
Cuttings inserted	11,165	28,020
Plants into one-gallon cans	9,605	4,923
Plants moved to permanent field location	3,391	5,281
Identification labels made	4,608	17,220



Dimond, Donald S. 1961. "Research." *Biennial report* 1965-67, 15-21.

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