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THE DIRECTOR'S REPORT

RANCHO SANTA ANA BOTANIC GARDEN

1965

The past year was eventful and successful for the botanic garden. Among new innovations was the inauguration during late autumn of a youth education program which will be available to schools throughout southern California. The organized programs will be oriented toward students from the age of cub scouts through high school, although major emphasis at first will be toward the middle grammar school group. In the development of the grounds the most outstanding achievement was the completion of paving of all roads in the garden. It was desirable to complete the work at this time because the plant community area has reached a stage of development which makes it of considerable interest to ecologists, conservationists and advanced classes. At the present time 20 plant communities are represented. The next major undertaking will be the labeling of the plantings.

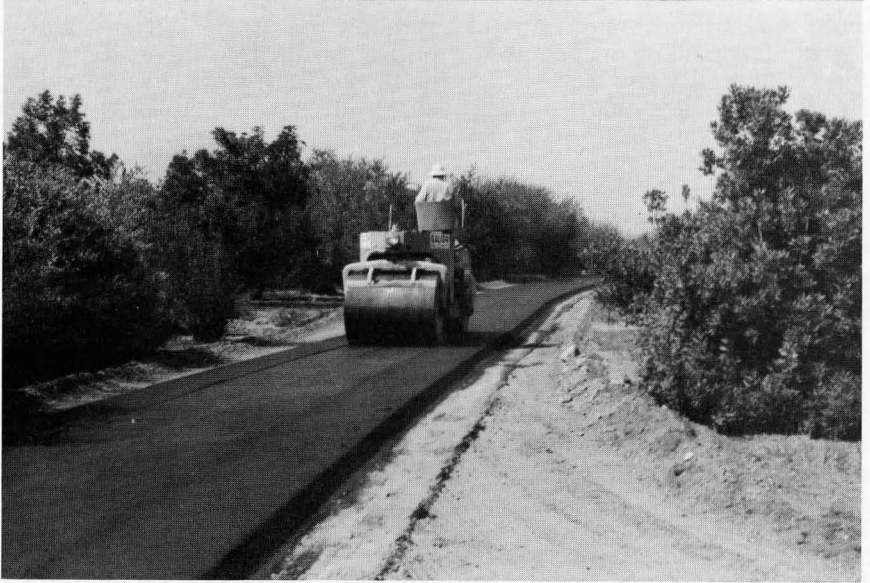
One of the agreements reached when the botanic garden moved to Claremont, was that the Pomona College herbarium would be housed at the botanic garden thus making the two collections available within the same building. Until now they have occupied separate floors. In 1965 a National Science Foundation grant of \$89,600 was made to Pomona College for the improvement of its herbarium and the hiring of additional personnel. New steel cabinets will replace the present wooden ones and the two herbaria are to be physically combined into one integrated collection. However, each institution will retain ownership of its own specimens. This move is of major importance in that it will decrease, to a marked degree, the labor required for maintenance, especially in matters such as handling loans, etc. It will also make the collections more readily accessible for scholars and students. When the herbaria are combined, the Claremont collection will be the third largest in Western United States and, in conjunction with the already combined research libraries, will make the facilities at Claremont a major center for the study of the flora of Western North America.

Visitor attendance continues to rise and during the past year more than 42,000 people passed the turnstile in spite of the fact that April, one of the months with the greatest number of visitors, was exceptionally wet and visitor attendance was considerably lower than usual. One interesting trend is that the winter months, formerly a period attracting relatively few visitors, recently has shown a marked increase in the number of visitors. This undoubtedly is due to the fact that the plantings of the larger shrubs and trees have reached a stage of maturity which makes the grounds attractive at all seasons.

ADMINISTRATION:

During the past year there were three staff appointments. Mr. Voldemar Siska, botanic garden librarian, resigned in September and returned to Australia. Myra White (Mrs. A. M.) was appointed to succeed him. Mrs. White has a B.A. from Brooklyn College, Brooklyn, New York, and a M.S. in librarianship from the University of Southern California, Los Angeles. Miss Gladys Boggess, who had served as secretary and receptionist for nearly ten years, retired at the end of the year. Cleidith Rue (Mrs. C. A.) was appointed secretary and assumed her duties on January 1, 1966. In November the botanic garden inaugurated a youth education program and appointed Mrs. Mary Coffeen to supervise the new department. Mrs. Coffeen's background and experience make her exceptionally well prepared to handle the new program.

In August Dr. Benjamin attended the annual meeting of the Mycological Society of America held in conjunction with the American Institute of Biological Sciences convention at Urbana, Illinois. As President of the Mycological Society of America, he presided over the business meetings of the society and delivered the presidential address entitled "The Merosporangium." He will continue as a member of the council of the society for the next two years. Dr. and Mrs. Verne Grant attended the fall meetings of the National Academy of Sciences in Seattle, Washington, as invited guests. Dr. Grant presented a paper on his *Gilia* work at one of the sessions of the meeting. Dr. Grant also attended the annual meeting of the Genetics Society of America at Fort Collins, Colorado, in September. Dr. Thorne presented a series of lectures at the University of North Carolina, Chapel Hill, in early summer. Mr. Everett completed his term as Immediate Past President of the International Plant Propagators' Society and attended the Board meeting in Cleveland, Ohio, held in conjunction with the Eastern Region Conference of the society. At the Western Region Conference of the same society held at Los Gatos, he presented a paper entitled "New Plant Introductions from the Rancho Santa Ana Botanic Garden." Mr. Everett has also been appointed chairman of the Arboreta Committee, Western Shade Tree Conference. Dr. Lenz represented the Rancho Santa Ana Botanic Garden as an invited guest to the two-hundredth anniversary celebration of the birth of James Smithson which was held at the Smithsonian Institution in Washington, D. C., in September. While in Washington he visited the National Arboretum; before returning to Claremont he also visited the Fairchild Botanic Garden, Miami, Florida, and a former graduate student, Dr. Calaway H. Dodson, now a member of the faculty of the University of Miami. Dr. and Mrs. Munz spent the summer in London where he worked at the British Museum (Natural History) and at the Royal Botanic Garden, Kew, studying Old World delphiniums. He also studied specimens at the Museum National d'Histoire Naturelle, Paris. While on the Continent, he and Mrs. Munz visited friends in several countries before returning home in November. In December, Dr. Carlquist attended the meetings of the American Association for the Advancement of Sciences in Berkeley and presented a paper "Loss of Dispersibility in the Hawaiian Flora."



All roads in the plant community area were black topped during August. The Laird Paving Co. of Claremont was the contractor for the work. Installation of engraved redwood labels for identification of the communities is now in progress.

WEATHER:

The total rainfall for the season was 2.49 inches below normal, but this exceeded that of the previous season as shown in the table below:

Rainfall Report—Monthly Totals
(July 1–June 30)

Month	1963–1964	1964–1965	Average Monthly Rainfall
July	0.00	0.00	0.01
August	0.01	0.00	0.05
September	2.94	0.02	0.21
October	0.37	0.35	0.71
November	2.77	2.34	1.36
December	0.00	1.86	3.10
January	2.44	1.08	3.59
February	0.44	0.61	3.64
March	4.08	2.86	2.79
April	0.75	5.89	1.61
May	0.30	0.05	0.47
June	0.22	0.10	0.11
Total	14.32	15.16	17.65

Again the distribution of rain did not follow the normal pattern; November had a rainfall of 0.98 inches above normal, while December, January, and February, normally the wettest months of the year, were, respectively, 1.14, 2.51 and 3.03 inches below normal. On the other hand, April, with 10 rainy days, was relatively wet and registered 4.28 inches above normal. Although this was beneficial to most plants, it prevented many of them from flowering properly, particularly the California poppies and annual lupines.

The new season has started with very heavy rains that promise to bring the total above average and thus break a period of drought that has extended over a number of years. November, with a total of 11.17 inches of rainfall, 9.81 inches above normal, was the wettest on record. December had 4.36 inches of rain, 1.26 inches above normal. The heavy rains and accompanying wind in November and December resulted in the loss of 13 trees, all of them cypresses.

The highest temperature recorded for the year was 102°F reached on August 9. The lowest temperature was 28°F on February 10. This compares with a high of 100°F and a low of 30°F for the previous year.

In 1965 there was a total of 35 days with temperatures above 90°F—2 in April, 1 in May, 6 in July, 13 in August, 4 in September, and 9 in October. In 1964 there was a total of 42 days with temperatures above 90°F. July was relatively cool, but in August we experienced a heat wave between the 6th and 15th with temperatures ranging between 91 and 102°F. It was accompanied by unusually high relative humidity (averaging about 55%) that added to the discomfort. The lowest relative humidity was 7% recorded on October 25.

Less water was used for irrigation during the year than at any time during the past six years. This reflects the generally improved conditions resulting

from increased annual rainfall during the past two years. Totals for the past five years are given in the following table:

Amounts of water used during the past five years

Year	Water Used (cubic feet)	Rainfall for Calendar Year (inches)
1961	4,316,900	6.85
1962	1,955,500	16.10
1963	1,382,700	6.09
1964	1,452,800	12.80
1965	1,287,700	26.98

SEEDS AND PLANTS:

The 1965 seed exchange list consisted only of collections made from plants growing in their native habitats. A total of 551 packets of seed was distributed this year: 421 went to institutions in 26 countries; the remainder to institutions within the United States. In addition, special distributions of large quantities of seed went to universities and other institutions as follows: University of Connecticut, Storrs, 20 packets of seed for studies on effect of day length on germination; Texas Technological College, Lubbock, 1 packet of *Phacelia tanacetifolia* for continued studies on its germination; University of California, Riverside, 2 pounds of *Simmondsia chinensis* for continued research; United States Department of Agriculture, Albany, California, 2 packets of *Salvia* species for research on biological control of the introduced weed pest, *Salvia aethiopsis*; Queen Elizabeth College, London, 1 packet of *Simmondsia chinensis* for anatomical studies of the species; City of Fremont, California, 6 packets of *Fremontodendron* seeds to be planted in honor of General Fremont. The city adopted *Fremontodendron* as its city tree. The Theodore Payne Native Plant Garden, Hermosa Beach, received 34 packets of seed and 25 plants; Los Angeles State and County Arboretum, Arcadia, 10 packets of seed and plant material for continued research on fire resistant plants; Lions Club, Curitiba-Parana, Brazil, 10 packets of seed for an international friendship park; Dr. R. F. Hoover, California Polytechnic Institute, San Luis Obispo, 44 plants for additions to the botanical garden; Van Ness Water Gardens, Upland, tubers of the native pond lily, *Nuphar polysepalum*; and Duncan and Davies Nursery, New Plymouth, New Zealand, 6 packets of fremontia seeds. On a cooperative basis the botanic garden grew over 200 plants for the United States Forest Service Fire Laboratory, Riverside, for testing in their studies of low fuel-type plants.

Accessioned during the year were 396 collections consisting of seeds, plants and cuttings, of these, 55 represented items new to the garden's plantings. Of the accessioned material, members of the staff collected 203 lots, and 45 lots were gathered in the garden. The latter consisted principally of seeds of

annuals and cuttings from selected plants. The remaining 148 numbers were gifts and purchases.

GROUNDS:

The year 1965 marked the end of the first 15 years of the botanic garden's operations at Claremont, and it might be of interest to review a few of the major results attained thus far. The first organized program at the Claremont site involved the establishment of the boundary lines of the botanic garden and the installation of an interconnected grid of pipelines for irrigation purposes. Approximately 12 miles of pipe were laid during this early stage of development. At about the same time a chainlink fence was erected on the perimeter of the entire 80 acres of the new garden. Roadways were established and most of them paved with asphalt. Following these preliminary operations the formal planting of the garden was begun. It is estimated that since 1950 about 200,000 plants have been set out; in 1965 the number was 11,288.

The garden's present plantings have representatives of 112 plant families including 407 genera and 1345 species and subspecies. In addition there are between 200-300 cultivars and hybrids. The oaks are particularly well represented in the garden and we now have all of the species found in the state. The Coniferales are represented by all but nine species and one variety. All members of the Taxales are represented, as are all but three taxa of the Cactaceae. Of the 72 species and varieties of *Arctostaphylos* found in California, the botanic garden possesses all but five species and seven varieties.

One of the outstanding features of the botanic garden is the plant community area consisting of about 50 acres. Of the 29 plant communities recognized by Munz and Keck (*El Aliso* 2: 87-105, 199-202), 20 are accounted for in the garden. In addition, there are elements of two others. Special garden or habitat areas that have been developed are the rock, desert, coastal sand dune and desert sand dune gardens and the pool and streamside plantings. A home demonstration garden depicting the use of many California native plants was established in 1959.

The plant labeling program was continued during the year with the same strong emphasis it has received in previous years. At the present time there are more than 1500 engraved laminated plastic labels and plaques in use.

Disease and pest control continue to require much of Mr. Lolonis' time. No new diseases or pests were found in the garden this past year but ones previously reported are still causing concern. The ceanothus stem gall, *Periploca ceanothiella*, continues to be a serious pest on several species of California lilac. As in the past, control was attempted using systemic insecticides, mainly Cygon 267 (30.5% dimethoate). The percentage of kill varies depending upon a number of factors such as time of application and state of growth of the host plant. After several years of experience in attempting to control this insect, it has been decided that in the future the spray program will be designed to prevent infestations rather than attempt eradication of larvae already in the host tissues. Meta-Systox-R, a relatively new systemic, has been found to be somewhat less effective than Cygon in controlling the gall moth. Cultural means of control of this pest are probably of greater importance than chemical control.

Preventing rapid succulent growth during the period of greatest susceptibility to the pathogen—from late June through the middle of October—should keep infection to a minimum. Control of growth can be accomplished by limiting soil moisture during this period. As usual, aphides were numerous during the period from February through May and many susceptible plant species required spraying. The madrone, *Arbutus menziesii*, requires at least one application of an aphicide to prevent inward rolling of the injured leaves. For the first time, several *Pinus radiata* and *P. remorata* trees were nearly defoliated by aphides. The manzanita leaf gall aphid, *Tamalia cowenii*, is now well established in the garden. It mainly attacks *Arctostaphylos edmundsii*, *A. hookeri* and their hybrids during the summer and fall months. Only through systemic insecticides can the aphides within the curled leaves be reached. Both Cygon and Meta-Systox-R applied at the rate of two pints per 100 gallons of water have been found effective. An unidentified species of *Psyllia* regularly attacks the fremontias, especially *Fremontodendron mexicanum*. The insects are readily controlled by an application of Malaphene-D. Our experience is that Kelthane is the most successful spray for the control of mites, which are particularly troublesome on the irises and strawberries. Oak root fungus, *Armillariella mellea*, continues to be a major problem and among the plants lost during the year from attack by this parasite were two large live oaks, *Quercus agrifolia*. A 'Branch Die-Back' or 'Blight' caused trouble in some plantings of *Arctostaphylos* 'Pt. Reyes' and *A. edmundsii*. It appears to be associated with adverse soil conditions, especially poor drainage and low fertility, and is usually absent in plantings in well drained soils or soils covered with a thick layer of mulch.

Ceanothus species with a heavy dense habit of growth have been harmed by rats and mice stripping the bark, thus causing the branches to die. Rats build large nests in the center of the plants and as they are often hard to detect from the outside, a regular inspection of the plants is now made to forestall future attacks. Birds have forced the use of very expensive methods of protection in order for us to have an adequate display of annuals. The garden's resident pair of gray fox have been of considerable help in controlling rabbits and other rodents. The pair have raised three young during each of the past two years. Nevertheless, a shooting program still is necessary in order to maintain the rabbit population at a tolerable level.

As in the past, weed control is one of the major items in the operation of the garden. The pre-emergence herbicide Simazine (2-chloro-4, 6-bis [ethylamino]-s-triazine) was widely used last season in conjunction with and as a substitute for weed oil in the plant community area. Simazine was especially useful in the cactus garden where it cut our man-hours in weeding to about one fourth. Here it was applied over and around the plants without injury. For best control two applications are probably necessary, one in the fall before the rains begin and a second one in January.

The post-emergence herbicide Ortho-Diquat (a chloride salt of 1-1 ethylene 2-2 dipirydylium) was also used considerably in our desert garden and on the mesa for control of annual weeds. In areas where no annual flowers were to be grown, it was applied in conjunction with Simazine and with good results.

During the year, 160 cubic yards of compost were made using the Indore

method. It is of great value in improving soil structure and fertility, and strawberries and dichondra respond very favorably to liberal applications.

Labor saving devices purchased during the year included an electric sander and a chain saw. Funds from a National Science Foundation grant made to Dr. Grant permitted installation of an electric heating cable in the cutting bench of the propagation house.

FIELD WORK:

The amount of field work conducted by members of the staff in 1965 was considerably greater than it has been during the past few years. Areas within the state rated from poor to very good depending upon the distribution of rainfall. Dr. Grant worked mainly in the Colorado Desert, the high Sierra Nevada and in the Chiricahua Mountains of Arizona. During the autumn he worked at the higher elevations of the San Gabriel Mountains. Dr. Thorne collected rather widely in the coastal areas of the state. On one of these trips he was accompanied by Mr. Everett. He made one trip into the Mojave Desert and another into the central Sierra Nevada. He also spent several days on two occasions on Santa Catalina Island gathering material for his flora of the island. On both trips he was accompanied by Mr. Everett. Shorter trips were made into the San Gabriel Mountains. Dr. Lenz collected over a rather wide area of southern California, the west side of the San Joaquin Valley and around Sacramento. In late April he collected briefly in the vicinity of Yuma, Arizona, and late in the season in the Mammoth Lakes area on the east side of Sierra Nevada. Dr. Benjamin made a number of short collecting trips into the local mountain and desert areas. He also accompanied Dr. Lenz on a trip into Tulare County in April.

Shortly before the end of the year a new $\frac{3}{4}$ ton Chevrolet chassis was purchased and the body from the present field truck was transferred to the new vehicle.

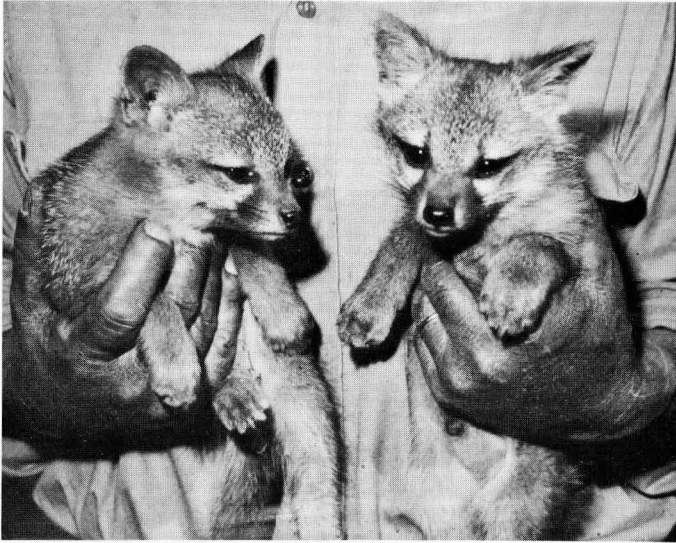
THE SCIENTIFIC COLLECTIONS:

During the year, 11,579 sheets of vascular plants were mounted and inserted into the herbarium bringing the botanic garden total to more than 180,000 sheets. We received on an exchange basis 4,185 sheets from 14 herbaria, and distributed 5,479 sheets to 39 herbaria. Another large distribution of duplicates will be made early in 1966. At least 4,600 sheets of vascular plants were received as gifts from 13 individuals, 1,076 sheets were received for determination from at least 7 sources, and 1,250 sheets were added by members of the staff. Several sets donated by Dr. Thorne, totalling 3,344 sheets, included 3,000 from Australia, 300 from the western United States, and 25 from Java and India.

Of the 11,579 processed sheets, more than 5,000 were from California and Baja California, 1,433 from the other western states, 1,356 from Florida and Georgia, 815 from other states, mostly the Upper Midwest, 2,096 from Pacific Basin islands and Asiatic countries bordering the Basin, 787 from the West Indies and Central and South America and 73 from Europe and Africa. Gifts have been accepted and selective exchanges have been continued to provide specimens badly needed for the teaching and research programs.

During the year, 519 sheets were sent on loan from the herbarium to 11 institutions, and 577 sheets in 4 loans were returned to the herbarium from 4 institutions. We received 50 sheets in 2 loans and returned 1 earlier loan.

As part of the effort to integrate the Pomona College and botanic garden herbaria, the curator combined the sheets of about 125 of the smaller families. Many hundreds of new genus covers were typed and inserted into the collections. The collection of Polemoniaceae was reorganized, and sheets of many species in various families were rearranged alphabetically by county for California specimens and on a geographic basis for non-California American material.



The resident pair of gray fox each year raise young in the botanic garden. Being quite tame, the parents are often seen by visitors.

The mycological culture collection was increased by about 150 numbers during the year. The new material represents fungi isolated here at the botanic garden and gifts from other institutions; included are 11 types. Maintenance of the culture collection requires periodic transfer of the fungi to fresh media, and approximately 1,000 such transfers were effected during 1965. About 950 dry specimens were prepared for the herbarium. Transfer of the collection of alcohol-preserved insects in the Laboulbeniales collection to standard vials was completed during the year. In 1965, 40 fungus cultures were distributed to mycologists at other institutions.

The pollen slide collection was increased by 900 numbers during the year. This collection was received on an exchange basis from Dr. D. A. Livingstone, Department of Zoology, Duke University, North Carolina. The wood sample

collection was enhanced by the addition of about 100 collections of wood and pickled material of the Onagraceae. This collection, presented by Dr. Peter Raven, represents the best and most thorough collection of woods of the Onagraceae ever assembled.

LIBRARY:

The continued growth of the library is evident particularly in the serial collection. By the end of the year the number of serials currently being received reached 451. Of these, 283 published volumes were bound in 169 physical volumes. A project was begun to provide more complete records of the serial holdings and to allow more varied approaches to them. This project will be continued as time allows.

The book collection was augmented by the addition of 147 new titles as well as 24 volumes added to various series. A section has been set aside for oversized books and a program begun for the gradual transfer to it of appropriate volumes. This will provide more space for the ever growing collection.

The library's holdings in the form of microfiches continue to grow. A new microfiche reader has been acquired to make the use of this material more convenient. The assembly and organization of this collection will be continued to make it even more useful.

In addition to the botanic garden's acquisitions, approximately 90 books and 65 bound volumes of periodicals were added to the collection deposited in the library by the Claremont Graduate School and Pomona College.

Distributions 245-248 of the Gray Herbarium Card Index and 20-22 of the Index Nominum Genericorum were filed.

RESEARCH ACTIVITIES:

Dr. Benjamin continued his work on the merosporangiferous Mucorales. This was supported in part by a grant from the National Science Foundation. Early in the year, he carried out a cytological study of the merosporangium of representative species of the families of merosporangiferous Mucorales; results of this and other studies on these fungi were incorporated into his Presidential Address delivered before the Mycological Society of America at Urbana, Illinois, in August. He now has begun a monographic study of the genus *Piptocephalis* (Mucorales: Piptocephalidaceae) based primarily on isolates made in California during the past 10 years. This fall he has been engaged in the preparation of line drawings depicting species of this genus.

Dr. Carlquist's research during 1965 included completion of his studies on wood anatomy of Compositae. This series, begun 10 years ago, will be completed with publication of a study of woods in the tribes Anthemideae, Ambrosieae, Arctotideae and Calenduleae, followed by a summary of wood anatomy and wood evolution in the family as a whole. Contributions to this series thus will number 13 papers, which have appeared in the journals *Tropical Woods* and *Aliso*.

Other anatomical studies completed during 1965, include a monograph on root and stem anatomy of the family Rapateaceae. This contribution, the second in a series which was begun with a study of pollen, will appear shortly

in *Phytomorphology*. A study of the genus *Gongylocarpus*, which bears fruits embedded in the pith of stems, was undertaken in order to determine the floral and fruit ontogeny in this peculiar Mexican member of Onagraceae. Results are appearing soon in a paper, authored jointly with Peter H. Raven, in the *American Journal of Botany*.

Dr. Carlquist's book *Island Life*, which appeared in October, is being accompanied by a series of scientific papers which bear the series title, "The biota of long-distance dispersal." The first paper completed was a survey of principles of dispersal and evolution in insular areas. This was followed by a pair of studies in which an insular phenomenon, loss of dispersibility, was explored and documented. The first contribution, dealing with loss of dispersibility in Pacific Compositae, will appear in *Evolution*. The second, in which loss of dispersibility in the Hawaiian flora is surveyed, will appear in *Brittonia*. A fourth paper in this series, dealing with outcrossing and other genetic systems in insular floras, was completed and submitted for publication recently. The studies on evolutionary phenomena in insular flowers were aided by field work and museum studies in the Hawaiian Islands during June, July and August.

Projects currently being pursued by Dr. Carlquist include studies of leaf anatomy of Rapateaceae, wood anatomy of Lobeliceae, wood anatomy of Goodeniaceae, and certain insular phenomena.

Dr. Grant spent much time in the field from March (in the low deserts) to September (in the high mountains) studying the feeding behavior of hummingbirds in relation to the pollination of flowers in the general flora. Numerous new pollination records were obtained in various areas of California and Arizona.

The *Gilia laciniata* group has an interesting distribution pattern: two species occur on the Pacific coast of California and three others in coastal Peru and Chile. Hybrids between the species have been produced and studied cytogenetically by Dr. Grant. These studies give an insight into the interrelationships and origin of these species found on the coast lines of two continents.

Since 1956, Dr. Grant has been carrying out a selection experiment with a group of desert *Gilias* of hybrid origin; one new generation has been grown in the experimental screenhouse each year. This year he spent considerable time analyzing the data from this long-term experiment. He now has a clear picture of the steps whereby the lines, which were highly sterile and nonviable in earlier generations, have recovered normal fertility and vigor in response to selection for these traits. Some new crosses between the lines were made in the spring of 1965.

A six-year study of the evolution of pollinating mechanisms in the family Polemoniaceae was published this year by Columbia University Press—*Flower Pollination in the Phlox Family*, by Verne Grant and Karen A. Grant.

Dr. Lenz continued his investigation of iris and spent considerable time studying chromosome pairing behavior in the spuria hybrids produced earlier. He also continued his studies of certain of the New World members of the Allieae (Liliaceae), especially members of the brodiaea complex. Since polyploidy is very common in many species, chromosome determinations are being made of all cultures used in this study. Work was also continued on the selection of elite clones in a number of genera, particularly *Arctostaphylos*, where

the search for improved forms for use as groundcovers has been going on for a number of years. One particularly fine *Mahonia* hybrid, 'Golden Abundance', is being propagated as rapidly as possible so that it can be released to the trade. The collection of species of *Arbutus* was increased during the year by the addition of two species.

During the year Dr. Munz continued to work on several projects started earlier. His work on the delphiniums of Asia and Africa supported by a National Science Foundation grant was continued both at Claremont and in Europe. He spent the summer in London working at the British Museum (Natural History) and at the Royal Botanic Garden, Kew. Both institutions have very large herbarium collections including many types. Through the courtesy of the British Museum he obtained extensive loans from Leningrad of Siberian types and also specimens from Edinburgh. Later in the season he studied material in Paris. Since returning to Claremont, Dr. Munz has reviewed the specimens held in American herbaria in the light of new information obtained in Europe. In addition to his delphinium work, Dr. Munz continued to work on a supplement to *A California Flora*. This supplement will include additions to the flora of California, newly introduced species, extensions of range, changes made necessary through the publication of monographs by specialists and the correction of typographical errors. It is hoped that this supplement can be published as a separate booklet so that it will be available to present owners of the Flora.

Dr. Thorne has spent much time collecting and determining plants from various parts of California. He has continued a systematic survey of the flora of Santa Catalina Island and started a similar survey of the flora of the San Gabriel Mountains. He also has continued, with colleagues, his studies and photography for a projected booklet, illustrated in color, on the plant communities of California. He has continued earlier floristic studies on other areas, and has identified nearly 600 sheets of Florida plants sent for determination. Work on his book of angiosperm phylogeny is nearing completion.

Research by several students on taxa of uncertain position promises to clarify the phylogenetic relationships of these families, mostly represented in California.

GRADUATE INSTRUCTION:

The botanic garden continues to cooperate with the members of the botany department of Pomona College and with the Claremont Graduate School appointee in botany in presenting a unified botanical program leading to the M.A. and Ph.D. degrees. During the year two students completed their studies and will be awarded the degree of Ph.D. at the June graduation. They were Dr. Warren Drugg whose thesis was on the micropalontology of the Moreno formation (Late Cretaceous-Paleocene) in California. Dr. Drugg is employed by the California Research Corporation, La Habra. Dr. David Walkington's thesis was a study of certain *Opuntia* hybrids found in southern California. In this work he stressed the chemical approach to taxonomy. Dr. Walkington is a member of the faculty at the California State College, Fullerton. Mr. Mark Parratt completed work for his M.A. which was awarded in June. In August

he left for Australia where he plans to spend a year at the University of Western Australia, Perth, on a Fulbright fellowship.

Students who held botanic garden-graduate school half-time research assistantships during the year were Robert Rutherford, Jimmy Massey, Ruth Wilson, Bryce Christman and James Henrickson. Mr. Rutherford and Mr. Henrickson continued their investigations of *Pilostyles* and *Fouquieria* respectively and their work is nearing completion. Miss Wilson is studying *Krameria* (Krameriaceae) for her Ph.D. thesis. Mrs. Pat Wilder is continuing her study of leaf anatomy of species of the genus *Ceanothus*. She spent the summer working at the University of Washington Arboretum, Seattle. New graduate students are Mr. Bryce Christman from Miami University, Oxford, Ohio, and Mr. Jimmy Massey from Texas A. & M. University, College Station.



Time out during field operations on San Bruno Mountain. James Roof, Director, Tilden Regional Park; Robert F. Thorne, Taxonomist, and Percy C. Everett, Superintendent, both of the Rancho Santa Ana Botanic Garden. (Photograph by Walter Knight.)

PUBLIC SERVICE:

As in all recent years, the public service features of the garden's activities again increased in 1965. As the garden becomes more widely known, so do the number of inquiries for information and consultation. Although the botanic

garden restricts its major activities to the flora of California, the inquiries range over the entire field of horticulture and related fields of agriculture and forestry. Sometimes the demands are so great as to interfere with staff research. This is particularly true in the case of the curator of the herbarium who is called upon regularly to identify plant material. In addition to routine identifications during the year, Dr. Thorne served as a member of the Council of the American Society of Plant Taxonomists and was appointed chairman of the society's committee to study the feasibility of a *Flora Boreali Americana*. During the year he also delivered lectures at the University of North Carolina, the Southern California Academy of Science, the Southern California Horticultural Society and the California State College at Fullerton. Dr. Thorne was elected President of the Southern California Botanists at their meeting in March. During the year Dr. Grant presented lectures at Pomona College and Claremont College. Dr. Benjamin prepared two sections for the *Mycological Guidebook* being compiled by the Mycological Society of America for use of teachers of mycology. Dr. Benjamin's papers were on the Laboulbeniales and the Gymnoascaceae. In November he was appointed to membership on the Advisory Committee on Fungi of the American Type Culture Collection, Rockville, Maryland. Mr. Everett served as a consultant to many groups during the year, including representatives from the State College at San Bernardino; Chaparral Elementary School, Claremont; City of Anaheim and City of Pasadena and the Theodore Payne Native Plant Garden, Hermosa Beach. Both he and Dr. Lenz spoke to a number of garden clubs and other horticulture organizations. During the year Dr. Lenz completed his term of office as a member of the Board of Directors of the American Iris Society and retired as chairman of the society's Scientific Committee, a post which he had held for ten years. He continues as a publications consultant for the American Orchid Society.

During the year staff members often were called upon to review manuscripts submitted to various journals for publication and to review National Science Foundation and other grant proposals. In September, Dr. Lenz conducted an on-site inspection at the request of the National Science Foundation. Although officially retired, Dr. Munz continues to be called upon for advice and counsel by many people. He also spends considerable time in the identification of California plants and of Onagraceae from both North and South America.

The popular lecture series inaugurated two years ago has proven to be very popular and during the past year four lectures were held during the winter months.

PUBLICATIONS:

The first number of Volume 6 of the garden's journal, *Aliso*, edited by Dr. Benjamin, appeared on March 22, 1965, and was mailed to all subscribers and to institutions with which we maintain an exchange arrangement. This number appeared with a newly designed cover with a motif of sycamore leaves, a tree which has been intimately associated with this botanic garden. The journal consisted of 132 pages and contained, in addition to contributions by staff members which are listed below, an article by Dr. Peter Raven entitled *Notes*

on the flora of San Clemente Island, California and one on The evolution of a pair of sibling allotetraploid species of *Cobwebby Gilias* (*Polemoniaceae*) by Dr. Alva Day, a former graduate student. Other papers included one by C. O. Stone, *Modoc cypress, Cuppressus bakeri Jeps. does occur in Modoc County, and Chromosome numbers of Spermatophytes, mostly Californian* by Raven, et al.

PUBLISHED WRITINGS OF THE BOTANIC GARDEN STAFF:

- Benjamin, R. K. 1965. Addenda to "The merosporangiferous Mucorales" III. *Dimargaris*. *Aliso* 6(1): 1-10.
- . 1965. Study in Specificity [Laboulbeniales]. *Natural History* 74(3): 42-49.
- . 1965. Revision of British Gymnoascaceae, by A. E. Apinis. *Mycol Papers* No. 96. Commonwealth Mycol. Inst., Kew. in *Mycologia* 57(4): 678-679. (Review).
- Carlquist, S. 1965. Wood anatomy of Cynareae (Compositae). *Aliso* 6: 13-24.
- . 1965. Wood anatomy of Eupatorieae (Compositae). *Aliso* 6: 89-103.
- . 1965. Island Life. A Natural History of the Islands of the World. Natural History Press, New York. 452 pp.
- . 1965. Rare Cypress clings to coast habitat. *Natural History* 74(8): 38-43.
- Grant, V. 1965. Species hybrids and spontaneous amphiploids in the *Gilia laciniata* group. *Heredity*, 20: 537-550.
- . 1965. Evidence for the selective origin of incompatibility barriers in the Leafy-stemmed *Gilias*. *Proc. Nat. Acad. Sci.*, 54: 1567-1571.
- Grant, V. and K. A. Grant. 1965. Flower Pollination in the Phlox Family. Columbia University Press, New York and London. 180 pp.
- Lenz, L. W. The Pacific Coast species of *Iris* and their hybrids: natural and garden. *In* Atti del 1st Simposio Internazionale dell' Iris, Firenze, May 14-18, 1963. n.d. [1965].
- . 1965. The Director's Report. *Aliso* 6: 115-132.
- Munz, P. A. 1965. Onagraceae. *N. Am. Flora* 5: 1-231.
- Thorne, R. F. 1965. New Caledonia, island of botanical opportunity. *Newsletter Hawaiian Bot. Soc.* 4(1): 1-3.
- . 1965. Floristic relationships of New Caledonia. *Univ. Iowa Stud. Natur. Hist.* 20(7): 1-14.
- . 1965. Vascular plants collected by R. F. Thorne in New Caledonia in 1959. *Univ. Iowa Stud. Natur. Hist.* 20(7): 15-65. (with A. Guillaumin and R. Viro).

GIFTS AND GRANTS:

- Ames, Dr. Ralph W., California State Polytechnic College, Pomona. 9 fungus cultures.
- Balazuc, Dr. J., 2 rue des Messiers, Argenteuil S.-O., France. 18 specimens of insects bearing Laboulbeniales.
- Balls, Mr. E. K., Carmel Highlands. Seeds, bulbs and 63 voucher specimens.
- Broadus, Mrs. Mabel, Carmel Highlands. 3 cartons Marcus Jones publications. California, University of, Davis. 11 collections of plants and seeds.
- California, University of, Los Angeles. 9 packets of seed (exchange).
- Carlquist, Dr. Sherwin, Claremont. 2 books and 600 herbarium specimens.
- Centraalbureau voor Schimmelcultures, Baarn, Netherlands. 2 fungus cultures.
- Conard, Prof. H. S., Lake Hamilton, Florida. 25 herbarium specimens.
- de Laubenfels, Dr. D. J., Syracuse University, Syracuse, N. Y. 2 cartons conifer specimens.
- Demaree, Dr. Delzie, Arizona State College, Flagstaff, Arizona. 64 herbarium specimens.
- Drugg, Dr. Warren, California Research Corporation, La Habra. 1 book.
- Embree, Dr. Robert W. Department of Botany, Brown University, Providence, Rhode Island. 4 fungus cultures.
- Fairbrothers, Dr. D. E., Rutgers University, New Brunswick, New Jersey. 14 herbarium specimens.
- Fuller, Dr. T. C., California Department of Agriculture, Sacramento. 26 herbarium specimens.

- Gaw, Dr. and Mrs. E. A., Glen Allen. Cash gift.
- Grant, Dr. Verne, Claremont. 4 books.
- Grey, Mrs. Robert, Calistoga. 7 collections of bulbs.
- Hesseltine, Dr. C. W., Northern Regional Research Laboratory, Peoria, Illinois. 48 fungus cultures.
- Hoover, Dr. Robert F., California State Polytechnic College, San Luis Obispo. 11 seed and 37 bulb collections.
- Huang, Dr. Tseng-Chieng, National Taiwan University, Taipeh, China. 34 herbarium specimens.
- Hutchison, Mr. Paul, University of California, Berkeley Arboretum. 14 herbarium specimens.
- Illinois State Natural History Survey, Urbana, Illinois. 15 specimens of insects bearing Laboulbeniales.
- Indoh, Dr. H., Department of Botany, Faculty of Science, Tokyo University of Education, Tokyo, Japan. 2 fungus cultures.
- Knight, Mr. Walter, Berkeley. 5 collections of bulbs.
- Lathrop, Dr. E. W., Loma Linda University. 333 herbarium specimens.
- Leech, Mr. H. B., California Academy of Science, San Francisco. 11 specimens of insects bearing Laboulbeniales.
- Lenz, Dr. Lee W., Claremont. 4 books.
- Martin, Dr. G. W., Department of Botany, University of Iowa, Iowa City, Iowa. 1 fungus culture.
- Mason, Dr. Georgia, University of Oregon, Eugene, Oregon. 8 herbarium specimens.
- Massey, Mr. Jimmy, Rancho Santa Ana Botanic Garden, Claremont. 62 herbarium specimens.
- Munz, Dr. Philip A., Claremont. 5 books.
- Museu Nacional, Rio de Janeiro, Brazil. 19 herbarium specimens.
- Norland, Elizabeth, San Diego. 2 seed collections.
- Norris, Dr. R. A. Tall Timbers Research Station, Tallahassee, Florida. 600 herbarium specimens.
- Olive, Dr. L. S., Department of Botany, Columbia University, New York, N.Y. 1 fungus culture.
- Parratt, Mr. Mark, Rancho Santa Ana Botanic Garden, Claremont. 46 herbarium specimens.
- Rao, Dr. A. N., University of Singapore. 145 herbarium specimens.
- Raucek, Mr. William H., Oakland. 6 Kodachromes.
- Roderick, Mr. Wayne, Berkeley. 10 collections of bulbs.
- Roos, Dr. J. C., San Bernardino. 3 seed collections.
- Roth, Dr. Louis M., Natick Laboratories, U. S. Army Natick, Massachusetts. 4 specimens of insects bearing Laboulbeniales.
- Santa Barbara Botanic Garden, Santa Barbara. 1 collection of acorns.
- Santa Catalina Island Rock and Ranch Company (Douglas Propst). 3 collections of seed.
- Sarbhoy, Dr. A. K., Commonwealth Mycological Institute, Kew, Surrey, England. 1 fungus culture.
- Schmidt, Marjorie, Hayfork. 3 collections of seed, 3 of bulbs.
- Simmons, Dr. E. G., Natick Laboratories, U. S. Army, Natick, Massachusetts. 1 fungus culture.
- Stephens, Mr. Trow, Glendora. 12 plants.
- Stone, Mr. C. O., California Division of Forestry, Redding. 18 herbarium specimens.
- Thompson, Wandalee, Lake Hughes. 6 packets of seeds.
- Twisselmann, Mr. E. C., Cholame. 324 herbarium specimens.
- United States Forest Service Fire Laboratory (Dr. E. C. Nord). 5 plants.
- van Royen, Dr. P., Department of Forests, Lae, New Guinea. 2 herbarium specimens and bottle preserved material.
- Vasek, Dr. F. C., University of California, Riverside. 2 type specimens.
- Washington, University of, Arboretum, Seattle, Washington. 3 *Ceanothus* hybrids for testing.
- Williams, Mrs. Charles, Calexico. Pamphlets for the library.

National Science Foundation grants made previously and continued through 1965, included one to Dr. Munz for a study of African and Asian delphiniums, and one to Dr. Grant for study of pollination in the Phlox family. Awarded to Dr. Grant, in 1965, was a second National Science Foundation grant for "Evolutionary Studies of Western American Plants." The second grant was for the amount of \$20,800. A National Science Foundation grant made earlier to Dr. Benjamin terminated during the year.

Lee W. Lenz, Director

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