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1931

ST. LOUIS, MISSOURI

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AIR VIEW OF CENTRAL PANEL OF MISSOURI BOTANICAL GARDEN.

Missouri Botanical Garden Bulletin

Vol. XIX JANUARY, 1931 No. 1

FORTY-SECOND ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the forty-second annual report of the Director.

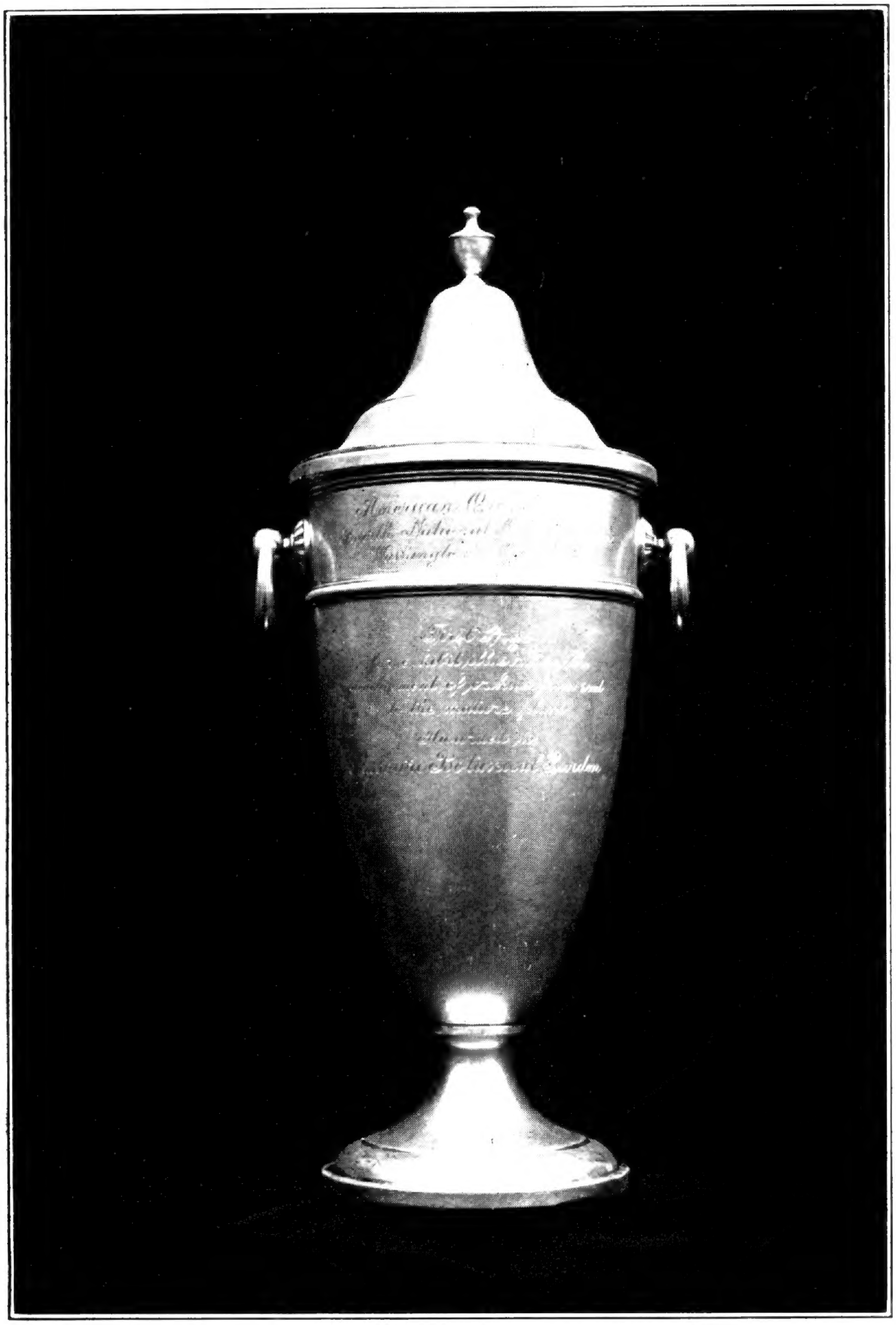
The yearly report of an institution like the Garden is apt to be nothing more than an account of what might be called the "customary seasonable routine." Frequently the only topic which calls for unusual treatment is the "unusual" weather, and it must be confessed that previous reports have not neglected to emphasize the effect of catastrophes such as hailstorms, cyclones, and smoke clouds. Extraordinarily dry or wet seasons, very low or high temperatures, with their effect upon vegetation, have almost invariably been commented upon. Even in this report some mention must be made, before it is concluded, of the extreme heat and drought of last summer, particularly since the effect of that season will probably be reflected for several years to come in the growth of trees and other plants.

Once in a generation it is possible to report some outstanding achievement, such as the acquisition of the Gray Summit Extension, but this is chiefly of local interest. Only occasionally is the Garden able to "make the front page" with an item of sufficient interest to be broadcast throughout the world. The year 1930 will be notable for two such events, namely, the securing of seed of the lost yellow water-lily,

Nymphaea Stuhlmannii, and the celebration of the three hundredth anniversary of the first recognized use of cinchona. Certainly nothing which the Garden has been able to accomplish in recent years has so appealed to the imagination of the public, as evidenced by the very widespread publicity given to both these events. A full account of the cinchona celebration appeared in the November, 1930, number of the BULLETIN, and further comment here is unnecessary. Numerous letters from physicians, pharmacists, and scientists generally testify to the significance of the celebration. Many requests for copies of the proceedings have been received, making it imperative that the papers presented on this occasion be made available to the professions interested. The volume which will embody these contributions is now in press and will appear some time during the coming year.

After a search of over ten years, which had been prosecuted through every known channel, the Garden received in September, 1929, through the personal efforts of Mr. B. D. Burtt, Botanist of the Department of Tsetse Research, Tanganyika Territory, East Africa, seed of what was presumed to be the true *Nymphaea Stuhlmannii.* A single seedling was obtained from the thousands of seed sent, and it can be imagined with what interest and care this tiny plant was nursed to maturity. In July, 1930, the plant was set out in the large tropical lily pool where it bloomed profusely. An abundant supply of seed of this species was consequently obtained, but, much more important, are the seed resulting from eighty different crosses made with other tropical lilies. Without being able to predict exact results, there would seem to be no question that through securing this lily the Garden will be able to introduce within the next few years a new strain of tropical water-lilies which should add to the already secure reputation of the Missouri Botanical Garden in this particular field. Several specialists in water-lily culture, who likewise have been seeking the lost yellow lily and who consequently appreciate the importance of its discovery, made special trips to St. Louis in order to be convinced that the true *Nymphaea Stuhlmannii* had really been obtained.

Restoration of the "Museum and Library" Building.—



FIRST PRIZE AWARDED THE MISSOURI BOTANICAL GARDEN FOR THE EXHIBIT ILLUSTRATING THE DEVELOPMENT OF ORCHIDS FROM SEEDS, FOURTH NATIONAL SHOW OF AMERICAN ORCHID SOCIETY, WASHINGTON, D. C., OCTOBER 16, 1930

EXHIBIT ILLUSTRATING THE DEVELOPMENT OF ORCHIDS FROM SEEDS TO MATURE PLANTS. AWARDED FIRST PRIZE (MRS. F. E. DIXON SILVER CUP), FOURTH NATIONAL SHOW OF AMERICAN ORCHID SOCIETY, WASHINGTON, D. C.

This building was erected by Henry Shaw in 1859 and used during his lifetime as a museum and for housing the herbarium and library. In the report of the previous Director for the year 1890 appears the following statement: "Until a new building is erected for the reception of the library and herbarium, and for office purposes, no attempt can be made to form a museum and the specimens collected by Mr. Shaw for this purpose have suffered to such an extent as to be for the most part worthless owing to the ravages of insects and the accumulation of dust during many years." In 1891, in accordance with the requirements of Mr. Shaw's will, the residence located at the corner of Seventh and Locust Streets was removed and rebuilt on its present site within the Garden. The acquisition of this building permitted the transfer to it of the herbarium and library, thus vacating to a considerable extent the museum room. In the Annual Report for the year 1896 occurs the following: "Notwithstanding the provision of safe and for the time being ample quarters for the library and herbarium in the reconstructed city residence, it has not as yet been found practicable to remove the numerous wood specimens and other unattractive but necessary and valuable material from the old museum building so as to free the latter for other uses. Nor has it proved possible to spare funds for the purchase of material and the salary of an assistant who should be charged with the installation and maintenance of a museum illustrating some branch of pure or applied botany such as might be accommodated in this small building were it empty." In 1902 a portion of the old museum building was adapted to office and laboratory use for pathological work under the direction of Dr. von Schrenk, Pathologist to the Garden. The laboratory in the basement is still retained for the exclusive use of Dr. von Schrenk, and the wall cases on the balcony of the main room now contain his valuable collection of wood specimens. But this building has not been open to the public since the death of Mr. Shaw, it having been used primarily for the storage of books and dried plants.

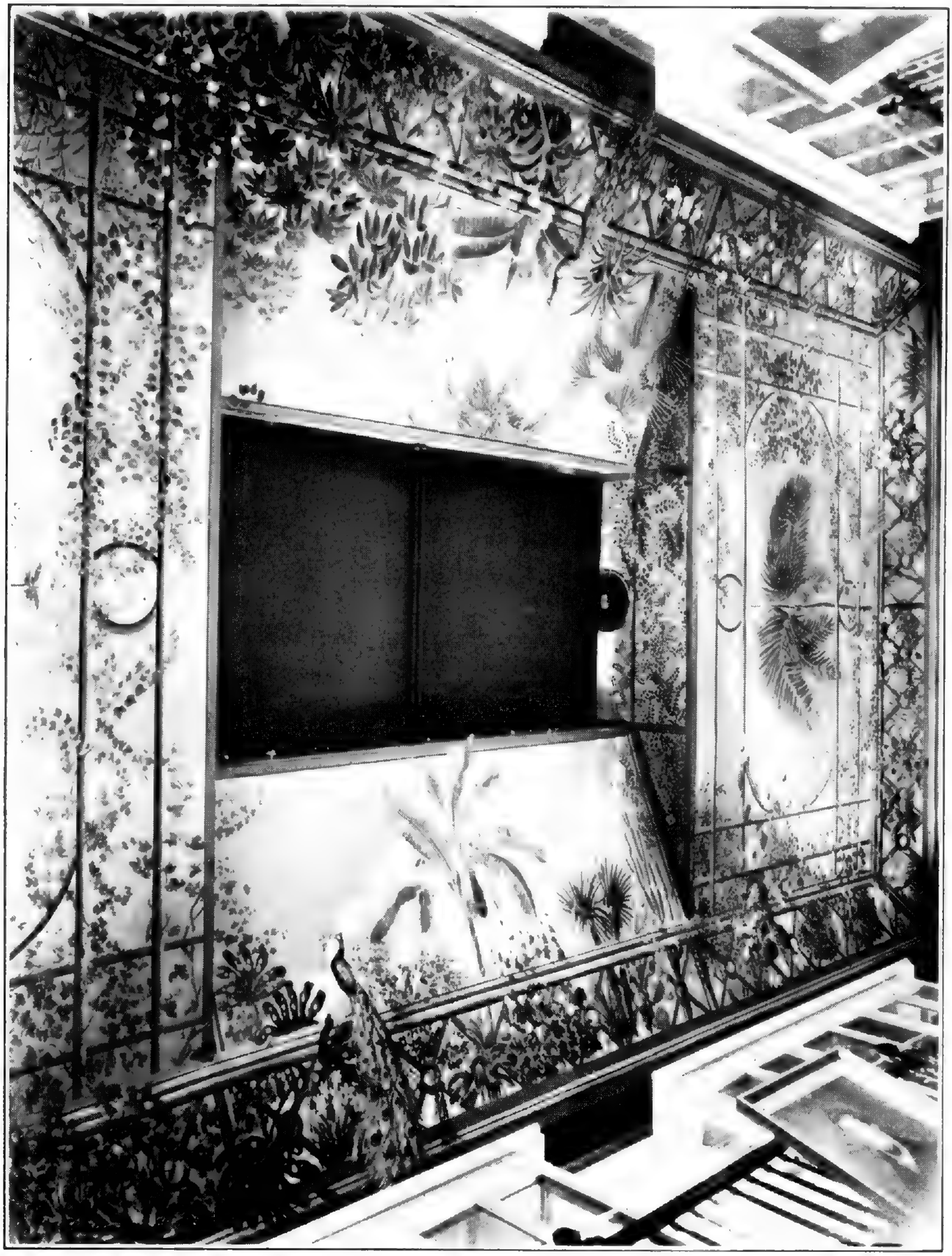
The conversion of the assembly room in the administration building into an additional stack room for the library

left no place where meetings or public lectures could be held. In view of the ceremonies attending the cinchona celebration, it became necessary to provide some such room at the Garden and naturally the "museum and library" building suggested itself. Little or nothing had been done to either the interior or exterior since it was originally constructed, so that it was necessary not only to renovate and restore the interior but to repair the exterior extensively, including building a new skylight and roof, replacing the gutters and downspouts, as well as tuckpointing the brick and stone. The ceiling was originally decorated with paintings of plants and birds, under the direction of Mr. Shaw, and it must be confessed that probably no such depiction of the world's fauna and flora had ever before been brought together in such a small space. Owing to leaks in the roof, the plaster on which the paintings were made was in such condition that considerable portions of it had to be removed. Previous to repairing the ceiling water-color sketches were made of the paintings, so that after replastering the original design could be restored. This was done most successfully, and with the repainting and furnishing and the installation of an indirect lighting system, a modern moving-picture and stereopticon booth and curtain, the Garden is at last provided with one of the most attractive auditoriums of its size that can be found anywhere.

Additional Range of Growing Houses.—Greenhouse space for growing the increasing amount of material needed for the monthly flower shows, as well as outdoor planting, has been at a premium for the past four or five years, and more recently plants have suffered from lack of room. In order to afford some relief, two houses 20 feet wide and 75 feet long, and one house 28 feet wide and 75 feet long, have been added at the end of the existing range of houses of the same dimensions. The superstructure alone was purchased from the manufacturer, and Garden employes built the foundation, as well as doing the erecting, glazing, installation of heat, water, ventilators, etc. Some 5,000 additional feet of much-needed growing space has thus been obtained.

Some minor construction items, but all contributing to the

VIEW OF SOUTH END OF LECTURE ROOM IN "MUSEUM AND LIBRARY" BUILDING.



RESTORED FRESCOES ON CEILING OF "MUSEUM AND LIBRARY" BUILDING, ORIGINALLY PAINTED FOR MR. SHAW IN 1859.

general improvement of the Garden, are listed. The installation of concrete posts to support a trellis, replacing the old wooden posts bordering the economic garden, is a notable improvement. On this trellis there are being trained fruit trees which will eventually produce a pleached alley through the center of this garden. Nearly two hundred feet of additional fence have been erected along the Alfred Avenue boundary. The pit formerly devoted to the growing of bananas in the floral display house was converted into a pool in which the Victoria and other water-lilies could be grown under glass. By transferring the bananas to the house where the coffee finca was established, a great many more of these trees can be raised, which insures having one or more of them always in fruit. Much painting, both indoors and out, has been taken care of, and the usual amount of repair work has been done, including the storm-water sewers in various parts of the Garden and the replacing of gutters and downspouts with copper where galvanized iron had previously been used.

Floral Displays.—The usual flower shows, which, from the standpoint of the public, form one of the most important features at the Garden, have been staged in season. An attempt is usually made to diversify the arrangement each year although necessarily the same plants have to be used. While this would seem to be the best policy, it must be admitted that visitors are apt to complain that special features which they enjoyed in previous years are not represented. It should be realized that the floral displays held at the Garden, unlike the usual flower shows held throughout the country, are always maintained for several weeks and sometimes for longer periods. This entails having a large amount of duplicate material on hand, and in the arrangement of the show it must be borne in mind that the plants have to be accessible for the purposes of watering and replacement.

Following the usual Christmas exhibition of poinsettias, the orchid show in 1930 was staged in a modernistic setting which at least had the effect of novelty. Three separate shows were staged during the month of March, the first consisting of spring bulbs, including tulips, hyacinths, freesias, etc. A cen-

tral garden was laid out and for the first time this was raised slightly so that the pots could be completely hidden in peat. With the use of bent grass the illusion of an actual outdoor garden was perfect. After this came the spring flower show of the florists and nurserymen of St. Louis and vicinity. This was pronounced the most successful ever held by the local growers, who expressed their gratitude to the Garden for the privilege of holding it under such favorable conditions and at such small expense to them. Toward the end of the month the annual display of cinerarias, azaleas, lilies, etc., was staged. Following in successive months came the hybrid pelargoniums, salpiglossis, begonias, marguerites, lupines, etc. In the fall the dahlia section of the St. Louis Horticultural Society, after having tried for several years the experiment of holding its show down town, returned to the floral display house for the dahlia exhibition. Supplemented by novelties and newer varieties grown at the Garden, a most creditable display was made. The chrysanthemum show, on account of the cinchona celebration, was staged somewhat in advance of its regular date, it being ready for visitors on October 29, and was maintained until December 7. Attention was called in the December BULLETIN to the new cascade chrysanthemums produced by special training of certain varieties, and these, together with the hanging baskets, attracted much attention.

The question is frequently asked as to what is done with the flowers from these shows and the surplus planting material which the Garden may have from time to time. For a number of years the St. Louis Book and Flower Guild has undertaken to distribute cut flowers and plants to all hospitals and other charitable institutions and has done the considerable amount of work involved most admirably. Letters from the recipients indicate how greatly this is appreciated. Those who are able to have flowers always about them sometimes fail to realize how much the gift of a few plants or blossoms means to those who are cut off from this source of enjoyment. Below are listed the institutions which during the past year have been supplied by the Garden through the able assistance of the Book and Flower Guild:

Alexian Bros. Hospital
Baptist Hospital
Barnard Free Skin & Cancer Hospital
Bethesda Hospital
Bethesda-Dilworth Memorial Home
Blind Girls' Home
Central Institute for the Deaf
Children's Home Society of Missouri
Christian Hospital
Christian Old People's Home
Christian Orphans' Home
City Infirmary
City Poorhouse
Deaconess Home and Hospital
Episcopal Orphans' Home
Good Samaritan Altenheim
Home of Ancient and Infirm Israelites
Home of the Friendless
Jewish Hospital
Jewish Orthodox Old Folks' Home
Kingdom House Settlement
Kirkwood Old Folks' Home
Lutheran Hospital
Little Sisters of the Poor
McLain's Home for Crippled Children
Masonic Home (Hospital Wards)
Memorial Home
Missouri Baptist Hospital
Missouri Pacific Hospital
Mount St. Rose Sanitarium
Park View Old Folks' Home
Russell Home
St. Ann's Maternity Hospital
St. Joseph's Deaf and Mute Institute
St. Luke's Hospital (Charity patients)
St. Mary's Hospital
Shriners' Hospital for Crippled Children
U. S. Veterans' Hospital No. 92

Outdoor Planting—Trees and Shrubs.—About 600 pounds of commercial fertilizer were used in continuation of experiments started in 1928 on the feeding of large shade trees. The unusual summer permitted few of the tests to reach completion. In 1930 ninety-four trees were used in these tests. Except for some of the smaller, and in one case the largest tree treated, results have been negative. It might be said that these experimental trees were in "good condition,"

nearly all showing some improvement, but specific changes such as the longer retention of leaves and improved color are extremely hard to tabulate.

Dormant spraying with the new power sprayer by a well-trained crew in two successive years has reduced oyster-shell scale on Cornus, and San Jose scale on Prunus by almost 100 per cent, and has to a remarkable degree checked red spider, mite, obscure scale, and mealy bugs. Practically, this result will make possible the dilution of spray material by 34 per cent in 1931. Complete discontinuance of dormant spraying is not possible in so large a planting as the Garden, with the many avenues of reinfestation open to pests. Summer spraying in 1929 completely eradicated the bagworm, webworm, and other types of chewing insects, making it unnecessary to use a single gallon of poison spray in 1930. Some poison spray will be needed this year to control leaf miners, rollers, and sewers, a group of minute insects that gained some headway late last summer.

Tree surgery in its many branches continued throughout the year. Pruning of all shrubs and trees in the entire Garden was completed within eight months. Cabling was found to be necessary for ten trees where the type of branching would have permitted injury by wind and sleet. Concrete fillings were placed in five trees; these fillings ranged from a simple trunk cavity, fourteen inches long, to a complex root, base, trunk, and notch cavity, requiring steel bracing. Experiments with a dressing to prevent the drying of the cambium and to seal the edge of the concrete filling proved of little value. Some work was done with "plastic wood" as a filling in tree cavities.

In the main garden, ten each of twelve varieties of flowering crab and cherry were planted in places where they will become the outstanding plant when in flower. Nine hundred additional privets were removed from the nursery and planted throughout the Garden; almost three hundred other trees and shrubs, some of considerable size, were moved and replanted.

Outdoor Planting—Display Gardens.—The beds in the main garden are filled with growing plants for almost eight

months of the year. Starting with tulips or pansies in April, the summer bedding plants follow in late May, and these are replaced with early-flowering chrysanthemums in September. As soon as a heavy frost blackens the chrysanthemums they are removed from the beds and the tulips are again planted. In making these changes, naturally a certain amount of soil adheres to the roots and is carried away so that in a period of ten years the beds have reached a level below that of the sod. To remedy this and raise the beds to the proper level last spring required forty truck loads of soil. The addition of this fresh soil to the beds not only improved them in the matter of drainage but also added new life to the plants.

In 1917 the present rose garden was started on a site formerly occupied by greenhouses and various service buildings. During the past thirteen years a gradual settling of the beds has taken place, and last spring 175 truck loads of soil were brought into this garden. Extensive changes were made in re-locating rose beds, eliminating certain grass walks, and combining others to permit the use of the power lawn-mower. When the rose garden was originally planned the intention was to grow as large a variety of hybrid tea and hybrid perpetual roses as possible, but time has shown that this plan, if carried out, necessitated too heavy an expenditure each year for replacements. The mortality rate in the rose garden in some years was quite high, due to the weak nature of some of the varieties and also the changeable weather conditions in early spring.

The west end of the Linnean garden, comprising an area 80x120 feet, being quite flat, was also in need of better drainage. Various iris rot diseases were yearly becoming more prevalent in the six large beds of iris located here. Consequently all the plants were removed during the summer, the level of the beds raised by adding a total of 40 truck loads of soil, and then replanted with 4,000 divisions of iris plants, comprising 50 of the best varieties for landscape use. The iris produces more flowers per plant at one time than any other herbaceous perennial and consequently in the mass it is the most effective perennial. The Linnean garden, comprising more than half an acre, is almost entirely

planted with iris, and the effect in May cannot be equalled for beauty and mass of color. But unfortunately this area lacked color during the remainder of the summer. In replanting the iris this year a 2½-foot border was left on all sides of the rectangular beds and planted to tulips. In the spring myosotis, English daisies, and pansies will be added, and during the summer these borders will be filled with various dwarf annuals.

In the fall more bulbs were planted than in any recent year, comprising 22 varieties of hyacinths, 14 varieties of single early and double tulips, 40 varieties of Darwin tulips, 14 varieties of Breeder tulips, 4 varieties of Parrot tulips, 14 varieties of Cottage tulips, and 58 varieties of the new Triumph tulips, making a total of 27,000 bulbs. The Triumph tulips should prove extremely interesting during the coming spring as they represent a new race, just beginning to find its way to this country, resulting from the cross of early tulips with the Darwins. Whether these tulips will in time surpass the many excellent present-day varieties of Darwin, Breeder, and Cottage tulips is problematical, but it will be interesting at least to see some of the varieties for comparison. This collection has been planted in the Linnean garden.

As in the past, the Italian garden was planted with a variety of bedding plants in the spring. In glancing over the main garden and Italian garden it is hard to realize that these two gardens require every spring a total of 35,000 plants. In the iris test garden all of the dwarf bearded iris varieties were brought together in one bed and likewise the intermediate irises. One hundred and sixty-seven new varieties were added to the collection during the year and the iris test garden now contains a total of 1,238 named varieties and species.

ATTENDANCE FOR THE YEAR 1930
(Recording turnstile count)

	Week-days	Sundays
January	7,735	6,017
February	8,104	11,850
March	18,615	32,676
April	15,883	13,600
May	18,476	16,730
June	18,027	13,104
July	19,091	6,484
August	23,385	11,508
September	22,254	18,283
October	22,406	16,232
November	23,569	36,815
December	3,716	8,082
	201,261	191,381
		201,261
Total		392,642

Gray Summit Extension.—Aside from the continuation of road building, with the necessary grading, hauling of gravel, building of culverts, etc., the chief item of construction has been the erection of three additional greenhouses made necessary by the rapidly expanding orchid collection. Some 450 additional feet of rock wall along the Manchester Road frontage were also completed. The work was stopped because of the uncertainty as to just where the contemplated new Highway 66 would intersect the Manchester Road. When this matter is settled it will then be possible to carry out plans for the erection of a lodge house and the establishment of what will be eventually the public entrance to the Gray Summit Extension. It has long been recognized that the appearance of the frontage on the Manchester Road could be considerably improved by changing the grade between the concrete highway and the stone wall. Permission was obtained from the State Highway Commission to make the necessary alteration, and grading, sodding, and the construction of catch basins have all combined to change this area materially for the better. Wild rose bushes are being collected this fall on the property for planting along the wall, and if the new highway intersects the Manchester Road at

the present junction of the Pacific and Manchester Roads, suitable planting there will make the approach to the Gray Summit Extension the most attractive of any public garden. Especial attention has been paid to the sodding and seeding of slopes which have always washed badly. The work accomplished should eliminate many of the gulleys which previously had been cut by heavy rains.

Four hundred additional flowering crab-apple trees were planted out, and 1,000 large-flowered dogwoods, including 75 of the pink variety, have been established in the vicinity of the cherry and crab-apple orchards. All of these trees, including the apple orchards, have been regularly cultivated and sprayed during the season and are all in excellent condition. Approximately 10,000 trees and shrubs were transplanted from the seed-beds to the nursery.

With the completion of the three new greenhouses the orchid collection can be segregated in a way that has not heretofore been possible. Changing the majority of the plants from baskets to pots has resulted in economizing considerable space, but with the rapid accumulation of seedlings which for the next seven or eight years will need more and more room, it is doubtful whether even the existing range will be able to accommodate all the plants. At the present time the hybrid forms of various Cattleya species are represented by approximately 20,000 seedlings. Since most of these are from parents of exceptional quality, some most satisfactory results should be obtained. Particular attention has been paid during the past year to growing the spray orchids in greater numbers. Vigorous seedlings of *Vanda caerulea, Vanda Sanderiana, Oncidium varicosum Rogersii,* as well as Dendrobium and Miltonia hybrids, are now growing. With the possibility of maturing a thousand or more plants of each of these species some idea may be obtained of the future orchid shows at the Garden.

At the fourth National Show held by the American Orchid Society in Washington, D. C., on October 16, the Garden made an exhibit illustrating the development of orchids from seeds to mature plants. This display was awarded the Mrs. Fitz-Eugene Dixon cup, first prize in this class.

Tropical Station.—Mr. Pring, the Superintendent, and Dr. Woodson, Research Assistant, visited the Tropical Station in February. They were able to make several trips into the jungle and, accompanied by Mr. Hunter, Manager of the Station, and Mr. Bouchet, secured a number of orchids to be added to the collection either on the Canal Zone or at Gray Summit. Mr. Hunter continues to make collecting trips whenever possible and as he visits new regions is constantly making new discoveries. The value of the Tropical Station to the Garden is manifest to anyone who has an opportunity to judge of the work done there and the manner in which it contributes to the activities of a garden located in the temperate zone.

The Weather.—As has previously been intimated, no report of a botanical garden can be complete without some reference to the weather. This is justified to an unusual degree this year by the severity of the winter of 1929-30, followed by the drought and excessive heat of last summer. The outdoor work of last spring was materially increased because of the unprecedented damage done during the previous winter. Shrubs, vines, and even trees, which have survived the winters of St. Louis for the past twenty-five years, succumbed to the alternate freezing and thawing to which they were subjected during last winter. Practically every plant in the rose garden had to be cut back to the ground and a more dismal appearance than it presented could not be imagined. Without attempting to enumerate the different kinds of plants showing the effect of the winter, it need only be stated that probably not since the Garden was established by Mr. Shaw has vegetation out of doors been subjected to such severe conditions.

That last summer was the driest since 1837, the first record available, is well known. This drought, accompanied by the hottest period of equal length on record, was a most severe strain, particularly since it followed such a devastating winter. Plants had to be severely cut back and consequently much of the growth was new and soft. The rainfall deficiency at St. Louis was even greater than the average deficiency in the state. From February to August,

inclusive, the rainfall at the Garden was 60 per cent below normal and for July and August was 91 per cent below normal. The fact that the dry weather continued up to the end of the year, with the moisture deficiency constantly increasing, makes the prospect very discouraging for vegetation next spring. Unless an unusual amount of snow and rain falls during the first three months of 1931, the outlook for maintaining many trees and shrubs in normal condition is distinctly unfavorable. The fact that there is practically no water in the ground, and that plants require such abundant moisture to carry on their normal activities, has caused the Garden BULLETIN to issue a special warning calling attention to the necessity for artificial watering wherever possible during the winter and early spring.

Annual Bequests.—The Annual Flower Sermon "to commemorate the goodness of God as revealed in flowers," as stipulated in Mr. Shaw's will, was delivered at Christ Church Cathedral on May 11, the Rev. Robert Norwood, D. D., Rector of St. Bartholomew's Church, New York City, officiating.

On September 30 the National Association of Park Executives held its convention in St. Louis and some four hundred delegates were entertained at luncheon at the Garden. The Gardeners' Banquet fund was drawn upon to meet a part of the expense of the affair, the St. Louis Park Department contributing the balance.

The Trustees' Banquet, provided for in Mr. Shaw's will, was held in connection with the celebration of the three hundredth anniversary of the first recognized use of cinchona, on the evening of October 31, at Hotel Jefferson. Over three hundred were in attendance, including distinguished foreign guests, delegates from out of the city, and friends of the Garden in St. Louis.

As for the past few years, the employes of the Garden have elected to receive each a turkey at Christmas rather than being entertained at a dinner, and the Gardeners' Banquet fund was expended in this manner this year.

A part of the fund set aside by Mr. Shaw for prizes at flower shows was donated toward the expenses of the annual

spring show of the florists and nurserymen of St. Louis and vicinity, held in March. The silver cup provided by this fund was awarded this year to Joseph Witek, Florist.

RESEARCH AND INSTRUCTION

The largest number of graduate students ever registered in the Henry Shaw School of Botany has been accommodated at the Garden and in Rebstock Biology Hall of Washington University during the past year. With the exception of the work in taxonomy, which is given at the Garden because the herbarium and library are housed there, the major portion of graduate work is now conducted at the University where facilities not previously provided are available. An addition to the greenhouses at Rebstock Hall has made it possible to carry on extensive experiments in plant physiology as well as to provide material for undergraduate courses.

In July, Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, was granted a six-months' leave of absence for the purpose of visiting European herbaria. He will return in time to resume his duties at the beginning of the second semester. Dr. Adele Lewis Grant, formerly of Cornell University and the University of South Africa, was appointed Acting Curator of the Herbarium and Assistant Professor in the Henry Shaw School of Botany, and has carried on the required curatorial duties in the absence of the Curator, as well as conducting certain graduate courses. Dr. Grant is continuing her studies in the endemic genera of South African Scrophulariaceae and completing monographic studies on the genera Nemesia, Diascia, Diclis, and Hemimeris.

Dr. E. S. Reynolds, Physiologist to the Garden and Associate Professor in the Henry Shaw School of Botany, besides his teaching duties, has directed the research work of students majoring in plant physiology. He is continuing his investigations on the toxic effect of plant extracts on fungi causing diseases of peas, beans, and other plants; and also the work on the internal temperature of trees and its relation to external temperature.

Dr. Edgar Anderson, Geneticist to the Garden, was advanced from Assistant Professor to Associate Professor in the Henry Shaw School of Botany upon his return from abroad where he held a National Research Fellowship. The major portion of his time was spent at the John Innes Horticultural Institution acquiring facility with modern cytological methods. While there he made a study of the division of vegetative and generative nuclei in Uvularia; the artificial production of chimeras in the Solanaceae; in conjunction with Miss de Winton, an analysis of Mendelian factor interactions in *Primula sinensis;* and in conjunction with Miss Brenhilda Schafer, an investigation of interspecific hybridization in Aquilegia. Dr. Anderson, in addition to attending the International Horticultural Congress and the International Botanical Congress, visited various gardens and botanical departments in England, as well as making trips to Brussels, Berlin, and Geneva, where he studied herbarium material.

Dr. David H. Linder, Mycologist to the Garden, and Assistant Professor in the Henry Shaw School of Botany, in addition to spending much time in organizing the mycological herbarium and conducting his classes, has completed two papers now in press, one on the "Genus Helicoceras," and the other on "Notes on the Helicosporeae, with the Descriptions of Three New Species." There was likewise published in "Mycologia" "Notes on *Tremellogaster surinamensis.*" During the year miscellaneous phytopathological investigations, chiefly concerned with the identification of the causal organisms, have been completed. On the occasion of the visit of Dr. Buisman of Holland, a specialist in the study of the Dutch elm disease, a brief survey of this region was made to discover whether or not this disease had appeared in the vicinity of St. Louis. The investigation was not conclusive because of the drought, but no evidence of the presence of this elm disease was found.

Dr. Robert E. Woodson, Jr., Research Assistant to the Garden, was appointed an Instructor in the Henry Shaw School of Botany. Besides conducting the new course in plant anatomy, he has continued his studies on the anatomy of the flower and inflorescence of representative genera of the

Apocynaceae. He is also attempting to interpret, through a study of the floral anatomy of representative genera, the phylogenetic history of the Contortae.

Dr. Roland V. LaGarde, Research Assistant, took charge for the second semester of the course in gardening offered to the students of the School of Occupational Therapy. He is continuing his investigations on the non-symbiotic methods of raising orchids from seed.

Miss Katherine L. Perkins, a graduate of the School for Gardening of the Missouri Botanical Garden, assumed charge in the fall of the course given to the students in the School of Occupational Therapy.

In June, Dr. Amos Showalter, Assistant Professor of Botany in the Henry Shaw School of Botany, resigned and the courses formerly conducted by him were taken over by Dr. Anderson in the fall.

The course in gardening offered to amateurs was again given in 1930, the major portion of the instruction being conducted by Mr. Paul A. Kohl, Floriculturist to the Garden. The work was given on Tuesday afternoons from March 4 to May 13, inclusive, and seemed to meet a rather widespread demand from St. Louis and vicinity.

The system of apprenticeships adopted in 1929 has been continued with little change. There are now nine apprentices enrolled at the Garden, three additional young men being admitted each fall to replace the three who have completed the three years' work. That the system is successful would seem to be indicated by the number of applications now on hand to fill prospective vacancies. By no means all those who desire to become apprentices can be accommodated, so that it is possible to select with considerable care those who seem best qualified for the work.

Graduates, Fellows, and Scholars.—The following appointments have been made in the Henry Shaw School of Botany for the academic year 1930-1931: Martha L. Beardsley, A. B., M. S., Washington University, Instructor in Botany (half-time graduate student, Cytology, Plant Physiology, and Mycology); Assistants in Botany (half-time graduate students), A. F. Bucholtz, B. S., Cornell University, M. S.,

Washington University (Plant Physiology); Harry J. Fuller, A. B., M. S., Washington University (Plant Physiology and Mycology); Mary Elizabeth Pinkerton, B. S., University of Nebraska (Taxonomy); Rufus J. Lackland Research Fellows in Botany, George J. Goodman, A. B., University of Wyoming, M. S., Washington University (Taxonomy and Morphology); Charles Leo Hitchcock, A. B., A. M., Pomona College (Taxonomy and Morphology); John Adam Moore, B. S., Butler University, M. S., State College of Washington (Taxonomy and Morphology); Julian A. Steyermark, A. B., M. S., Washington University (Taxonomy and Morphology); and F. Lyle Wynd, B. S., M. A., University of Oregon (Plant Physiology and Taxonomy); Washington University Scholarship, Josephine Darlington, A. B., B. S. in Forestry, University of Montana, M. S., Washington University (Taxonomy and Morphology); Jessie R. Barr Fellow in Botany, Marion Child, A. B., Oberlin College, M. S., Washington University (Mycology and Physiology).

Fellowship in American Creosoting Company, Earl E. Berkley, A. B., University of West Virginia, M. S., Washington University (Plant Physiology and Chemistry); Special Garden Fellowships, Caroline K. Allen, A. B., Vassar College, M. S., Washington University (Taxonomy and Morphology); Lily M. Perry, B. A., Acadia University, A. M., Radcliffe College (Taxonomy and Mycology); Paul F. Shope, B. S., Pennsylvania State College, M. S., University of Colorado (Mycology and Morphology); Special Yenching University Fellowship, Chien-fan Li, B. S., Yenching University, China (Taxonomy and Morphology). Independent Students, D. George Deihl, A. B., Grinnell College (Taxonomy and Morphology); Mary E. Ledgerwood, A. B., Harris Teachers College (Plant Physiology); Dorothy M. Megowen, A. B., University of Illinois (Taxonomy).

Degrees.—The following graduate students in the Shaw School of Botany received advanced degrees at the Washington University commencement, June 10, 1930: Hamilton H. Card, Rufus J. Lackland Research Fellow (Taxonomy and Morphology), and Eva M. Fling Roush, Jessie R. Barr Fellow in Botany (Taxonomy and Morphology)—Doctors of

Philosophy; Earl E. Berkley, Rufus J. Lackland Research Fellow (Plant Physiology and Chemistry), Josephine Darlington, Graduate Scholar (Taxonomy and Morphology), Dorothy S. Francis, Assistant in Botany (Plant Physiology and Morphology), George J. Goodman, Rufus J. Lackland Research Fellow (Taxonomy and Morphology), Julian A. Steyermark, Graduate Scholar (Taxonomy and Morphology) —Masters of Science.

Published Articles.—The results of research and investigation have appeared in the ANNALS OF THE MISSOURI BOTANICAL GARDEN, the quarterly journal which since it was founded in 1914 has so admirably served the members of the staff and graduate students of the Henry Shaw School of Botany as a place of publication. During the year two double numbers of the ANNALS have been issued. Following are the titles of articles by staff or students which have appeared in the ANNALS and elsewhere:

Hitchcock, C. L. Revision of North American Species of Godetia. Bot. Gaz. **79**: 321-361. 1930.

Hogstad, Anton, Jr. Coming Back: The Show Globe, Emblem of Pharmacy. Am. Druggist, October, 1930.

Jensen, L. P. Native Plants for the Rock Garden. Garden Life **3**[7]: 1-2. 1930.

Linder, D. H. Botanical Report on Liberia. Report of the Harvard-African Expedition upon the African Republic of Liberia and the Belgian Congo, pp. 513-568. 1930.

Linder, D. H. Notes on *Tremellogaster surinamensis.* Mycologia **22**: 265-269. 1930.

Mathias, Mildred E. Studies in the Umbelliferae. III. A Monograph of Cymopterus including a Critical Study of Related Genera. Ann. Mo. Bot. Gard. **17**: 213-474. 1930.

Mathias, Mildred E. Botany. Am. Year Book, 1930.

Moore, George T. The Greatest of Human Pleasures. Junior League Magazine. June, 1930.

Pring, George H. Orchids. Ladies' Home Journal **47**[1]: 18-19, 154. 1930.

Pring, George H. Chrysanthemums. Ladies' Home Journal **47**[11]: 30-31, 162. 1930.

Pring, George H. Boxwood. Garden Life **3**[1]: 3. 1930.

Woodson, Robert E., Jr. Studies in the Apocynaceae. I. A Critical Study of the Apocynaceae (With Special Reference to the Genus Apocynum). Ann. Mo. Bot. Gard. **17**: 1-212. 1930.

Scientific and Popular Lectures.—The demands upon the scientific and Garden staff for talks before various organizations increase from year to year. While this service to the public is freely granted in so far as possible, it must be admitted that with the present organization, which includes no one whose special duty it is to give popular addresses, the work is becoming somewhat burdensome. Following is a list of the more important lectures given during the year. The names of the organizations requesting talks will indicate how diverse are the interests desiring to hear discussed some aspect of botany or horticulture.

Edgar Anderson, May 11, Mill Hill School, England, "Camping in America"; May 12, Genetics Club, Cambridge, England, "Biological Factors Affecting Speciation"; June 25, Royal Society of London, England, "Interspecific Hybridization in Aquilegia"; August 21, International Botanical Congress, Cambridge, England, "Internal Factors Affecting Discontinuity between Species"; December 5, St. Louis Horticultural Society, "English Gardens"; December 15, Radio Station KMOX, "Modern Miracles of Plant Science."

Adele L. Grant, November 5, P. E. O. of Webster Groves, "Collecting Plants in South Africa."

Anton Hogstad, Jr., January 3, St. Louis Horticultural Society, "Vegetable Drugs"; May 21, Colloidal Medical Seminar, "The Modern Atom"; May 23, teachers of biological sciences, St. Louis Schools, "The Romance of Drugs"; June 12, South Side Lions Club, "The Romance of Drugs"; July 16, Nature Study Group of the Piasa, Illinois, Chautauqua, "Orientation of Man to Nature"; September 27, Naturalists' Club of St. Louis, "Some Chemico-Pharmacological Aspects of the Nightshade Family"; October 15, Colloid Medical Seminar, "Isomerism as a Related Phenomenon to that of Colloidal Chemistry."

L. P. Jensen, February 10, Alpha Chi Sigma, "The Evo-

lution of Landscape Art''; June 7, St. Louis Horticultural Society, ''The Gray Summit Extension''; August 1, St. Louis Horticultural Society, ''Wild Flowers for the Garden''; October 18, Villa Ridge, Mo., ''Roadside Beautification''; October 18, Kirkwood Garden Club No. 1, ''Trees''; October 22, citizens' meeting, Washington, Mo., ''The Value of a Garden Club and How It May Be Organized.''

Paul A. Kohl, February 7, St. Louis Horticultural Society, ''Plant Germination from Seed.''

Roland V. LaGarde, August 10, German Students' Union, Prague, ''Universities and University Life in America.''

Katherine H. Leigh, October 3, St. Louis Horticultural Society, ''Glass Gardens for the Home.''

David H. Linder, September 5, St. Louis Horticultural Society, ''Plant Exploration in British Guiana.''

Geo. T. Moore, March 5, St. Louis Coöperative Club, ''The Missouri Botanical Garden''; March 6, Forsythe-West Lindell Improvement Association, ''The Planting of Trees, Plants, and Flowers as a Community Asset''; March 10, Mary Institute, ''Moving Pictures of Plant Life''; March 12, John Burroughs School, ''Moving Pictures of Plant Life''; April 24, Garden Lovers Club of Cincinnati, ''Orchids''; May 9, Webster Groves High School, ''Movement in Plants''; May 25, Radio Station KMOX, ''The Hobby of Gardening''; May 30, American Electro-Chemical Society, ''Movement in Plants''; October 21, Garden Club of St. Louis, ''What Goes on in the Plant''; November 10, Technical Club, Madison, Wis., ''The Plant Commonwealth''; November 17, McBride Lecture, Western Reserve University, Cleveland, Ohio, Morality in Plants"; December 12, American Society of Mechanical Engineers, ''Plant Growth.''

George H. Pring, January 21, Cosmopolitan Club, ''The Activities of the Missouri Botanical Garden''; February 19, Women's Club, Cristobal, C. Z., ''The Missouri Botanical Garden and its Tropical Station''; February 21, Army and Navy Y. M. C. A., Balboa, C. Z., ''Plant Curiosities''; February 26, High School, Balboa, C. Z., ''Insect Pollination and Seed Dissemination''; April 8, St. Louis Electrical Board of Trade, ''Spring Work in the Garden''; April 9, City Club,

"Orchid Exploration in Panama"; April 10, St. Louis Florists' Club, "Commercial Rose Growing in Panama"; April 17, Floricultural Department, Ohio State University, "Water Gardens"; April 17, Faculty and Students, Ohio State University, "Orchids"; May 15, South Side Optimists' Club, "Some Experiences in the Jungles of Panama"; May 15, Men's Club, Union Avenue Christian Church, "The Orchids in the Tropical Station, Missouri Botanical Garden"; May 21, St. Peter's Evangelical Church, "Orchid Exploration in Central and South America"; June 11, Teachers' Institute of the Missouri Commission for the Blind, "Horticulture"; June 12, Teachers' Institute of the Missouri Commission for the Blind, "Floriculture"; August 22, South Side Kiwanis Club, "Plant Curiosities"; September 26, Osage Hills Garden Club, "Flowering Plants for the Garden"; September 30, Convention of Park Executives, "Movement in Plants"; November 7, St. Louis Horticultural Society, "Orchids"; November 25, Festus J. Wade Parent-Teachers' Association, "A Hunt for Orchids"; December 16, School of Design, Soldan High School, "House Plants."

E. S. Reynolds, February 20, Washington University Chapter of Sigma XI, and the Academy of Science of St. Louis, "Moving Pictures of Plant Life"; December 15, Radio Station KMOX, "Modern Miracles of Plant Science."

HERBARIUM

Probably the most important single piece of work done during the year was the rearrangement of the mycological herbarium in its new quarters on the third floor of the administration building. This has taken a great deal of time and work on the part of the Mycologist, and the collections are now available for the use of research workers.

Another accomplishment has been the distribution of a large amount of duplicate material to various herbaria in the United States and in Europe. Nearly 36,000 sheets have been sent out in continuation of exchanges and in the establishment of new exchanges, so that long-standing obligations to other institutions have finally been met.

Somewhat more material has been acquired during the year than in 1929, but the number of specimens that have been mounted and incorporated into the general collection has been less. The new collections have been obtained chiefly from different parts of the United States, Central America, South America, and Europe. With additional trained assistance the work of mounting and incorporating these specimens can go forward rapidly.

New Accessions.—Many collections have been received during the year, chief amongst which are the following: Arnold Arboretum, 1434 plants of the United States, collected by E. J. Palmer; Wm. Bembong, 450 plants of India, collected by Wm. Guntur; Lyman Benson, 500 plants of Oregon and Washington; Botanical Garden of Cracow, 100 plants of Poland; Botanical Institute, University of Brno, 100 plants from Bohemia; B. F. Bush, 68 plants from Missouri; A. L. Cabrera, 14 plants from Argentina; Agnes Chase, 17 plants of Brazil; J. and M. S. Clemens, 687 plants of Borneo; Carnegie Institute at Stanford University, 157 plants of Western United States, collected by David Keck; Cornell University, by K. M. Wiegand, 544 plants of New York; A. Donat, 100 plants of Patagonia; K. Domin, 101 plants of Czechoslovakia; J. A. Drushel, 238 plants of eastern United States; Dudley Herbarium at Stanford University, 292 plants of the Pacific Coast and Mexico; E. H. Eames, 52 plants of Connecticut; W. J. Eyerdam, 128 plants of Kamchatka; H. J. Fuller, 47 plants of western United States; R. M. Harper, 13 plants of southern United States; G. Herter, 103 plants of Uruguay; H. D. House, 100 plants of New York; R. H. Imler, 430 plants of Kansas; M. E. Jones, 325 plants of Arizona; O. Jaap, 1022 "Fungi selecti exsiccati"; C. L. Lundell, 159 plants of British Honduras; W. E. Muenscher, 50 North American Myxomycetes; New York Botanical Garden, 11 plants collected by H. H. Rusby; H. O'Neill, 380 plants of the southern United States; H. Pittier, 129 plants of Venezuela; C. A. Purpus, 50 plants of Mexico; Eva M. F. Roush, 147 plants of Indiana and West Virginia; G. Samuelsson, 278 plants of Brazil collected by Dr. Dusen; W. A. Schipp, 663 plants of British Honduras; F. and A. B. Seymour, 108 plants of Massachu-

setts; E. E. Stanford, 400 plants of California and Oregon; B. E. Stephenson, 116 plants of Ohio; H. Sydow, 150 "Fungi exotici exsiccati" of South America; University of California, by E. B. Copeland, 1026 plants, mostly from California; University of Minnesota, 350 plants of "Reliquiae Holwayanae"; University of Tennessee, by H. M. Jennison, 106 plants of eastern Tennessee; United States National Herbarium, by Wm. Maxon, E. E. Killip, and others, 504 plants from British Honduras, various parts of United States, and Mexico; E. J. Valeur, 287 plants of the Dominican Republic; S. Venturi, 611 plants of Argentina; T. O. Weigel, 372 plants of Eumycetes collected by Weese.

Besides these, many small collections have been received from correspondents, friends, and former students in the Henry Shaw School of Botany. The names of these donors have been recorded in current numbers of the BULLETIN. In addition, a number of photographs of types, sometimes accompanied by type fragments, have been received from herbaria in Europe and America. These add materially to the value of the collections.

Mounting and Inserting of Specimens.—The mounting of specimens has continued throughout the year. Some additional help was employed to assist the regular mounter, but trained help was not available to mount all the numerous specimens requiring attention. A large number of mounted specimens has been inserted in the herbarium, a few of the more advanced students in taxonomy having done most of this work.

Reorganization of Specimens in the Herbarium.—Much reorganization work needs to be done in all large herbaria. With the valuable assistance of several of the advanced students additional plant families have been placed in order, while others have been rearranged. Consequently a larger part of the herbarium is more readily accessible for comparison and for the use of research workers than ever before.

Exchanges.—In past years the Garden has secured a great many duplicate specimens through the purchase of various large collections. It seemed highly desirable to distribute

part of these to various herbaria in continuation of our exchanges with them and to establish a number of new exchanges. In accordance with this policy, nearly 36,000 sheets of duplicate specimens have been sent to herbaria in Europe and America. The herbarium has now much more than met its obligations in this respect to most of the institutions on its exchange list, and many collections have been promised in return. This is one of the most important ways in which additions can be made to the number of plants in the herbarium. The collections distributed were mostly those of E. J. Palmer, made in Missouri, Arkansas, and Texas, during the years 1913-1919; the Eggert Herbarium and the Rev. John Davis collections made in Missouri and South Carolina.

Field Work.—Some field work has been carried on during the year, chiefly by the graduate students. Two of them made an extended automobile trip through southwestern United States to California and thence northward to Washington and Wyoming. The plants collected by them are being distributed to various subscribing institutions, and the remaining duplicates will be sent out later as herbarium exchanges. Another graduate student made extensive collections in West Virginia for the herbarium. One of the Research Assistants made a collecting trip to Panama. The Acting Curator has collected extensively in South Africa for four years, and the first set of this collection will be incorporated into the herbarium during the coming year. Members of the class in Taxonomy of the Bryophytes have been in the field on several collecting trips and have added to the local collections. One student in this class has added a few records of plants new to Missouri.

Use of the Herbarium by Outside Botanists.—As in former years, numerous herbarium specimens have been loaned to outside institutions in this country and abroad, for study by specialists. Many loans have been made to the Garden for study by members of the staff and by several advanced graduate students in the Henry Shaw School of Botany. All of these loans have been asked for in connection with monographic studies. A number of botanists and botanical stu-

dents have visited the Garden during the year to make use of our library and our extensive herbarium collections.

Statistical Summary (For the year ending December 31, 1930).

Number of specimens received on new accessions:			
By purchase	9838		
By exchange	3138		
By gift	533		
By transfer	9		
Total	13518	valued at	$1,531.80
Number of specimens mounted and incorporated	12,394	valued at	2,478.80
Number of specimens discarded from herbarium	40	without value	
Number of specimens in organized herbarium	986535,	valued at	$158,903.20
Number of specimens in unorganized herbarium	87500,	valued at	8,750.00
Wood specimens, etc., in the herbarium	....,	valued at	280.00
Microscopic slides	.....	valued at	450.00
Total valuation			$168,383.20

LIBRARY

Although no new collections have been acquired, there have been more rare or valuable books added to the library in 1930 than any year since the donation of the Sturtevant prelinnean library. Many important works for which the library had been watching for some time were advertised in catalogues this year and purchased by the Garden. Perhaps the most noteworthy of these purchases are Ruiz and Pavon's "Flora Peruviana et Chilensis"; Hooke's "Micrographia", first edition; Batsch's "Elenchus Fungorum"; Lambert's "The Genus Pinus", and Bruch, Schimper and Gümbel's "Bryologia Europaea"—six volumes and supplement.

An unusual amount of bibliographical assistance has been given during the year. Until five years ago there were only two or three students specializing in taxonomy. Now there are ten, the majority of them working on American

genera. In taxonomic work the literature is very important and every reference to the plant should be consulted. Some of the books are so rare or the manner of citing so obscure that finding the references is extremely difficult. To obtain one South American publication required writing to four libraries before the book could be located, and then it could not be loaned because of its rarity and the pages required had to be photographed. The library is now trying to purchase these rare books and when that is impossible to have the needed pages or plates photographed to become a permanent part of the library. In addition to taxonomists on the Garden staff, taxonomists from other institutions have sent in many requests for verification of references, or for a compilation of all the literature on a certain plant. One request was that all the references on a species of South American grass be transcribed; a professor who has been writing a series of papers on "Botanists of the Southwest" has obtained the greater part of his material from the Garden library. The papers for the cinchona congress occasioned a great amount of research, and one two-hundred page paper on the "History of the Cinchona" was worked up largely from books in the Garden library.

In order to make room for rapidly increasing accessions, the Garden set of "Biochemische Zeitschrift", consisting of about 110 volumes, has been loaned to Washington University, where it will be in constant use by students of plant physiology.

The two itinerant bookbinders whom we employ for a short period each year, spent two weeks at the Garden in April, when 232 books were mended. The older books are gradually being rehabilitated and by having some work done each year they can be kept in good order.

In July the Annals reprints were mailed to the botanists with whom the Garden maintains exchanges. About 700 reprints were sent to 270 individuals, each receiving the publications in his special field of botany.

Use of the Library.—In addition to the staff and students in the Henry Shaw School of Botany, the following botanists have consulted the library during the year: Dr. L. H. Pam-

mel, professor of botany, Iowa State College; Mr. C. C. Deam, state forester of Indiana; Dr. Edgar T. Wherry, of the Bureau of Chemistry, U. S. Department of Agriculture; Mr. R. A. Studhalter, head of the department of biology, Texas Technological College, Lubbock, Texas; Mr. S. Kamesam, of the Forest Research Institute, Dehra Dun, India; Mrs. Susan Delano McKelvey, of Boston, author of botanical monographs; Prof. O. C. Schultz, associate professor of Botany, Oklahoma A. & M. College; Mr. A. C. Hottes, assistant editor of "Better Homes and Gardens"; Dr. Ella M. Martin, professor of biology, Greensboro College, Greensboro, North Carolina; Dr. Ethel T. Eltinge, instructor in botany, Mount Holyoke College, South Hadley, Mass.; Miss Catherine L. Lieneman, instructor in botany, North Carolina College for Women, Greensboro, North Carolina; Dr. C. C. Epling, instructor in botany, University of California at Los Angeles; Dr. A. Saeger, of Kansas City Junior College; Dr. H. M. Jennison, professor of botany, University of Tennessee; Dr. C. E. Moore, head of biology department, State Teachers College, Memphis, Tenn.; Dr. Arthur D. Houghton, of Los Angeles, California; Dr. Frederick R. Wellman, of the U. S. Dept. of Agriculture; Dr. Walter F. Loehwing, professor of plant physiology, University of Iowa; Dr. Edward J. Petry, head of the department of biology, Central College, Fayette, Mo.; Professor D. M. Moore, professor of botany and plant physiology, University of Arkansas; Prof. T. S. Painter, professor of zoology, and Dr. Frederick McAllister and Dr. B. C. Tharp, professors of botany, all of the University of Texas; Prof. E. S. Heath, Breneau College, Gainesville, Georgia. In addition, Professors Alex. Laurie and L. C. Chadwick, of the University of Ohio, brought their class in floriculture to visit the Garden and library, and Prof. H. W. Rickett, of the University of Missouri, accompanied by the instructors and students in botany of that institution, visited the library and herbarium. Out-of-town botanists also have the privilege of borrowing books on the inter-library loan plan, 151 loans having been made to 34 institutions during the year.

Garden Publications.—Volume XVII of the ANNALS OF

THE MISSOURI BOTANICAL GARDEN was completed during the year. The volume, which contains 476 pages, 51 plates, and 22 text-figures, consists of two monographs, "Studies in the Apocynaceae, I", by Robert E. Woodson, Jr., and "Studies in the Umbelliferae, III", by Mildred E. Mathias. The 1930 volume (XVIII) of the monthly BULLETIN comprises 171 pages and 41 plates. Both ANNALS and BULLETIN are sold or sent in exchange for other publications. There are now 550 institutions or individuals receiving the ANNALS in exchange for their publications. The receipts from the sale of ANNALS, BULLETINS, Books of Views, reprints, and ANNUAL REPORTS during the year amounted to $1,404.10.

New Accessions.—Besides the works previously mentioned the library has received some interesting publications during the year through Mr. Gurney Wilson, the Garden's European representative. Among these was a packet of original drawings by Oliver for his "Natural Orders of the Vegetable Kingdom"; sketches of orchid drawings made by J. Weathers, 6 volumes; a list of orchids certificated by the Royal Horticultural Society, 1872-1889; Gerarde, "The Old Riddle and the Newest Answer." Other donations were Miller's "Gardeners' Dictionary", by Mrs. S. W. Fordyce; Sprengel's "Versuch einer pragmatischen Geschichte der Arzneykunde", Neuberger's, "Geschichte der Medizin", and Gildermeister and Hoffmann, "Die ätherische Ole", by Mr. Leo Suppan.

Some of the important purchases are the following: Alexander, Colloid chemistry; new set of Bailey's Cyclopaedia of American Horticulture; Bailey, Hortus; Bibliotheca Botanica, vol. 89; Britton, H. T. S., Hydrogen ions; Burdett, The Odyssey of an orchid hunter; Curtis, A catalogue of British medicinal, culinary and agricultural plants cultivated in the London Botanic Garden; Dykes, Notes on tulip species; Encyclopaedia Brittanica; Engler & Prantl, Natürlichen Pflanzenfamilien, vol. 15[a]; Goebel, Organographie der Pflanzen, 3rd edition; Hardy and half-hardy plants (periodical); The life and works of Robert Hooke, vols. 6 and 7; Index generalis, 1929-30; Kappen, Die Bodenazidität; Korsmo, Unkraüter im Ackerbau der Neuzeit; Levine and Schoenlein, A

compilation of culture media for the cultivation of microorganisms; Liebmann and Oersted, Les chênes de l'Amerique tropicale; Martyn, The first lecture of a course of botany, being an introduction to the rest, 1729; Protoplasma Monographien, 1-3; Murakoshi, Honda, Tamba and Matsumara, Dai skokubutso dzukan; Oehlkers, Erblichkeitsforschung an Pflanzen; Pharmacopoeia pauperum in usum nosocomii regii Edinburgensis, 1758; Reprints of three of Rafinesque—One-hundred genera of Ombelliferous plants, Coquilles bivalves et fluviales de la Riviere Ohio, and The natural family of the Carexides; Ridley, Dispersal of plants throughout the world; Sugiyama, The aristocrats of Japan's national flower; Thom, The Penicillia; Villiers & Stuart, Garden art in the Spanish peninsula; Webel, German-English scientific dictionary; Wiesner, Die Rohstoffe, 4th edition.

Statistical Information.—There have been donated to the library or received in exchange during the year, 621 books valued at $1,396.80, and 1707 pamphlets valued at $341.93. Four hundred and forty-six books were purchased at a cost of $3,741.30, and 235 pamphlets at a cost of $302.07. The library now contains 45,877 books and 70,482 pamphlets. There are 331 manuscripts valued at $1,614.80 and 981,828 index cards valued at $11,751.29. A total of 8,966 cards were added during the year of which 1,365 cards were written by Garden employees and 7,601 were purchased at a cost of $155.42. Three hundred and sixty-three books were bound and 232 repaired. Eleven charts were bought at a cost of $10.00, and one photostatic copy of a botanical work, at a cost of $25.00.

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1930

GARDEN ATTENDANCE:

Total number of visitors.....11,798

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	32
Total number of books and pamphlets donated.....	381

PLANT ACCESSIONS:

Total number of seed packets donated.....	32

PLANT DISTRIBUTION:

Total number of plants and cuttings distributed.....	62

HERBARIUM ACCESSIONS:

By Purchase—

Benson, Lyman—Plants of Washington and Oregon.....	500
Domin, K.—Plants of Czechoslovakia.....	101
Samuelsson, Dr. G.—Plants of Brazil collected by Dr. Dusen.....	100
Schipp, Wm. A.—Plants of British Honduras.....	148
Stephenson, B. E.—Plants of Ohio.....	116

By Gift—

Arthur, J. C.—Fungi from Alaska collected by J. P. Anderson.....	2
Carnegie Institute at Stanford University.—Plants of Western United States, collected by David D. Keck....	157
Eastwood, Alice—Plants of Utah.....	1
Harper, R.—Plants of Georgia, Florida, and Alabama....	13
Sherff, E. E.—Plants of Oahu, H. I.....	1
Total.....	1,139

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

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Mycologist

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Curator of Herbarium
(On leave of absence)

ANTON HOGSTAD, JR.,
Pharmacognosist

ADELE L. GRANT,
Acting Curator of Herbarium

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EDGAR ANDERSON,
Geneticist

ROBERT E. WOODSON, JR.,
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Superintendent

JOHN NOYES,
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PAUL A. KOHL,
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Orchidologist

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Chief Engineer

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Trees and Shrubs

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Herbaceous and Nursery

J. CUTAK,
Exotics

J. LANGAN,
Assistant Engineer

A. D. FORRESTER,
Plant Recorder

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Painter

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Carpenter

GRAY SUMMIT EXTENSION

L. P. JENSEN,
Arboriculturist

D. MILLER,
Orchids

G. GOEDEKE,
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R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
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GURNEY WILSON, F. L. S.

MISSOURI BOTANICAL GARDEN BULLETIN

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"DANCING GIRL"

Perfect flower of *Oncidium stipitatum* (magnified about 4 times)

Missouri Botanical Garden Bulletin

Vol. XIX FEBRUARY, 1931 No. 2

"THE DANCING GIRL" ORCHID
(ONCIDIUM STIPITATUM)

No other family in the vegetable kingdom can compare with that of the orchid for diversity of form and adaptation for insect pollination. The collector in the jungle is on the lookout for new species. The native, on the other hand, observes the flower from the standpoint of its resemblance to some common object. All orchid flowers, to his mind, represent insects or persons or some well-known event. It is from such interpretations that we get the common names of "The Lady of the Night," "El Spirito Santo" (Holy Ghost orchid), "Holy Week," "Butterfly," "Bucket," "Swan," "Chinela" (slipper), "Mariposa" (moth), "Rat-tail," and "Breath of the Angels."

One of these fanciful-named flowers which the writer obtained in Panama is the "Dancing Girl." This plant, with its spray of flowers, attracted much attention during the recent orchid show held at the Garden. The illustrations show not only a single dancing girl (pl. 6), but how by a little arrangement a flower ballet with the leading lady in the center may be represented (pl. 7). The head of the girl, covered with a yellowish brown tight-fitting helmet-shaped hat completely covering the ears, is formed by the anther case. As a protection from the rain, the dorsal sepal is hooded to form a perfect umbrella. Nature, of course, is trying to protect the pollen, since moisture would cause its decomposition. The extended arms, clothed in a light yellow sleeve, are formed by

the winged upper portion of the lip, the different species showing various arm gesticulations. The base of the lip represents a beautiful tight-fitting bodice of a reddish brown color. The skirt is a gorgeous primrose-yellow and is made in the present fashion, tight at the hips, falling to the floor in ripples, and slit to permit perfect grace during the perpetual dance. The flower spikes are pendant, bearing upwards of two hundred flowers arranged upon a series of lateral branches, each individual flower being plainly visible. With the slightest movement of the air the tiny girls begin their dance.

The genus Oncidium is represented by over three hundred species native to Central America, South America, and the West Indies. The prevailing color of the flowers is yellow, spotted and barred with brown. White or rose-colored flowers occur in a few species, and chocolate-brown is represented by such Brazilian species as *O. crispum*, *O. Forbesii*, and *O. Gardneri*. The various species have a wide range as to the elevation at which they grow. The writer has collected plants at sea-level in Panama, at 5,000 feet in the Vulcan region in Costa Rica, and at 10,000 feet in the Andes of Bogota. All are epiphytic except *O. confusum*, which was found growing in clay soil at sea-level, near Panama City. Most of the species are upright growers of pseudo-bulbous habit, bearing strap-shaped leaves varying in length from a few inches, as in *O. cheirophorum*, to three to four feet, as in *O. panamense*. Another group possesses small sessile pseudo-bulbs supporting large leathery leaves, examples being *O. luridum* and the rose-colored *O. Lanceanum*. The pygmy group is represented by *O. iridifolium* with small fan-shaped foliage. *Oncidium stipitatum* is the only pendant species observed growing upon trees in the jungle (*O. Cebolleta*, native of Brazil, has the same habit). It differs from the other species in possessing sessile pseudo-bulbs and long stiletto-like leaves ofttimes reaching two feet in length. These cylindrical leaves have a peculiar gutter-shaped groove upon the upper side which seems to drain off the water. The flower spike pushes out from a bract or sheath which protects the base of the stem-like leaf and the small pseudo-bulb. The plant prefers the trunk or large branches of trees growing in a pendant position.

G. H. P.

FLOWERS OF ONCIDIUM STIPITATUM (NATURAL SIZE) ARRANGED AS A BALLET

(Sepals and petals removed from all the dancers except leading lady in the center)

Pistillate (female) flower.

Staminate (male) flower.

CYCNOCHES WARSCEWICZII

THE SWAN ORCHID (CYCNOCHES WARSCEWICZII)

To the early botanists Cycnoches was the most puzzling of any genus of the orchid family, because of its peculiar habit of producing either male or female flower spikes. Both sexes may be seen either upon the same spike or on separate spikes at different times. Under cultivation it is a rarity to see opposite sexes; in fact, the plant illustrated (pl. 8) is the first at the Garden to produce female flowers within the last twenty years. In their native home this phenomenon is evidently not unusual, for in both Central America and South America the writer has observed plants bearing seed-pods.

In former years specimens of this plant were sent to both Reichenbach and Lindley for determination, resulting in the same plant bearing two specific names. At a later date R. A. Rolfe, then editor of the "Orchid Review," wrote: "The work of clearing up the history of a genus which has been so much confused as Cycnoches is necessarily slow, but it is satisfactory that materials are gradually coming to hand." In discussing a plant of *C. Warscewiczii* in the collection of H. J. Ross, of Florence, Italy, possessing both sexes upon the same plant, he stated: "Although Mr. Ross's plant is the C. Warscewiczii mentioned above, I am very doubtful if it is the one originally described by Reichenbach (Bot. Zeit., X, p. 734) in 1852, as an authentic flower of the latter, which was sent by the author to Dr. Lindley, is a female of much larger dimensions. In fact, Reichenbach said it was near C. chlorochilon, and suggested that it might be a dimorphic form of some other species. It was collected at Chiriqui, in Costa Rica, by Warscewicz. The collector also obtained C. aureum, Lindl. (Paxt. Fl. Gard. III, p. 5, t. 75) at the same time and place, and wild dried flowers were also sent by Reichenbach to Lindley, localised, and correctly named. I rather suspect that C. Warscewiczii Rchb. f. may be the female of C. aureum Lindl., partly because they were collected together, and partly because the former is about as much larger than the female of Mr. Ross's plant as C. aureum is larger than the male of the same; which is just what one would expect."

The Garden specimens were collected in the Chiriqui Region of Panama, in March, 1927, on the Llanos of Caldera, at an

elevation of 3,000 feet, a full account of the collecting trip being published in the May number of Vol. 15 of the BULLETIN. The following two summers several plants flowered at the Garden, producing only male spikes. In June, 1930, the seasonal growth of the largest specimen (noted by the writer as collected by "Grandma") equalled that in its native habitat. When fully matured, in July, it produced a massive spike bearing ten well-balanced male flowers (see pl. 8). The plant was carefully packed and brought in from the Garden Extension, at Gray Summit, for display at the Garden, and immediately after flowering it was taken back to the orchid houses for its resting period. The following month, after partial defoliation, the plant surprised us by producing another flowering spike above the previous one, and what was even more unexpected, two of the large flowers were female, the first in the history of the Garden collection. Both sexes are a light yellow grading to pea-green in the center, with a very dark green patch upon the labellum or lip. The female flowers are larger than the male and lack the swan-like mimicry. The sepals are much heavier in texture, the petals measure five inches in width, while the column is thicker and but half the length of the male.

In cultivation the plants make better growth when suspended in baskets from the roof glass than when grown in pots upon a stage. The former method more nearly approaches their natural habit, where they attach themselves to low-growing trees, favoring the forked branches. They are extremely local in their distribution, growing in association with the Catasetums which they closely resemble when deciduous. The collector, however, can recognize the genus Catasetum by its pungent coat of armor terminating the apical portion of the old pseudo-bulbs. These rigid spines are the converging portion of the leaf veins which are left behind when the deciduous leaves break off. The Cycnoches have more slender pseudo-bulbs, and their foliage dehisces closer to the bulbs, leaving spineless bracts. Both genera may be found growing upon the same tree, particularly low-growing trees, where the orchids enjoy the partial shade from the sparsely leaved foliage during the growing season. The deciduous habit of

MORMODES ATROPURPUREUM

the tree causes the orchids to be exposed to full sunlight during the resting season, which they seem to enjoy after shedding their leaves to offset the loss of moisture.

G. H. P.

MORMODES ATROPURPUREUM

When this unusual orchid was sent to Dr. Lindley, of London, England, for determination, he was evidently somewhat puzzled by the peculiar formation of the flowers, for he gave it the generic name Mormodes, meaning "a grotesque creature." However, to the native Panamanians the flower resembles small birds in flight, and the writer, having seen these plants in bloom upon trees in their native environment, agrees with this interpretation. With the least movement in the air, the weight of the thick waxy flowers will cause a fluttering, giving the impression of a small bird or large insect flying along the tree stump.

The Mormodes are fast becoming extinct in the Chiriqui Region of Panama. The specimen illustrated (pl. 9) was collected during the Garden expedition into that region in 1927, where after much search it was discovered south of Bouquete, along the banks of the Rio Caldera, growing upon a half-rotten tree trunk (see May, 1927, BULLETIN). It was in this same territory that Warscewicz, a famous orchid collector, discovered the plants. Subsequently they were sold in London, and in 1851 a specimen flowered in an English orchid collection.

Under cultivation the plants gradually deteriorate, not only in this locality, but also in the Tropical Station at Balboa. In the Tropical Station they are attached to logs of wood suspended from the trees and seem to be perfectly at home until the bark of the tree stump rots. The plants are then doomed and fresh plants have to be brought from the jungle to replace them. In St. Louis the plants do better when grown in peat soil in baskets suspended from the roof. The two specimens illustrated bloomed at the Gray Summit orchid houses last summer, and had flower spikes equal to those in their native home. It is interesting to watch the flowering plants in the Tropical Station, where they attract many bees by their fra-

grance or oddity in color or possibly their mimicry. The visit soon becomes a riot, and the lucky bee who maintains the firmest foothold upon the individual flower sucks up the last drop of nectar. If the flower spike has a dozen flowers one can readily imagine there would be plenty of activity and ruination of the flowers unless they were protected by a wire screen. During the struggle the sticky pollen masses adhere to the back of the bee, bringing it in contact with the stigma on the next flower. Almost immediately after pollination the flowers begin to wilt.

When in flower the pseudo-bulbs or bulb-like stems are naked, the leaves having broken off and leaving light brown, membranous, sharp-pointed sheaths or scales as a protection for the stems. The scape is twelve to eighteen inches high and supports twelve to fifteen flowers. These are dark purple-brown to chocolate color, and have the form of a bird. The edges of both sepals and petals are decidedly reflexed or rolled back. The lip or labellum is velvety, with short hairs upon which the bees obtain their foothold when struggling for the nectar. The leaves are pea-green and fan-shaped.

G. H. P.

A WHITE-FLOWERING PARTRIDGE PEA

The partridge pea *(Cassia Chamaecrista* L.*)* is a well-known native annual plant about six to fifteen inches high. It is generally found growing in masses along roadsides and on sandy fields and hillsides from Massachusetts to Minnesota and southwest. Its leaves are evenly pinnate, with twelve to thirty linear-oblong leaflets, giving a fern-like appearance. The bright yellow flowers make the plant conspicuous during the months of August and September. They have five petals, two of which are larger than the other three, and there is a purple spot at the base of the petals. As far as can be ascertained no other color has ever been found in the flowers except yellow. However, on August 20, 1928, the writer, accompanied by Mr. Anton Hogstad, Jr., while engaged in exploring the hills of the Garden Extension at Gray Summit, discovered eight plants of a distinct creamy white color (pl. 10). These were found in the midst of a large mass

WHITE-FLOWERING PARTRIDGE PEA

FLOWERING BRANCH OF PARTRIDGE PEA

FILM OF GLUE FROM LEAF (MAGNIFIED 500 TIMES).
SHOWING ADULT SPIDER, EGGS, AND SOOT.

of the typical plants and differed in no other way from their parents. Had there been only one plant producing these unusually colored flowers, it would have been concluded that it was merely a chance variation, such as occurs occasionally in many species of plants, but the fact that there happened to be eight plants made one suspect that they might be a second generation, the progeny of a single plant which bore these cream-colored flowers in 1927.

The seeds were collected and planted in the seed-beds in the nursery in the fall of 1928. About forty plants were produced, all but two showing the new color of flowers. The seeds of this generation were planted in the nursery, with the result that out of about 400 plants which flowered in 1930 only one produced the typical yellow flowers (pl. 10).

L. P. J.

GLUE AS A CONTROL FOR RED SPIDER

Red spider is one of the most troublesome pests that the gardener or florist has to combat, especially during the hot summer months. Forcible spraying is one of the best means of control, using a special hose nozzle which directs the spray upwards and cleans the under sides of the leaves. This method is effective when the plants are grown in open benches, because then all sides of the plants are accessible for spraying, but when this is not the case dusting sulphur and similar insecticides must be relied upon.

A very cheap and successful control has been used in the greenhouses at the Garden this last summer—one pound of powdered glue in four or five gallons of water. Sufficient water is added to the glue to cause disintegration by heating, after which it is poured into cold water and agitated until thoroughly mixed. It is then ready for use in the spraying machine. With perfect coverage tests have shown that after two or three days the film of glue will naturally dry and roll off from the leaf, bringing with it both the agglutinated adult spiders and eggs, or if the plant is sprayed with water the glue will be washed off without injury to the leaf.

The Citrus House was used for the conclusive tests. The upper surfaces of the leaves were well coated with an oily

soot deposit of several winters, and the under sides were infested with red spiders. All the plants were well sprayed with the glue mixture, and two days later were sprayed again to insure a perfect coverage of the leaves. After six days the glue was observed peeling off in sheets, bringing with it both soot and spiders. A film from one of the leaves was carefully removed and photographed with the aid of a microscope. The photograph (pl. 11) showed spider and eggs and soot deposit securely fastened in the film of glue. The plants could not have presented a cleaner appearance had they been cleaned by hand. This spray may be used upon evergreens, especially spruce and hemlocks, or any plants which possess glabrous (shiny) leaves, but will not be successful upon plants with pubescent (hairy) leaves.

G. H. P.

SPRING COURSE IN GARDENING FOR AMATEURS

During the past two years courses in various phases of gardening have been conducted at the Garden. Owing to the popular demand for this type of instruction, a course will again be conducted this spring during the months of March, April, and May. The class will meet at the Garden on Tuesday afternoon of each week at 3:45 P. M., in the lecture hall of the Museum Building, entrance at the gate at Tower Grove and Cleveland Avenues.

An outline of the subjects to be given follows:

March 3—Registration. Gardening books.....Moore

March 10—Brief discussion of catalogues, horticultural magazines, and bulletins. Illustrated lecture and instruction on growing plants from seeds and cuttings. The use of hot-beds and cold-frames.....Kohl

March 17—Trees and shrubs:
Pruning of shrubs at planting time.
Summer and winter pruning of trees and shrubs with relation to the time of bloom; i. e., trees and shrubs flowering in spring from buds formed the previous season; those blooming in summer on wood made during the current season.....Beilmann

March 24—Practical demonstration (students participating) in growing plants from seeds and cuttings. This

period will be conducted in the greenhouse at the rear of the floral display house, automobile entrance at Alfred and Castleman Avenues.....Kohl

March 31—General care of trees; the importance of tree surgery and the use of fertilizers. Practical demonstration in pruning trees and shrubs.....Beilmann

April 7—Transplanting of seedlings grown from seed sown on March 24. (Greenhouse).....Kohl

April 14—Lawns:
Seed lawns: Preparation of the soil, seed selection, fertilizers.
Stolon lawns: Methods of planting by means of stolons and plugging.
Lawns and their subsequent care.
Experimental lawn plots.....Pring

April 21—Identification of common insect pests.
Illustrated lecture .....Beilmann

April 28—Controlling insect pests.
Materials to use.
Demonstration of power and hand-operated sprayers and dusters .....Beilmann

May 5—Practical demonstration in the greenhouse of potting seedlings, cuttings, and larger plants.
Transplanting plants to the garden.
Preparation of soil by spading and raking for sowing seeds outdoors.....Kohl

May 12—Irises, peonies, roses, dahlias. Illustrated lecture....Kohl

May 19—Water gardens. Illustrated lecture:
Construction of pools.
Preparation of soil and planting.
Caring for hardy and tropical water-lilies during growing season.
Propagation by seeds, tubers, and leaves.
Breeding.
Winter storage .....Pring

May 26—Annuals, perennials, bulbs. Illustrated lecture.....Kohl

FIELD TRIPS TO STUDY THE NATIVE SPRING FLORA.
Should there be a demand for these field trips, several will be arranged during the spring season..Kellogg

REGISTRATION: No previous notice of intention to join the course is necessary. Registration will take place in the lecture-hall of the Museum Building, Tower Grove and Cleveland Avenues, on Tuesday, March 3, at 3:45

P. M. Subsequent meetings will be held at the same hour on the dates indicated.

FEES: A fee of $5.00 payable at the time of registration will be charged.

NOTES

Mr. John Kellogg spoke before the botany group of the Webster Groves Nature Study Club, January 19, on "Rare and Interesting Missouri Plants."

On January 24, Prof. John T. Bucholz, professor of botany, University of Illinois, accompanied by a party of graduate students from that institution, visited the Garden.

Dr. George T. Moore, Director of the Garden, gave a lecture illustrated with moving pictures, before the St. Louis Horticultural Society, February 6, on "What Goes On Inside the Plant."

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the South Kirkwood Garden Club, January 9, on "Aquilegias"; and before the Webster Groves Nature Study Society, January 30, on "Flower Growing in the Scilly Islands."

Among the recent visitors to the Garden were Dr. N. I. Vavilov, Director of the Institute of Applied Botany, Leningrad, U. S. S. R.; Prof. D. M. Moore, professor of botany and plant physiology, University of Arkansas; Dr. Paul C. Mangelsdorf, Agronomist, Texas Agricultural Experiment Station, College Station, Texas; Dr. E. M. East, professor of genetics, Bussey Institute, Jamaica Plain, Mass.; and Dr. S. H. Yarnell, Horticulturist, Texas Agricultural Experiment Station, College Station, Texas.

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, has spoken on the subject, "The Changing Order of American Pharmacy" before the following groups recently: December 11, before the Philadelphia College of Pharmacy and Science; December 17, before the New Jersey College of Pharmacy of Rutgers College; December 17, before the annual meeting of the staff of Merck & Co., Rahway, N. J.; December 19, before the New York College of Pharmacy of Columbia University. He also conferred with government officials of the

United States Department of Agriculture, Department of Foreign and Domestic Commerce, Washington, D. C., relative to the national drug store survey to be conducted in St. Louis during the year 1931.

Mr. G. H. Pring, Superintendent of the Garden, has given the following lectures recently: January 19, before the University Temple Men's Club, "Jungle Experiences in the Tropics"; January 23, before the Wyman Parent-Teacher Association, "Plant Curiosities"; January 27, before the Hamilton School Parent-Teacher Association, "Orchid Exploration in the Andes"; January 28, before the Webster Groves Home Garden Club, "City Street and Highway Beautification"; February 3, before the Centennial Garden Club, Jacksonville, Illinois, "Water-lilies for Home Gardens"; February 10, before the Mothers' Club of the Büder School, "The Development of Orchids from Seed to the Mature Plant"; February 12, before the Men's Garden Club, Chicago, "Orchid Exploration."

STATISTICAL INFORMATION FOR JANUARY, 1931

GARDEN ATTENDANCE:

Total number of visitors	27,388

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	32
Total number of books and pamphlets donated	230

PLANT ACCESSIONS:

Total number of seed packets donated	15
Total number of plants donated or received in exchange	19

HERBARIUM ACCESSIONS:

By Purchase—	
Ciferri, Dr. R.—"Mycoflora Domingensis exsiccata," Nos. 1-100	100
Jardin de Botanique, Paris—Plant photographs	5
Linnean Society, London—Plant photographs	2
Pittier, H.—Plants of Venezuela	163
Thompson, J. William—Plants of Washington	406
Weigel, Theo. Oswald—Weese's, "Eumycetes selecti exsiccati," Lief. XVIII-XIX, Nos. 426-475, incl	50
By Gift—	
Anderson, Dr. Edgar—Plants of England and Michigan	10
Hargis, Miss Iva Jane—Plants of Oklahoma	15
University of Michigan, by Prof. H. H. Bartlett—Plants of Mexico and Honduras	12
Peebles, R. H., by C. L. Hitchcock—Plants of Arizona	16
Ruth, Albert—Plants from Arkansas and Rocky Mountain National Park	17
Schmalz, Albano—Fern from Brazil	1
By Exchange—	
Bot. Gart. und Museums, Berlin—Plants, chiefly from South America	62
Bot. Museum (Herbarium), Munich—Plant photographs	2
California Academy of Sciences—Plants of California	3
Gray Herbarium, Harvard University—Miscellaneous specimens	244
Overholts, Prof. L. O.—Plants of Missouri, mostly parasitic fungi	43
Stanford University (Dudley Herbarium)—Plants, mostly from Lower California	386
U. S. National Museum—Plants of Colombia and miscellaneous duplicates	352
University of California—Plants of California and Tonga	195
By Transfer—	
Pring, G. H.—Specimens of water-lilies	13
Total	2,097

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

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The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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VIEW ACROSS TROPICAL STATION, FROM FOOTPATH IN FRONT OF MANAGER'S RESIDENCE.

Missouri Botanical Garden Bulletin

Vol. XIX MARCH, 1931 No. 3

NOTES FROM THE GARDEN'S TROPICAL STATION, BALBOA, C. Z.

The following notes from the Missouri Botanical Garden Tropical Station, Balboa, Canal Zone, have been supplied by Mrs. A. A. Hunter, wife of the manager of the Tropical Station:

The nucleus of the Tropical Station of the Missouri Botanical Garden is the C. W. Powell collection of orchids. While it is spoken of locally as "The Orchid Garden," it really contains, thanks to Mr. Powell's wisdom and foresight, many other interesting plants and trees.

Visitors usually come to the Station expressly to see the orchids, but many times linger to become better acquainted with plants whose products they use daily, but with whose nature and habits they are not so familiar. For instance, the housewife visiting the tropics for the first time is pleasantly surprised to meet in the Station many of her old friends, in the form of fruits, nuts, spices, and perhaps the source of her favorite breakfast beverage. She may even need to be introduced to some before she recognizes them, for there is little resemblance between the neatly labeled products on her pantry shelves and the living fruits glowing against their own leafy background.

VANILLA

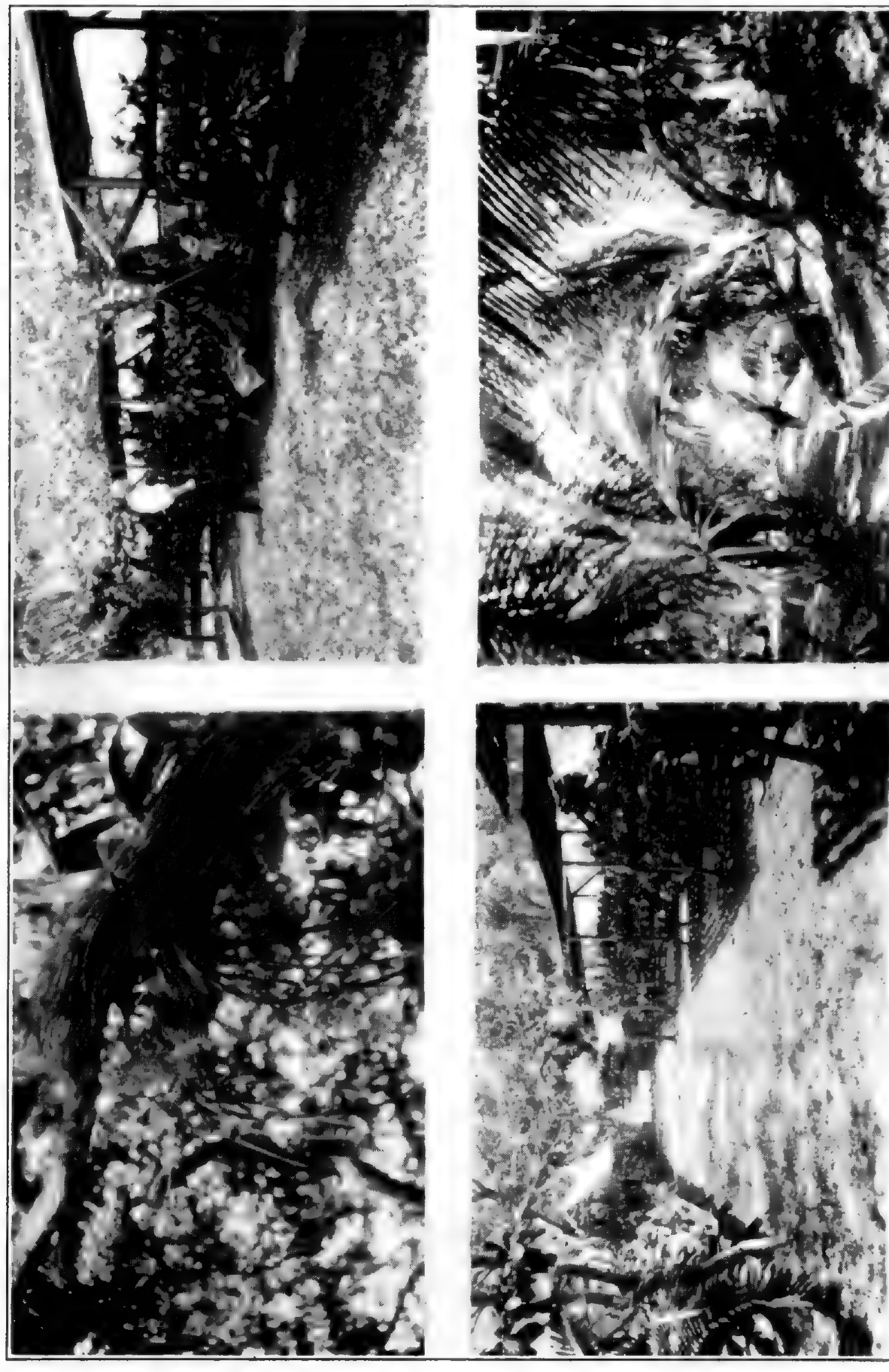
Visitors scarcely enter the Station before becoming aware of a vine which seems to court attention by its striking appear-

ance and daring nature. This vine, with its thick stem and leaves flatly outlined against the length of a tree, has an artificial appearance, as if a long, slender, symmetrical design of lustrous green had been modeled in bold relief on a background of gray bark. Not all visitors recognize this strangely fascinating plant as the vanilla, furnishing the flavoring so universally liked or the illusive odor of some costly perfume. Besides its unusual appearance, the vanilla has the distinction of being not only the one member of the aristocratic orchid family known to be of economic value, but also of being the longest orchid, sometimes attaining the astonishing length of one hundred feet.

Although seemingly so pretentious, vanilla really has simple tastes and grows easily and rapidly. A mere slip, planted in shallow soil at the foot of a tree, will establish itself in a few months. Then clinging firmly to the bark with its hidden adventitious roots, the vine in a vertical course quickly ascends the trunk of a tall tree. So eager is this plant to reach its high goal, that it does not even stop on the way to branch. When branches do occur they are the result of injury to the stem or of intentional trimming by the hand of man. Even when examined closely the vanilla vine still retains that artificial appearance. Not a rib or vein mars the smoothness of its leaves, which might have been cut in pointed ovoid form from a thick piece of glossy bright green wax. These unnatural-looking leaves of some six inches in length are arranged alternately and with symmetrical precision on either side of a thick round stem often measuring one inch in diameter and apparently molded from this shining green wax. The leaves on one plant may lie flat against the tree, at right angles to this prominent stem, while on another plant of the same species they may have a downward slant, even overlapping each other a few inches.

The flowers of the vanilla are rather large, trumpet shaped, and pale yellow in color. They grow in axillary clusters close to the stem. Owing to a peculiar formation only a limited number become naturally fertilized, and so in cultivation it is necessary to pollinate by hand in order to secure a worthwhile crop. Commenting on this in "The Tropical Crops,"

VIEW IN GARDEN'S TROPICAL STATION.



VIEWS IN GARDEN'S TROPICAL STATION.

Mr. Barrett says, "A trained worker can pollinate two hundred flowers an hour. This operation must be done before 2:00 p. m. while the pollen is ready to shed freely; each flower is viable only six hours or so." Better and larger pods are obtained when only a few flowers in each cluster are pollinated. To do this work and handle the picking conveniently, vanilla vines, except those grown for ornament, are kept trimmed low enough to be within easy reach. Strange to say, the pods of the showy vanilla are the most inconspicuous part of the whole plant. They look like just ordinary bean-like pods, of some five to nine inches in length, but in them the plant stores its treasure of exquisite fragrance. The pods mature slowly, often ten months being required to fully ripen them. As a rule they are gathered before they are thoroughly ripe.

The pods are prepared for use or shipment by first sweating them, and that usually means laying them out in the sunshine daily for a week or so until they become soft and turn dark. Then they are allowed to dry slowly, which sometimes takes over two months. During this preparatory period a curious change takes place within the pod. As its oily pulp, containing minute seeds, gradually ferments, a white crystalline substance, chiefly vanillin, is developed. Until this is developed the pod is not aromatic. These tiny crystals may be seen, like delicate frosting, on the dark surface of the dried pod. Their presence is taken as a criterion of quality. When the pods are dry they are almost black in color, thin, pliable, slightly oily, and should, of course, be "frosted." Finally the fragrant pods are tied up in bundles and packed in tin boxes for shipment.

It is safe to say that the unsuspecting housewife of today seldom gets the genuine essence when she buys a bottle marked "pure vanilla extract." The necessity of artificial pollinization accounts partially for the scarcity of vanilla in extract form, but the chief reason lies in the cleverness of chemists to produce substitutes, mainly from crude clove oil, which almost rival the genuine vanilla and are much cheaper. However, there are two ways by which the housewife may be certain that she is using the real vanilla. The easiest way and

the one used in a number of countries is to procure the vanilla pods or beans, and flake or grate off bits for flavoring purposes. A French woman, seeing some pods on a vine here, remarked that the French use the vanilla pods for flavoring, and that this custom sometimes leads to amusing situations. She went on to say that in days before travel had become so universal, it was not uncommon to see American tourists, when served with ice cream, look askance at their cream and then to endeavor painstakingly to pick out what appeared to be dark specks.

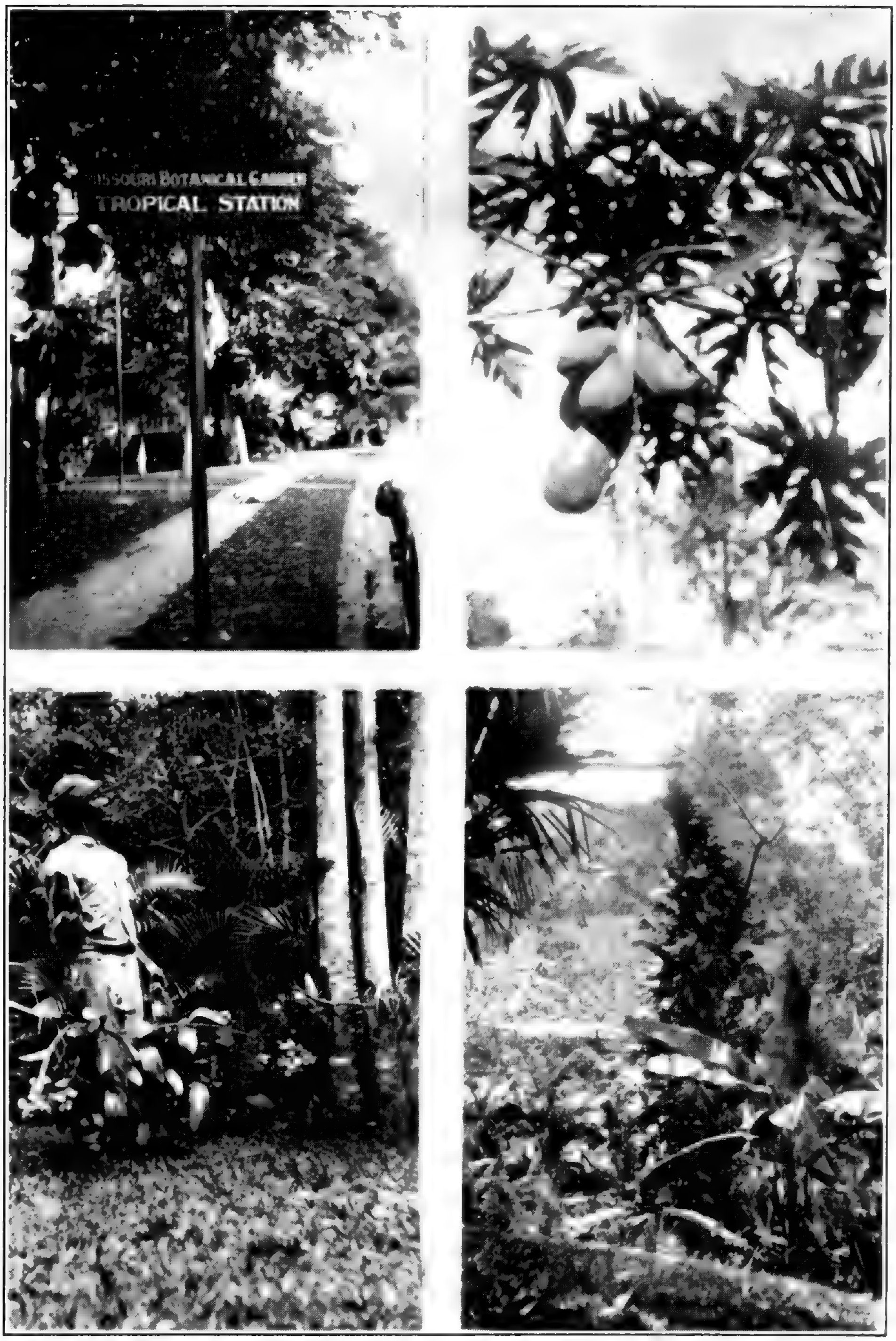
If the housewife wishes to avoid the presence of these "dark specks" in her cooking, and yet be sure she is using pure vanilla, she may prepare the extract herself by following this receipt:

Vanilla pods, ground fine.....four parts
Alcohol .....five parts
Soak the ground pods in the alcohol for forty-eight hours. Then filter. Keep the essence in a tightly closed bottle.

The ancient Aztecs were well aware of the delicate flavor of vanilla, which grew naturally in their fair land. They were accustomed to grind the pods with the cacao beans in making their national drink.

Of course, such a rare flavoring could not forever escape the collector's zeal, and in due time the plant was introduced into many tropical countries. However, long before this, the venturesome vanilla, true to its nature, fearlessly climbed over the borders of Mexico and wandered down through the jungles of Central America, and into Panama, where it established two species, *Vanilla planifolia* and *Vanilla Pompona*, and then continued on its way into South America.

A number of specimens of both these species are growing in the Tropical Station. While they have the same general characteristics, the *Vanilla planifolia* is not so striking in appearance. Its leaves are smaller, about four inches long, and occur on the stem at less frequent intervals. It, however, is the pet of the growers, for it is said to produce ninety per cent of the world's vanilla crop. The *Vanilla Pompona* is the large showy species, and by its vigorous growth thoroughly puts to rout the common notion that all orchids are delicate plants.



VIEWS IN GARDEN'S TROPICAL STATION.

GINGER

Near one of the vanilla vines is a little patch of ginger *(Zingiber officinalis)*. This household favorite is totally unlike the daring vanilla in its manner of life. Indeed it is so modest and inconspicuous that it is seldom noticed, being passed by for a clump of coarse reed-like grass. But all the time, hidden away in the pudgy fingers of its hand-like roots, is one of the world's best-known spices.

Ginger is a native of southern Asia, but grows equally well in any tropical country. Under cultivation it rarely ever blooms, propagation being solely from the roots, bits of which scattered about sprout readily. Fresh ginger root is a pale buff in color. There are two methods of preparing it for shipment. The first is to expose the roots or hands to the sun until dry. The second,, and the method usually preferred, is to scald them and scrape off the thin skin. Then dry them and dust them over with lime to prevent molding. This coating accounts for the "white" ginger seen in the druggist's glass containers.

From early history ginger has been highly prized as a household spice. In recent years the popular demand for ginger ale, and the large amount of delicious preserved root, exported from China, have brought fresh laurels to the deserving plant. The Jamaican variety is used for ground spice; but the Chinese variety is preferred for preserves and candy, for it has a milder flavor, that is, comparatively speaking, and is fleshy and tender.

Sometimes the visiting housewife likes to tuck this receipt in her pocket for a souvenir. It was worked out by the wife of a Canal Zone employee in the good old construction days:

> Scrape off the skin of young, tender ginger "fingers," cut them cross-ways into bits—half an inch thick. Soak them over night. Put fresh water over them in the morning and boil slowly. Remove from the stove and drain. Repeat the process of changing of the water and boiling until the strength of the root is reduced to suit the taste. Then, to a cup of sugar add a cup of the ginger bits and one-quarter cup of water. Boil rapidly until the sugar "threads." Remove from the stove and cool. Stir until the syrup creams.

Each bit of root will then be found encased in a firm coat

of fondant. Prepared in this way ginger is not only a pleasing sweetmeat but it is often a comforting companion on an ocean trip.

PEPPER

The fieriest of all spices is represented in the Station by *Capsicum annuum*, or, in every-day terms, red pepper or chili. Probably this shrub was never intentionally planted in the garden, but, like Topsy, it "just grew." Although so common and well known, it usually gets a nod and smile from visitors, for it is such a cheerful little shrub, alight with red and, when unripe, yellow, taper-like pods about an inch in length, standing erect on the branches, among the green leaves, and looking for all the world like tiny Christmas candles.

This familiar plant belongs to the potato family, and is distinctly of American origin. Varieties of Capsicum were in use by the aborigines ages before Columbus touched America's shore and carried specimens of the "new" spice back to Spain as souvenirs. All the world now uses red pepper but in varying measures. The northern housewife would not consider her kitchen cabinet complete without a box of cayenne pepper (the powdered pods). She uses it frequently in her cooking but so sparingly that the pepper-box seldom needs to be replenished. Her Southern sister seasons with a more lavish hand. When preparing soups and meats, she steps to the door and picks fresh chilies from a convenient bush, and adds them to these dishes in surprising amounts. The East Indian coolie crouches on the ground placidly eating his bowl of rice, so fiery with Capsicum that it would literally burn up throats less toughened, and smacks his lips with delight.

One reason given for the very liberal use of red pepper in southern countries, aside from the highly cultivated taste for "hot" dishes, is the belief that pepper wards off fevers. This seems quite reasonable, for no doubt the fever finding its subject already occupied by the fiery pepper retreats, abashed.

PERESKIA

Most visitors, even local ones, need a formal introduction to *Pereskia Bleo*, a little-known member of the Cactus family.

When seen from a distance, this large attractive shrub shows few, if any, of its family's characteristics. A closer view, however, reveals its many branches to be armed with countless sharp spines, which seem to repulse friendly advances, but, as if to counteract this unfriendly appearance, these branches also carry an abundance of shapely green leaves and of showy bright tomato-red flowers resembling a wild rose in shape and size.

It is, however, the fruit which adds the unique feature to this plant. Mr. Standley in "Flora of the Panama Canal Zone" (U. S. Nat. Herb. Contr., Vol. 27), describes it in these concise words: "The fruit is curious and very distinctive, in form a broad inverted cone, at maturity smooth and bright yellow."

The result of a little culinary experimenting with this fruit is rather interesting.

> **Half a dozen ripe fruits were washed and parboiled until tender, then the water was drained off. A cup of white sugar was added to this water and put on to boil. The fruits were dropped into the boiling syrup when it began to thicken. They were then gently stewed until clear.**

When the preserve was done, the fruit was found to have four outstanding points in its favor.

1. It had a peculiarly pleasing tart flavor.
2. It remained firm.
3. It retained its shape perfectly.
4. It lost but little color, and had a wax-like appearance.

It seems likely that this fruit would crystallize easily, and make a nice addition to a jar of glacè fruits. It is about the right size for this purpose, being some two inches across.

Pereskia Bleo is a native of Panama and Colombia. It is used in country districts for hedges and forms impassable barriers. Several varieties of this species were planted in the Canal Zone some years ago, for ornamental purposes. Perhaps they have not received much encouragement, for there are but few specimens left.

M. D. H.

(To be continued)

NOTES ON MISSOURI PLANTS FOUND ON CERTAIN GEOLOGICAL FORMATIONS

It is a fact of some significance that frequently plants are restricted in their distribution to certain types of habitats. Rainfall, temperature, light, and soil conditions are among the most important factors in the distribution of plants. In general, limestone and other calcareous rocks seem to give rise to alkaline and neutral types of soils, whereas sandstones, cherts, and granites and their derivatives may effect acidic conditions. Where all other conditions in a given small area remain relatively constant, the type of substratum may become the all-important factor in the occurrence of certain species, and often explains why a given species is rare or local in its distribution. It will be seen from the following lists that many of the species in Missouri found on sandstone also occur on granite and chert, but not on limestone; on the other hand, certain species range on limestone exclusively.

In the following lists are to be found certain plants[1] that are typical of the rock formations upon which they occur. Where they are found on other rock formations, a corresponding number is cited. Many species, however, occurring on these substrata are not shown, because of their general distribution on numerous other types of rocks.

1=St. Peter sandstone.
2=La Motte sandstone.
3=Granite and porphyry.
4=Various limestones.
5=Various cherts.

1. PLANTS FOUND ON THE ST. PETER SANDSTONE

2, 3. *Polypodium vulgare* L. (Common polypody).
Polypodium polypodioides (L.) Hitchc. (Gray polypody).
2, 3. *Cheilanthes lanosa* (Michx.) Wats. (Hairy lip-fern).
2, 5. *Asplenium Trichomanes* L. (Maiden-hair spleenwort).
Aspidium Thelypteris (L.) Sw. (Marsh shield-fern).
2. *Aspidium spinulosum* (O. F. Müller) Sw. var. *intermedium* (Muhl.) D. C. Eaton.
2, 3. *Osmunda cinnamomea* L. (Cinnamon fern).

[1]Plants listed according to Gray's Manual, seventh edition.

2. *Lycopodium lucidulum* Michx. (Shining club-moss).
2, 3, 5. *Selaginella rupestris* (L.) Spring (Rock selaginella).
5. *Selaginella apus* (L.) Spring (Creeping selaginella).
2, 3. *Pinus echinata* Mill. (Yellow pine).
2, 3. *Tradescantia bracteata* Small (Long-bracted spiderwort).
5. *Dicentra canadensis* (Goldie) Walp. (Dutchman's breeches).
Arabis lyrata L. (Lyre-leaved rock-cress).
2. *Saxifraga virginiensis* Michx. (Early saxifrage).
Saxifraga Forbesii Vasey (Forbe's saxifrage).
Mitella diphylla L. (Bishop's cap).
Sullivantia renifolia Rosendahl (Kidney-leaved Sullivantia).
2, 3, 5. *Hypericum prolificum* L. (Shrubby St. John's-wort).
2, 3. *Trichostema dichotomum* L. (Blue curls).
2, 3. *Hedeoma hispida* Pursh (Rough pennyroyal).
2. *Linaria canadensis* (L.) Dumont (Blue toad-flax).
Chelone glabra L. (Turtle-head).
2. *Mitchella repens* L. (Partridge-berry).
2, 3, 5. *Helenium tenuifolium* Nutt. (Fine-leaved sneezeweed).
5. *Artemisia caudata* Michx. (Tall wormwood).
3. *Krigia Dandelion* (L.) Nutt. (Dwarf dandelion).
3, 5. *Krigia virginica* (L.) Willd. (Carolina dwarf dandelion).

2. PLANTS FOUND ON THE LA MOTTE SANDSTONE

1, 3. *Polypodium vulgare* L. (Common polypody).
1, 3. *Cheilanthes lanosa* (Michx.) Wats. (Hairy lip-fern).
3. *Asplenium pinnatifidum* Nutt. (Pinnatifid spleenwort).
1, 5. *Asplenium Trichomanes* L. (Maiden-hair spleenwort).
Asplenium Bradleyi D. C. Eaton (Bradley's spleenwort).
1. *Aspidium spinulosum* (O. F. Müller) Sw. var. *intermedium* (Muhl.) D. C. Eaton. (Spinulose shield-fern).
Dicksonia punctilobula (Michx.) Gray. (Hay-scented fern).
3. *Osmunda regalis* L. (Royal fern).
1, 3. *Osmunda cinnamomea* L. (Cinnamon fern).
1. *Lycopodium lucidulum* Michx. (Shining club-moss).
Lycopodium complanatum L. var. *flabelliforme* Fernald (Trailing ground-pine).
1, 3, 5. *Selaginella rupestris* (L.) Spring (Rock selaginella).
1, 3. *Pinus echinata* Mill. (Yellow pine).
3. *Andropogon Elliottii* Chapm. (Elliott's beard-grass).
1, 3. *Aristida basiramea* Engelm. (Forked triple-awned grass).
1, 3. *Tradescantia bracteata* Small (Long-bracted spiderwort).
Epipactis pubescens (Willd.) A. A. Eaton. (Downy rattlesnake plantain).
1. *Saxifraga virginiensis* Michx. (Early saxifrage).
3, 5. *Hamamelis virginiana* L. (Witch-hazel).
3. *Acalypha gracilens* Gray (Slender three-seeded mercury).
3. *Ascyrum hypericoides* L. (St. Andrew's cross).

1, 3, 5. *Hypericum prolificum* L. (Shrubby St. John's wort).
Hypericum petiolatum Walt. (Larger marsh St. John's wort).
3. *Rhododendron nudiflorum* (L.) Torr. (Purple azalea).
3, 5. *Vaccinium arboreum* Marsh. (Farkleberry).
3, 5. *Vaccinium stamineum* L. (Deerberry).
3. *Isanthus brachiatus* (L.) BSP. (False pennyroyal).
1, 3. *Trichostema dichotomum* L. (Blue curls).
1, 3. *Hedeoma hispida* Pursh (Rough pennyroyal).
Pycnanthemum incanum (L.) Michx. (Hoary mountain-mint).
1. *Linaria canadensis* (L.) Dumont (Blue toad-flax).
1. *Mitchella repens* L. (Partridge-berry).
3. *Solidago arguta* Ait. (Cut-leaved golden-rod).
1, 3, 5. *Helenium tenuifolium* Nutt. (Fine-leaved sneeze-weed).
1, 3, 5. *Krigia virginica* (L.) Willd. (Carolina dwarf dandelion).

3. PLANTS FOUND ON GRANITE AND PORPHYRY

1, 2. *Polypodium vulgare* L. (Common polypody).
1, 2. *Cheilanthes lanosa* (Michx.) Wats. (Hairy lip-fern).
2. *Asplenium pinnatifidum* Nutt. (Pinnatifid spleenwort).
2. *Osmunda regalis* L. (Royal fern).
1, 2. *Osmunda cinnamomea* L. (Cinnamon fern).
1, 2, 5. *Selaginella rupestris* (L.) Spring (Rock selaginella).
1, 2. *Pinus echinata* Mill. (Yellow pine).
2. *Andropogon Elliottii* Chapm. (Elliott's beard-grass).
1, 2. *Aristida gracilis* Ell. (Slender triple-awned grass).
Cyperus aristatus Rottb. (Awned cyperus).
1, 5. *Tradescantia brevicaulis* Raf. (Short-stemmed spiderwort).
1, 2. *Tradescantia bracteata* Small (Long-bracted spiderwort).
Habenaria peramoena Gray (Fringeless purple orchis).
2, 5. *Anychia polygonoides* Raf. (Forked chickweed).
Cerastium arvense L. (Field chickweed).
2, 5. *Hamamelis virginiana* L. (Witch-hazel).
2. *Rosa Woodsii* Lindl. (Wood's rose).
2. *Acalypha gracilens* Gray (Slender three-seeded mercury).
Ilex verticillata (L.) Gray var. *padifolia* (Willd.) T. and G. (Black alder).
2. *Ascyrum hypericoides* L. (St. Andrew's cross).
1, 2, 5. *Hypericum prolificum* L. (Shrubby St. John's-wort).
5. *Viola sagittata* Ait. (Arrow-leaved violet).
2. *Rhododendron nudiflorum* (L.) Torr. (Purple azalea).
2, 5. *Vaccinium arboreum* Marsh. (Farkleberry).
2, 5. *Vaccinium stamineum* L. (Deerberry).
Vaccinium neglectum (Small) Fernald (Deerberry).
Gentiana quinquefolia L. (Stiff gentian).
Phlox bifida Beck (Cleft phlox).
2. *Isanthus brachiatus* (L.) BSP. (False pennyroyal).
1, 2. *Trichostema dichotomum* L. (Blue curls).

1, 2. *Hedeoma hispida* Pursh (Rough pennyroyal).
1, 2. *Houstonia caerulea* L. (Bluets).
1, 2. *Lonicera flava* Sims (Yellow honeysuckle).
2. *Solidago arguta* Ait. (Cut-leaved golden-rod).
Gnaphalium polycephalum Michx. var. *Helleri* (Britton) Fernald (Heller's fragrant everlasting).
1, 2. *Helenium tenuifolium* Nutt. (Fine-leaved sneezeweed).

4. PLANTS FOUND ON VARIOUS LIMESTONES

Cheilanthes Feei Moore (Slender lip-fern).
Asplenium parvulum Mart. and Gal. (Small spleenwort).
Asplenium Ruta-muraria L. (Wall rue spleenwort).
Veratrum Woodii Robbins (Wood's false hellebore).
Trillium declinatum (Gray) Gleason. (Drooping wake-robin).
Nemastylis acuta (Bart.) Herb. (Northern nemastylis).
Liparis liliifolia (L.) Richard. (Large twayblade).
Silene regia Sims (Royal catchfly).
Clematis Fremontii Wats. (Fremont's leather-flower).
Delphinium azureum Michx. (Prairie larkspur).
Caulophyllum thalictroides (L.) Michx. (Blue cohosh).
Erysimum asperum DC. (Western wall-flower).
Psoralea tenuiflora Pursh (Few-flowered psoralea).
Petalostemum purpureum (Vent.) Rydb. (Purple prairie-clover).
Petalostemum candidum Michx. (White prairie-clover).
Tephrosia virginiana (L.) Pers. (Goat's rue).
Astragalus distortus T. & G. (Bent milk vetch).
Astragalus mexicanus A. DC. (Ground plum).
Croton capitatus Michx. (Capitate croton).
Croton monanthogynus Michx. (Single-fruited croton).
Rhus canadensis Marsh. (Fragrant sumac).
Ilex decidua Walt. (Deciduous holly).
Rhamnus lanceolata Pursh (Lance-leaved buckthorn).
Hibiscus militaris Cav. (Halberd-leaved rose-mallow).
Passiflora lutea L. (Yellow passion-flower).
Oenothera missouriensis Sims (Missouri primrose).
Cryptotaenia canadensis (L.) DC. (Honewort).
Zizia aurea (L.) Koch (Golden Alexanders).
Taenidia integerrima (L.) Drude (Yellow pimpernel).
Polytaenia Nuttallii DC. (Nuttall's prairie parsley).
Gentiana puberula Michx. (Downy gentian).
Gentiana Andrewsii Griseb. (Closed gentian).
Apocynum androsaemifolium L. (Spreading dogbane).
Asclepiodora viridis (Walt.) Gray (Oblong-leaved milk-weed).
Heliotropium tenellum (Nutt.) Torr. (Slender heliotrope).

Lithospermum canescens (Michx.) Lehm. (Hoary puccoon).
Monarda Bradburiana Beck (Bradbury's monarda).
Satureja glabra (Nutt.) Fernald (Low calamint).
Pycnanthemum flexuosum (Walt.) BSP. (Narrow-leaved mountain-mint).
Conobea multifida (Michx.) Benth. (Conobea).
Castilleja coccinea (L.) Spreng. (Indian paint-brush).
Orobanche uniflora L. (One-flowered cancer-root).
Houstonia longifolia Gaertn. (Long-leaved houstonia).
Campanula americana L. (American bellflower).
Grindelia squarrosa (Pursh) Dunal (Broad-leaved gum-plant).
Solidago latifolia L. (Broad-leaved golden-rod).
Solidago Drummondii T. & G. (Drummond's golden-rod).
Solidago Gattingeri Chapm. (Gattinger's golden-rod).
Aster laevis L. (Smooth aster).
Aster azureus Lindl. (Sky-blue aster).
Silphium integrifolium Michx. (Entire-leaved rosin-weed).
Silphium terebinthinaceum Jacq. (Prairie dock).
Brauneria purpurea (DC.) Britton (Purple cone-flower).
Brauneria angustifolia (DC.) Heller (Narrow-leaved purple cone-flower).
Verbesina virginica L. (Virginia crownbeard).
Cacalia tuberosa Nutt. (Tuberous Indian plantain).

J. A. S.

SOME NEW AND INTERESTING PLANTS FROM MISSOURI

Collecting trips made by the writer in 1929 and 1930 resulted in the finding of two unusual species in the flora of Missouri. The first of these plants is the kidney-leaved Sullivantia *(Sullivantia renifolia* Rosendahl), a species described by Rosendahl in 1927 in his "Revision of the Genus Sullivantia" (Univ. Minn. Research Publication 6, pp. 401-427), and hitherto unreported for Missouri. It was found in the late spring of 1929, about six miles southeast of Catawissa, in Jefferson County. It is interesting to note that each of the six species comprising this genus has a very local and limited distribution, occurring particularly on moist rocky ledges of cliffs or on rocky creek bottoms. *Sullivantia renifolia* Rosendahl has, as far as Rosendahl's revision indicates, been collected only from southern Minnesota, southern Wisconsin, northeastern Iowa, and northwestern Illinois. The moist,

shaded bluffs of St. Peter sandstone, on which the Missouri specimen was collected, have thus provided a more southern station in Missouri for this plant.

The second of these plants, collected in December of 1930 about four miles east of Pickle, St. Genevieve County, along the River aux Vases, is the hairy Dumortiera *(Dumortiera hirsuta* (Sw.) Reinb. Bl. and Nees). This is a very rare liverwort of the same family as the common Marchantia. It belongs to a genus occurring in tropical and subtropical regions of both hemispheres, but is very rare and local. The Missouri plant was found growing luxuriantly in large mats at the base of a moist, shaded bluff consisting of La Motte sandstone. It is a strikingly beautiful plant; the thallus is of a dark green color, with smooth surface, has a conspicuous midrib, and, in some parts, attains a width of three centimeters. Only one specimen of this plant collected in the United States exists in the herbarium of the Missouri Botanical Garden, that collected by Emig in the Boston Mountains of Arkansas.

In addition to Dumortiera several other liverworts, found on St. Peter sandstone, are worthy of mention. According to Dr. Evans' records *Diplophyllum apiculatum* (Evans) Steph., *Jubula pennsylvanica* (Steph.) Evans, and *Frullania inflata* Lehm. & Lindenb., are new to Missouri. The Diplophyllum was found near Foley, in Lincoln County, and near Pickle Springs, St. Genevieve County, the Jubula near Oetters, Franklin County, and Frullania near Foley.

J. A. S.

NOTES

The ladies attending the convention of the Midwest Circulation Managers' Association visited the Garden March 10.

The Proceedings of the Three Hundreth Anniversary Celebration of the First Recognized Use of Cinchona, held at the Garden, October 31-November 1, have been published.

Mr. A. P. Beilmann, in charge of trees and shrubs at the Garden, spoke before the St. Louis Horticultural Society, March 6, on "Controlling Garden Pests."

Mr. L. P. Jensen, Arboriculturist to the Garden, is the author of an article in the March number of the "Missouri Magazine" (Vol. 3, No. 11), on "The Relation of Highways to State Conservation."

Mr. Leo Suppan, professor of pharmacognosy, St. Louis College of Pharmacy, gave a talk before the graduate seminar at the Garden, February 25, on "Aconite."

Dr. Hermann von Schrenk, Pathologist to the Garden, gave an illustrated talk before the Missouri Horticultural Society, March 25, on "How the Termites Wreck Our Buildings."

Mr. Francis Drouet and Mr. E. E. Naylor, graduate students in botany at the University of Missouri, spent several days at the Garden during March, consulting the library and herbarium.

Dr. Adele L. Grant, formerly Acting Curator of Herbarium, spoke before the Asklepios Society of Washington University, March 4, on "Collecting Plants in Africa"; and before the Bird Club of Webster Groves, March 27, on "Birds in Southern and Eastern Africa."

Recent visitors to the Garden include Mr. J. Horace MacFarland, of Harrisburg, Pennsylvania, president of the American Rose Society; and Mr. Arno Nehrling, of Richmond, Indiana, and Prof. H. B. Dorner, professor of floriculture, University of Illinois, both of whom acted as judges at the Spring Flower Show.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave a talk at the joint meetings of the garden clubs of Gray Summit, Washington, and Pacific, Missouri, at the Gray Summit Extension, March 2, on "Growing Plants from Seed." Over 300 people attended, some coming from a distance of forty miles.

Dr. George T. Moore, Director of the Garden, spoke before the Overhill Men's Club of the First Presbyterian Church, March 19, on "Plant Life Above and Below the Ground"; at the luncheon meeting of the Washington University Alumni Association, at the Mark Twain Hotel, March 25, on "The Relation of the Missouri Botanical Garden to Washington University"; and before the Greater St. Louis Mu-

seum of Natural History Association, March 26, on "Moving Pictures of Plant Life."

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, presented a paper, "A Correlative Review of the Morphological, Chemical, Pharmacological, and Serological Relationships of the Plant Families in the Light of Modern Allergy," at the March meeting of the St. Louis Colloid Medical Club; and spoke before the students of ten colleges of pharmacy and the Iowa State Pharmaceutical convention (Des Moines) and the Minnesota State Pharmaceutical Convention (St. Paul) on the subject "The Changing Order of American Pharmacy."

Mr. L. P. Jensen, Arboriculturist to the Garden, has given the following talks during March: March 10, before the White River Boosters' League, at the Rockaway Hotel, Rockaway Beach, Lake Taneycomo, Mo., "Conservation and Highway Beautification"; March 11, before a joint meeting of the garden department of Sorosis, the City Beautiful, and the Civic Affairs Bureau of the Chamber of Commerce, at Springfield, Mo., "The Use of Native Plants in Ornamental Planting"; March 17, before the St. Louis Garden Club, "Wild Flowers of Missouri"; March 20, before a meeting of the St. Francois County School Superintendents and School Board members, at the High School of Bismarck, Mo., "The Ornamental Value of Our Native Plants."

The St. Louis Spring Flower Show, sponsored by the St. Louis Flower Association, Allied Florists' Association, Wholesale Florists' Association, St. Louis Florists' Club, Retail Florists' Association, and St. Louis Greenhouse Producers' Association, was held at the Garden March 19-22. Prizes were given for the most artistic displays presented by members of the Floral Designing School conducted under the auspices of the Board of Education. Another new contest this year was for the best Japanese garden arranged by any garden club in St. Louis or St. Louis County. Mr. George H. Pring, Superintendent of the Garden, acted as chairman of the judges' committee.

STATISTICAL INFORMATION FOR FEBRUARY, 1931

GARDEN ATTENDANCE:

Total number of visitors	23,285

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	34
Total number of books and pamphlets donated	68

PLANT ACCESSIONS:

Total number of seed packets donated	43
Total number of plants donated or received in exchange	82

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	53
Total number of seed packets distributed in exchange	10

HERBARIUM ACCESSIONS:

By Purchase—	
Berkeley, Earl E.—Plants of West Virginia	1,000
British Museum of Natural History—Photographs of American plants	40
Goodman, George J.—Plants of Wyoming, Colorado and Utah, collection of 1929	360
Goodman, George J., and Charles Leo Hitchcock—Plants of western United States	1,078
Jones, Prof. Marcus E.—Plants, chiefly of Oregon and Texas	933
Kittridge, Miss E. M.—Ferns of Vermont	88
Museum of Natural History, Paris—Plant photographs	5
Schmalz, Albano—Ferns of Brazil	188
By Gift—	
Clemens, J. and M. S., by E. D. Merrill—Plants of Borneo	44
Fosberg, F. R., by Charles Leo Hitchcock—Plants of New Mexico	7
Hitchcock, Charles Leo—*Godetia parviflora* (H. & A.) Jepson from California	1
Suppan, Leo—Tuberiform roots of *Aconitum Napellus* L.	1
Verdoorn, Fr.—"Hepaticae Selectae et Criticae," Series I, Nos. 1-50 incl	50
Wynd, F. Lyle—*Equisetum* sp. from Lower Eocene, Oregon	1
By Exchange—	
Berlin Bot. Gard. and Mus.—Plant photographs	21
University v. Brno—"Exsiccata Republicae Bohemicae Slovenicae," Centuria VI, Nos. 501-600 incl	100
University of Utah, by Prof. V. C. Fisk—Plants of Utah	109
By Transfer—	
Pring, G. H.—Plants of Horticulture	4
Total	4,030

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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MISSOURI BOTANICAL GARDEN BULLETIN

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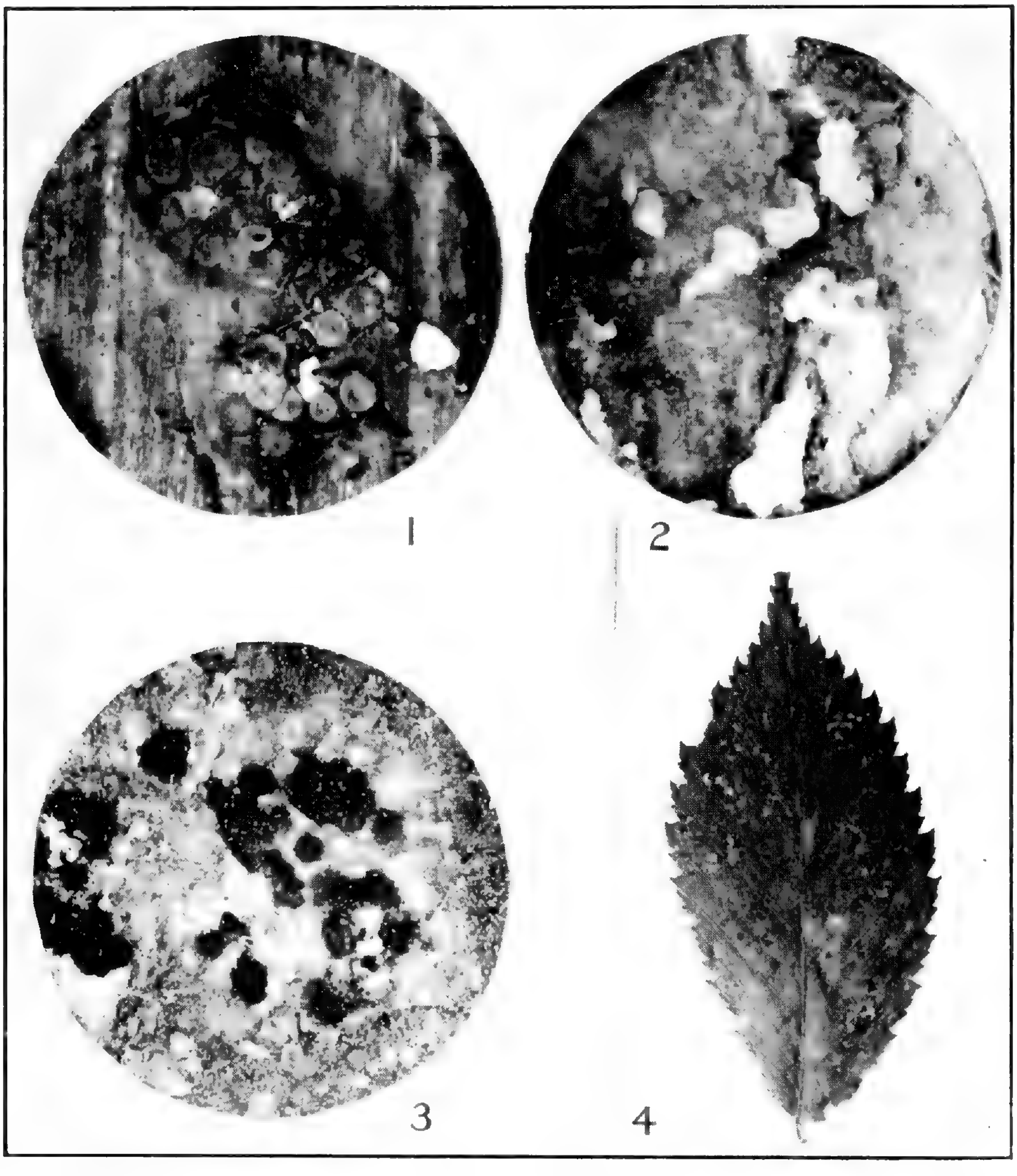

Fig. 1. Cluster of perithecia of *Nectria cinnabarina*, × 10.
Fig. 2. Fruiting bodies of *Verticillium* sp., consisting of dense aggregations of spore-bearing threads, × 10.
Fig. 3. A cluster of fruiting bodies of *Gnomonia Ulmea*, × 10.
Fig. 4. Black spots on elm leaf caused by *Gnomonia Ulmea*, about natural size.

Missouri Botanical Garden Bulletin

Vol. XIX APRIL, 1931 No. 4

SOME DISEASES OF ELM TREES

A few years ago there was created abroad a furor mingled with a goodly measure of despair when it was found that the elm trees were being attacked by a disease that apparently gave them no chance for recovery. Furthermore, in spite of all precautionary measures, the epidemic spread very rapidly. The disease, called the Dutch elm disease, was found to have been produced by a fungus which was described by Schwarz, a Dutch botanist, as *Graphium Ulmi*. Following the publication of the description in 1922, there was considerable discussion as to whether the trouble was actually caused by the fungus or by a bacterium that was also found in association with the disease. The discussion delayed the application of control measures, and by the time the problem was definitely settled the disease had spread from Holland into Germany. The rapidity of the advance and the severity of the attack of the fungus is clearly indicated by the fact that in Rotterdam, where there were about 30,000 elms, 17,000 have been cut down in eleven years, all dead from the disease. Reports on the presence of the fungus have also come from Belgium, France, Italy, and Spain, and in 1927 the first case was reported from England.

In America we have been more fortunate, but in 1930 one case was recorded from Cincinnati and four from Cleveland, Ohio. Subsequently one or two infestations have been brought to light at stations further west. These appearances could not

be traced to nurseries or to imported stock, and hence it appears likely that the fungus is endemic to North America. While such a statement appears premature on the basis of the meagre evidence at hand, the fact that the disease does not seem to be extremely virulent, or at least to have spread rapidly in this country, indicates that the American elm has been exposed to the fungus for so long a time that it has developed a degree of immunity. Seemingly this state of affairs parallels the case of the chestnut-blight disease which was introduced into this country from Asia, where the chestnut appears to be relatively resistant. The spread of the chestnut blight was extremely rapid and the attack severe, in fact so severe that unless the American chestnut develops resistance there is a chance that it will emulate the Dodo. The elm disease in Europe seems to be following a similar course.

The apparent resistance of the American elm to the disease should not kill our endeavors to find out as much as possible about the distribution and virility of the fungus, for, after all, there have been reports of epidemics of elm diseases that were of a very serious nature. They have not been satisfactorily explained in all cases, and it is possible that *Graphium Ulmi* was the causal agent in certain instances. Therefore all suspected trees should be reported either to the United States Department of Agriculture or to the Ohio Experiment Station at Wooster, and portions of infected twigs sent for examination. For the recognition of the symptoms, the following description based on M. and M. J. F. Wilson's article in the "Gardeners' Chronicle" (British) for January, 1928, is given below:

"Trees suffering from the disease may be readily recognized by the yellow discoloration of the leaves in the crown of the tree or at the tips of the side branches. This condition usually spreads rapidly over the tree and is followed by leaf-fall and subsequently the death of the tree. Defoliation may be complete within a week, but sometimes extends over a much longer period. External symptoms of the disease are usually observed about the beginning of June [in Great Britain]. Sometimes a tree which has lost all its leaves early in the

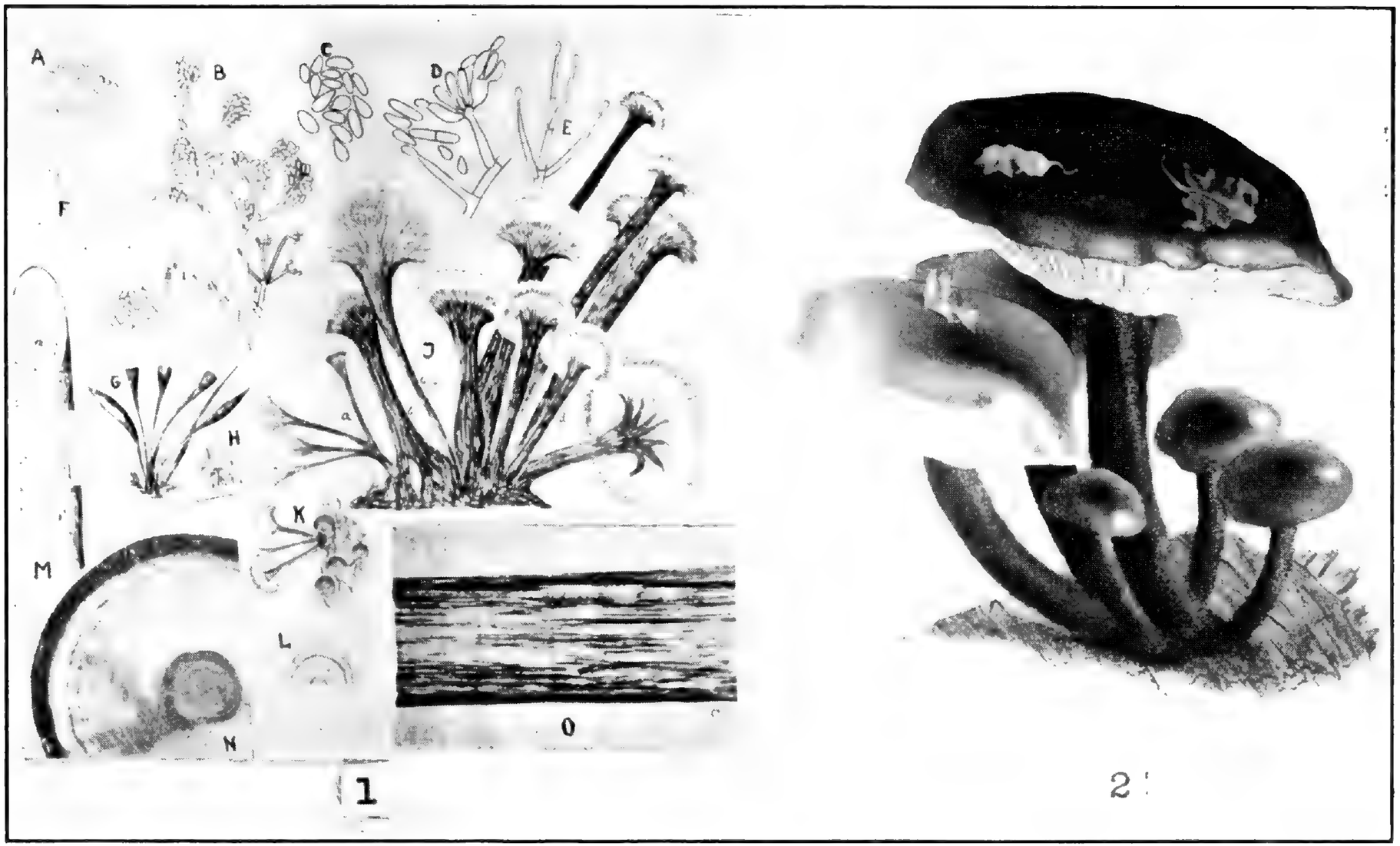

Fig. 1. *Graphium Ulmi*: A-K show various types of spores and spore-bearing threads. L-O show the effect of the fungus on the twigs, as indicated by the dark dots in the wood below the bark in N, or the dark streaks in O (A-N after Wollenweber, O after Wilson).

Fig. 2. *Collybia velutipes* or velvet-stemmed Collybia, occasionally parasitic on elms (after Rolland).

year may produce a second crop of leaves late in the season, but these are smaller and soon fall. Dying trees often produce a large number of leafy shoots at the bases of the branches and on the main trunk. Infected branches, when cut across, show one or more rings of small brown spots in the most recently formed wood (pl. 17, fig. 1, L-O). If the bark is peeled from such twigs, longitudinal brown streaks are observed, which correspond to the brown spots in the cross section. These internal symptoms can sometimes, but not invariably, be found in the roots."

Such then are the characters of the disease as they are evidenced in England. There is another disease of the elm that is not at all uncommon in Missouri, and may be confused with the Dutch elm disease. It is caused by a fungus of microscopic size which is known scientifically as Verticillium. This fungus is said to attack only the younger trees in which it also causes a browning of the wood. The brown area, however, has a more watery appearance than is the case in infections caused by *Graphium Ulmi*, and the discoloration is more generalized—not in streaks. The disease usually begins at the base of the tree rather than at the top. According to observations made in September, 1929, the following symptoms were characteristic: The leaves of branches on one side of the tree had turned yellow and fallen. An examination of the limbs showed that they were apparently healthy, but when the trunk was examined the bark was found to be cankerous from the base to heights varying from five to twenty feet above ground, and in strips of from two to eight inches wide. The cankerous bark was somewhat dry in appearance, slightly sunken, and inconspicuously cracked although in the older portions the cracks were more evident. In the crevices of the cankerous bark, the fungus forms its fruiting bodies which when young are waxy and salmon-pink but when older become dirty yellowish and horny. These fruiting bodies (pl. 16, fig. 2) are one-sixteenth to one-eighth of an inch in diameter and are flattened, somewhat irregular, cushion-shaped structures. In artificial cultures or on dead bark, all stages may be found between the loose cottony type of fruiting body to

the densely aggregated cushion-shaped mass already referred to.

Apparently the only effective method of controlling this and the Dutch elm disease is to remove the infected trees and to burn them. By so doing, the chances of the infection spreading are materially reduced, especially if the trees are removed before the fungi have produced their fruiting bodies. Possibly, when the tree is of great ornamental value and is infected with Verticillium it may be preserved by careful tree surgery. In this instance the wood and bark should be removed to a distance of two or three inches away from the wound, at least well beyond the infected area. At the same time, those roots that may be adjacent to the cankerous area should be bared and if infected cut off or treated in the same manner as the trunk, depending on the severity of infection. After treatment, new soil should replace the old fungus-infected soil.

Another fungus, more popularly called a mushroom, may also be the cause of root disease when conditions are favorable, but as a rule it prefers newly killed trees or relatively fresh, that is, little decomposed, stumps. This fungus, the hairy-stemmed Collybia *(Collybia velutipes)*, is very common in St. Louis and vicinity where it is the first to appear in the spring and the last to disappear in the fall (pl. 17, fig. 2). That it may be parasitic has been shown by several inoculation tests that have been made abroad, and also by the frequency of its occurrence at the base of trees that are still alive but in a weakened condition. Since this species has pathogenic potentialities and also since it is considered edible and to have an excellent flavor, it is described. The cap is three-quarters to two inches in diameter, smooth, slimy or somewhat so, tawny to reddish-yellow, darker at the center than toward the edge; the flesh is rather thick and white or yellowish. The stem is three-quarters of an inch to two and three-quarters inches long and one-eighth to one-quarter of an inch thick, firm, or with age hollow, yellow at the apex, below densely velvety, with short, tawny or blackish-brown hair.

When such fruiting bodies as have been described are

found either singly or in clusters at the base of a living elm tree that is highly cherished, especially when the tree appears sickly after an unfavorable year, the base of the tree and the upper part of the roots should be examined for infection. The treatment should be the same as given for the Verticillium disease and the same precautions taken.

The coral-spot disease caused by *Nectria cinnabarina* may at times cause the death of twigs or even of branches. Occasionally it may be the cause of canker on the trunks of young trees. The usual host for the fungus is maple, but it occurs on a wide variety of trees and shrubs, among which the elm is numbered. At first the fungus lives as a parasite in dead or dying tissue that has resulted from wounds, but once established it spreads into the healthy tissue, gradually girdling the branch or limb and thus by starvation killing all twigs or branches beyond the infested zone. When the infection has become old enough, the asexual type of fruiting bodies is produced. They consist of a vast number of spore-bearing threads which are aggregated to form numerous pustules or wart-like prominences that are conspicuous because of their bright pink or salmon color. The multitude of asexual spores is capable of spreading infection through the agency of birds, man, wind, and a number of other means. By the time that asexual spore production begins to let up, another stage takes its place. This is indicated by the production of small globose, red or orange-red structures on or beside the old pustules (pl. 16, fig. 1). These fruiting bodies, or perithecia, of the second phase, although seldom attaining a diameter of one-sixteenth of an inch, produce a large number of spores which are supposed to be resistant and to tide the fungus over winter. In addition to the resistant spores, the species may also spend the winter as fungous threads in the wood.

Since there is available to the fungus such a variety of methods for spreading and for spending the winter, it is obvious that the methods of control should be constantly practiced so that spore production and new infections be kept to a minimum. To attain this end, all dead twigs should be removed in the fall or early spring by pruning, the cuttings

made two or more inches away from the infected zones in order to avoid the chance of leaving the fungus to continue its destructive work. The wood that has been removed, and that which may be under the tree should be gathered and burned. This is a lot of work, but it is also very good insurance and protection for the stately yet graceful elms that lend so much charm to the landscape.

Occasionally when seasonal factors are favorable, the elm leaf spot, caused by *Gnomonia Ulmea,* may result in severe defoliation of the trees, but as a rule general infections are seldom encountered. Yet in the fall of 1927, a large number of infected leaves were seen under trees growing on the flood plain near Falling Spring, Illinois. Since heavy infection may cause a more or less complete dropping of the leaves in midsummer and thus reduce the vitality of the tree, and also in order that it may not be confused with the Dutch elm disease, the symptoms of the disease are given herewith.

The species forms minute black eruptions, somewhat clustered together in small circles or scattered over the whole upper surface of the living leaves (pl. 16, figs. 3 and 4). In time there is a whitish or grayish margin around the groups, due to the wearing away of the epidermis. The spores of the fungus mature on the old leaves on the ground in the spring. An asexual stage also connected with this fungus may attack the petiole of the leaves or the young green twigs in the spring, girdling them and causing the death of the subtended parts. This stage appeared rather abundantly in the spring of 1928. As a method of controlling this fungus, it is suggested that the leaves be gathered in the fall and burned. By so doing, spore production is kept to a minimum and the infection of the next year's crop of leaves is reduced.

While fungi undoubtedly are agents of destruction, they are certainly not the only ones, for insects may be either the direct or indirect cause of a number of fatalities. Thus the scale insects and aphids may be present in sufficient abundance to bring about the weakening of the host and to cause sufficient mechanical injury to make conditions favorable for the entrance of fungous parasites. The elm-sap beetle *(Scolytus scolytus)* of Europe has recently been proven to

be guilty not only of tunneling into the elm tree and affording a place for the germination of spores, but also of carrying the spores of *Graphium Ulmi,* already described as the cause of the Dutch elm disease. Similarly the leopard moth (*Zeuzera pyrina)* and the elm-bark beetle *(Hylesinus opaculus),* by making their conspicuous tunnels, afford a golden opportunity for the lodgment and germination of fungous spores. The moth of its own industry is capable of doing considerable damage, since its larvae tunnel under the bark, cutting deep galleries and often girdling the branches. Since two years are required for the insect to complete its life cycle, a systematic cutting and burning of infested branches will check the pest. When sawdust is seen on the main trunk of the tree, it is an indication that the larvae are at work at that point. These may be removed by cutting them out or by injecting carbon bisulphide and sealing the burrow. The procedure is the same as that outlined for the ash-tree borer and is described in the Garden BULLETIN for December, 1929.

Severe defoliation of the trees may be caused by a number of insect pests, but such pests may readily be controlled when the infestations are sufficiently severe to warrant the expense, by spraying with arsenate of lead.

Before leaving the subject of elm-tree diseases, a cause of death may be mentioned that perhaps is not uncommon in more or less thickly settled areas. This cause is illuminating-gas that may have escaped into the soil or air by way of broken pipes or leaky joints. Gas poisoning is rather difficult to determine since the trees so afflicted show the same symptoms as those with other root troubles. The roots, however, show rather characteristic symptoms when the concentration of gas is low for they produce proliferation tissue in the cortex (bark) which is three or four times thicker than that of normal roots. When the gas is more highly concentrated the bark of the tree, as far in as the wood, shows a browning and discoloration, and at the same time the wood darkens, becomes more brittle, and rapidly breaks down. When the trees have been destroyed by gas, the plants around the trees show the ill effects by drooping or dropping the leaves and by the enlargement of the roots. Therefore, before gas leakage is

blamed the plants in the vicinity should be examined. A very sensitive test for illuminating-gas in the soil is the etiolated-sweet-pea-seedling test. To make this, the sweet-pea seeds are grown in petri dishes until they are about two inches high, then they are placed under inverted cans on the soil suspected of containing the gas. If the concentration of the gas is strong, growth ceases; if it is weak, then the plants, instead of growing upright, bend over and grow horizontally. This test is reputed to be far more sensitive than any chemical test, and demonstrates the presence of gas even when it is not detectable by its odor.

So much for the disorders of the elm. By no means have all the causes of death or deformation been noted, but it is hoped that with the information furnished a slight insight into the problem may have been given. At least the commoner maladies are presented, and it is believed that sufficient diagnostic characters have been made available so that the Dutch elm disease can be distinguished and the danger of excessive alarm be avoided. On the other hand, it is desirable to emphasize that should the presence of the disease be suspected, then portions of the infected limbs or twigs should be sent to the nearest experiment station or institute at which mycological investigations of tree diseases are being carried out.

The best insurance against disease is a healthy plant, hence it is highly advisable that the trees be kept clean by pruning and healthy by feeding or watering. As far as possible, all wounds should be covered with some protective substance, such as asphalt, creosote, or Bordeaux paint, followed by a waterproof wound dressing. Feeding of the trees may be done as suggested in the Garden BULLETIN for October, 1929, but perhaps one of the best methods is mulching with a thick layer of decayed leaves and other nutrient material. Not only does the mulch provide nourishment, but it also tends to check rapid evaporation of water and drying out of the soil; at the same time it protects the roots from excessive heat and cold. None of these aids will do much good if they are not carried out while the tree is in good health. The hackneyed expres-

sion that an ounce of prevention is worth a pound of cure is the epitome of good sense when it comes to the care of trees.

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D. H. L.

NOTES FROM THE GARDEN'S TROPICAL STATION, BALBOA, C. Z.

(Continued from March Bulletin)

PAPAYA

The papaya *(Carica Papaya)* is one of Nature's paradoxes. It grows in abundance in southern countries, sometimes a wayside plant, a door-yard favorite, or a specimen in a garden. Although so common, there is about it a strangeness and aloofness, as if it belonged, not to the present, but to a pre-historic period.

This odd plant appears to be and is generally called a tree, yet it is not a tree, but rather, as Popenoe* says, "a giant herbaceous plant." The woodless stem, ordinarily without branches (like a palm), rises straight and tapering from eight to fifteen and even thirty feet in height. It is surmounted by a cluster of curious leaves. At regular intervals the smooth, tan-colored surface of this stem is marked by triangular leaf scars, which are so touched by the hand of nature that they appear to be geometrical figures embossed on the stem in artistic patterns. The leaves of the papaya are showy and distinctive, forming a fitting crown for the ornamented stem. They are some three to five feet in length, often three feet across, cut into deep sharp-pointed lobes, and are individually carried on stiff hollow stalks.

While the flowers are probably never used for bouquets, they are rather attractive, especially the staminate, which are creamy yellow in color. They grow in axillary sprays, scenting the air with a delicate fragrance. The pistillate flowers are larger and grow in the same position on the stem but closer to it. The papayas are usually found in groups. Perhaps the fact that the staminate and pistillate flowers are borne on different plants has something to do with their sociability. Curiously enough, the West Indian laborers claim that trimming off the stem of a male plant changes its sex; also that cutting away a large root has a like effect. The latter is being tested out at present in the Tropical Station.

Of course the papaya is prized chiefly for its delicious fruit. It somewhat resembles a long cantaloupe in shape, weighing from less than half a pound to over fifteen pounds. The fruits hang, frequently in surprising numbers, close to the stem, and as a rule just below the crown of leaves. Their thin, dark green skins turn yellow when ripe. Cutting lengthways a fruit of good quality, and this is easy to do in Panama for here the papaya reaches its climax of perfection, reveals a lovely as well as tempting sight. A rich salmon-colored pulp surrounds a mass of plump, shiny, black seeds. The quantity of seeds in one fruit shows that the papaya, although

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*Manual of Tropical and Subtropical Fruits.

it does seem a stranger to this age, is in no danger of becoming extinct.

It is customary to think of papaya as a breakfast fruit, and as such it is probably unsurpassed, combining rich coloring, delicate texture, and alluringly sweet, spicy flavor. It is served like cantaloupe, sometimes with salt. This is, however, but one of its many uses. It may appear on the dinner table as a vegetable. For this purpose green fruit is selected. After peeling, the pulp is cut into small pieces and cooked in salted water until tender. The water is then drained off and the papaya mashed and seasoned with pepper and butter, and served hot. The chance visitor at this meal more than likely asks for a second helping of that unusually good summer "squash."

An anxious hostess, looking for something different and tasty for an appetizer, will find her heart's desire by cutting a ripe papaya into small cubes or balls and chilling them thoroughly. Just before serving the prepared papaya is put into cocktail glasses with a generous dressing of catsup, and a sprig of mint to give a dainty touch. It is hardly necessary to mention that the colorful papaya is popular in salads. It may be either sliced and laid on lettuce leaves with a dressing of mayonnaise and a sprinkling of chopped nuts, or combined with other fruits or vegetables. The Spanish appetite fancies the papaya in dessert forms, and frozen at that, ices, sherbets, etc. As a preserve or sweet pickle, it rivals watermelon, and is prepared in the same manner as any other sweet pickle. Very green fruit is used for pickling.

Besides furnishing such a variety of delectable dishes, the papaya may be profitably milked. In true dairy fashion the milking is done in the early morning. With a sharp splinter the surface of green fruit (on the plant) is scratched lightly. Shallow bowls, or, better still, stiff leaves, are suspended to catch the milk, which is a whitish fluid containing papain (vegetable pepsin). Remarking on the strength of this, Barrett* says: "The fresh latex, even, will digest the skin of the fingers, especially under rings, in a few minutes." The same

*Otis W. Barrett in "The Tropical Crops."

fruit may be milked several times a week until it ceases to yield. This milky fluid coagulates rapidly, and if spread out on leaves will be almost dry in one day. When dry it is termed gum. Sometimes the gum brings as high as four dollars a pound. It is used in medicines and in the manufacture of chewing gum. The entire papaya plant, even to its leaves, is permeated by this papain. Many a piece of tough cold-storage meat has been made tender by wrapping it over night in fresh papaya leaves.

A group of papayas makes an ideal garden planting. There is never a time when visitors have to be hurried by because the plants are standing nude, for they obligingly exhibit leaves, flowers, and fruits, in all stages of development. Springing up from seed with surprising quickness, they bear fruit within the first year, and continue to produce an abundant crop during their life of from three to four years. A visitor, and of course one from the far north, after looking at the papayas, remarked: "I thought melons grew on vines, but I certainly counted thirty on one of those queer totem-pole trees."

MOMBIN

One of the largest, as well as one of the oldest, fruit trees in the Tropical Station is a yellow mombin (*Spondias Mombin*). Just because certain four-footed animals called hogs are fond of their fruits and become sleek and fat feeding on them the poor trees have been burdened with the unsavory name of "hog plum." However, regardless of this stigma, these stately trees, bravely carrying their heads high, some forty to sixty feet, grow in natural abundance from Mexico down through Central America to Brazil. Not only have they unselfishly furnished quantities of food to native people year after year, but, gaining in recognition, their fruits have become prized in preserved forms and delight the most refined tastes.

No doubt the specimen in the Tropical Station began life in a jungle and by some good fortune escaped the sharp machete. It is a pretty tree, especially when dressed in new leaves. Although the leaves are large they are composed of small leaflets, giving the appearance of fine foliage. The

rather inconspicuous flowers are followed by ovoid fruits which turn bright yellow when ripe. The fruits or plums of the tree at the Station are unusually large, sometimes two inches in length (almost twice the ordinary size), and considered by many, especially small boys, to be of superior flavor. As a rule the fruit ripens during August and September, and the crop is very abundant. At this time they scent the air with an odor not unlike ripe pineapples. It must be admitted that the seed is the largest part of the plum, but the pulp, what there is of it, is very tasty. It has a tang or pungent flavor. The northern taste usually fancies this fruit best in jellies, jams, etc., because cooking seems to bring out more of the plum-like flavor.

Last season some of the nicest of these plums were gathered and jelly made from them in the following manner:

> **After being washed, the fruit was put to soak over night. Next morning the water was drained off and the fruits placed in a kettle with sufficient water to cover them, and gently cooked until very soft. They were then strained through a colander to remove the cumbersome seeds, and the thick liquid poured into a jelly bag and allowed to drain. To every four cups of clear juice an equal amount of white sugar was added, together with one-half a cup of lime juice. This was boiled rapidly until it jelled.**

The result of this experiment was a firm, bright-red jelly of excellent flavor. Something, however, apparently was amiss for after a time the jelly lost its brightness and some of its firmness. Of course these difficulties can be overcome by a little patience.

Another member of the genus and a native of Mexico and Central America is the red mombin *(Spondias purpurea)*. While lacking the stately grace of the yellow mombin, it is by far the more popular and useful, and, besides, it is widely cultivated. The trees are sturdy and short of stature, not more than twenty-five feet in height, with stiff, spreading branches clothed in foliage similar to that of their tall cousins. When in fruit, a period of several months in the spring, they are especially attractive. The branches are then gaily decked full length with clustering fruits in shades of red, often bright cherry-red.

The fruits or plums are of the same shape, but somewhat smaller, than the yellow ones, and are considered to be of superior flavor. Certainly they are less pungent and therefore pleasanter to eat when fresh. They are used in a variety of ways. Sometimes they are dried, more often they are made into jelly, jam, cool drinks, and frozen desserts. Aside from being somewhat milder in flavor there seems to be little difference in jelly and jam made from the red mombin.

A visiting housewife, in talking over different fruits and their uses, remarked: "This morning I had some sherbet in an ice-cream parlor in Panama City. It was delightfully refreshing and agreeably different. The waiter said it was made of 'hobo' plums. I've been wondering why they are called by that queer name." Why these plums, which were none other than the lovely red mombins, should be called by the wholly misleading name of "hobo" is a dark mystery. Webster defines hobo thus: "A professional tramp." Now the trees of this species of Spondias are most home-abiding and enterprising. Let only a branch be planted and it will immediately take root, establishing itself permanently in that place, and in a few years will be generously supplying fruit to the neighborhood. The Station's thrifty little specimen of *Spondias Mombin* was a leafless, rootless twig only six months ago.

When the native farmers need substantial fences, they go to the red mombin for their posts, rather than to the lumber

yard. Cutting stakes of suitable size from the strong branches, they sometimes plant them very closely together, and soon have a living fence which constantly grows stronger. At other times the farmer sets the stakes as ordinary posts and nails barbed wire to them. True to their nature, these "posts" begin to grow and are soon sturdy trees, even providing shade for the cattle they help to guard.

CACAO

What is better than a cup of rich, steaming cocoa on a frosty day, or what more restful than to spend an evening with a good book and a box of chocolate bonbons, or what more satisfying than some chocolate "bars" when traveling? These dainty and refreshing forms of cacao are the result of to-day's enlightenment, yet ages ago the Indians of Mexico so recognized the value of cacao that they called it the "food of the gods," and believed it to be a divine gift brought to their shores from the garden of Eden. Later on, specialists, with cool scientific minds, delving about in the mass of tradition and superstition of facts, in some way failed to find direct evidence of this transplanting and so gave to Mexico the honor of being the natal home of cacao.

Although cacao *(Theobroma Cacao)* is now quite common, both in a cultivated and uncultivated state, throughout Tropical America, the tourist is not apt to see it growing, for it is usually found in country districts. The Las Cascadas Plantation of 6,000 acres, lying midway of the Isthmus, is by far the best place in Panama to see cacao in its different stages of growth. Unfortunately, the tourist seldom goes there for it is not included in the regular sightseeing tours. True, there are several cacao trees here in the Station, seedlings from this plantation, but rather too young to be either very interesting or instructive.

It is quite safe to say that the cacao tree would never win a beauty contest. A casual glance shows a rather ordinary-looking tree about twenty feet high with unattractive large leaves. However, it is redeemed from being just ordinary by its beautiful fruits, or pods as they are commonly called, and by the singular manner in which these pods grow, tightly

clustered on small disks, scattered here and there on its trunk and large limbs. Sometimes one little disk or "button," no larger than a quarter, will hold a cluster of four or five pods. It is somewhat difficult to describe the cacao pods, for the different varieties vary greatly in color, size, and shape. The pods in mind are from the Las Cascadas Plantation and said by Mr. Standley to be *Theobroma leiocarpum*. They are thick and woody, pointed oval in shape, and at least six inches in length. The ribbed surface, slightly roughened, is a deep yellowish-orange color brushed over with rich tones of red, purple, or sometimes brown, giving an effect beautifully artistic. Safely cradled in each ornate pod lie thirty or more lilac-colored seeds, wrapped in soft white pulp. The seeds are large and rather suggestive of plump lima beans. In some countries the dried seeds are used for currency. It was Peter Martyr* who aptly styled them, "the blessed money, which exempts its possessors from avarice, since it cannot be long hoarded nor hidden under ground."

The cacao tree is very prolific. When about four years old it begins to bear and will continue for many years, producing on an average two crops a year, one heavy and several months later a lighter crop. The handling and preparing of this crop for market is an interesting but toilsome and exacting process. Even the picking, to be profitably done, needs experienced hands. The next step after picking is called "breaking." The pods are collected in convenient piles, and then laborers, using small machetes or even stones, crack open the shells with sharp, well-aimed blows. This exposes and loosens the mass of pulp and seeds, which they toss to one side. Commenting on this phase of the work, Mr. Barrett† says: "A good breaker will handle five hundred or so pods in an hour without cutting either fingers or seeds."

Now women take a hand in affairs and strip the seeds from the stringy fibers which hold them in position in the pod. The seeds, freed from this restraint but still cuddled in the white pulp, which, by the way, is very tasty, are loaded into baskets and taken to the "sweating room." Here the mass of pulp

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*"Cocoa and Chocolate," by R. Whymper.
†The Tropical Crops.

and seeds is placed in perforated vats. The most intelligent care and good judgment, in fact intuition, are needed in handling cacao during fermentation, for no two batches are ever alike. A period of several days is required for the pulp to ferment and drain off. The now sticky, slippery seeds of a cinnamon-red color are put on drying trays. These trays are so constructed that they may be rolled under cover at night or during showers, for moisture in any degree, even dew, is fatal to cacao at this period. During the drying process extreme care and watchful attention are necessary, for either too fast or too slow drying is injurious. When the beans are nearly dry and about ready to enter upon their career, they are sometimes given a "dance." Mr. Barrett* describes the preparations for the affair in these words: "They [the beans] are made up into a flat-topped heap, a foot deep by six feet in diameter, sprinkled with powdered, fine red clay and then with a little water." Now the dancing begins, led by several barefooted laborers who tread around and around, while assistants, with shovels, stand near to keep the excited beans in proper bounds during their hilarious farewell frolic. After some ten minutes the beans leave the dancing floor, clad in snug overcoats of clay to protect them from mould on their long journey to the northern factory, where modern methods and machinery soon convert them into the well-known staples and delicacies.

Cacao is marketed as cocoa powder, cocoa butter, the latter being used in dentistry, and in forms of bitter and sweet chocolate. In talking about the cacao, a visitor asked: "Well, after all, what is the difference between chocolate and cocoa?" Briefly speaking, chocolate is the cacao bean, parched (dehulled), ground, and reduced by beating to a more or less creamy paste. Cocoa (powder) is really a residue, for it is the flour remaining after most of the fat has been taken out of the ground bean or chocolate.

In early construction days in the Canal Zone, chocolate enjoyed a wide popularity as an afternoon drink. The fact that the Chinese merchants imported from China very lovely

*The Tropical Crops.

chocolate sets may have had something to do with its vogue. No breath of social ambition influenced Mexico's swarthy monarch when, as Mr. Barrett* relates, "Without milk and sugar, bitter and gritty, the Emperor Montezuma quaffed fifty mugfuls a day and gave two thousand more to his household because, besides the nutritious fat, starch and proteids, they got a two per cent stimulus out of the theobromine."

COFFEE

It so happens that in the Tropical Station the specimens of coffee *(Coffea liberica)* of the Madder Family and the cacao seedlings are planted near together. Their very proximity invites friendly comparison. In the first place these two beverage-producing trees are totally unlike, yet they have much in common. It is certain that the coffee has less handicaps and that it easily leads in popularity, although it cannot claim to possess the good properties which abound in cacao.

The history of coffee, shrouded in traditions and legends, reaches so far back that it is all but lost in the mystery of vanished centuries. Perhaps one of the most picturesque of these legends is the French version of the dancing goats.† The story goes: Once upon a time, long ago, in the land of Abyssinia, lived a goat-herd named Kaldi. One day, Kaldi was astonished to see his staid goats disporting themselves in the most extravagant caperings and prancings. Casting about to account for their sudden gaiety, he finally attributed it to certain fruits of which the goats had been freely eating. Feeling heavy-hearted himself, he, too, partook of the mysterious berries and straightway forgot his troubles and was soon dancing merrily about with his goats. It chanced that a monk passed by when one of these strange dances was in progress. He stood speechless with amazement. Before him a score of goats pirouetted in fantastic manner about the goat-herd, who was gleefully executing the lively steps of a pastoral dance. Recovering himself, the monk inquired the cause of such an unheard-of performance. Kaldi told him

*The Tropical Crops.

†Sketched from story in "All About Coffee," by William H. Ukers.

of the strange magical fruits he had discovered. Now this pious monk had long been sorely distressed because he was unable to keep awake during prayers. To his devout mind this discovery was no less than a revelation from Mohammed to aid him in overcoming his drowsiness. Gathering some of the magic berries, he shared them with his fellow monks and in time, so the story says, dried and boiled the berries, thus brewing the first cup of coffee. News of the "Wakeful Monastery" spread. Soon the magical berries were in demand throughout the kingdom. Then neighboring nations, hearing of the new exhilarating beverage, came seeking the wonderful fruit.

Authorities on coffee all agree on Abyssinia as its birthplace and home since "time began." Perhaps this is the thread of truth running through the fabric of the fable which has held it intact. Certain it is that little by little, down through the years, in the face of religious superstitions, medical prejudice, and political opposition, the cultivation and use of coffee have spread by devious routes and by strange and almost unbelievable circumstances until it has become universally used and firmly implanted in almost all tropical countries.

The production of coffee is now the chief industry in a large and increasing number of southern countries. Brazil, producing three-fourths of the world's coffee, may be almost said to be one huge coffee plantation. The natural coffee region in Panama lies in the highlands about the Chiriqui volcano, some two hundred and fifty miles from the Canal Zone. Here, besides other favorable conditions, the coffee finds its favorite altitude of 1,000 to 4,000 feet above sea-level. In this particular it differs radically from cacao, which thrives best in the hot lowlands. Both cacao and coffee trees are partial to shade. When clearing land for either crop, it is customary to leave trees, here and there, to act as living parasols. The guava tree, with its large, flat leaves, is their favorite sunshade.

Happily for the tourist with limited time, the specimens of coffee in the Tropical Station afford a fair idea of the interesting plant. The visitor sees two beautiful evergreen shrubs

or small trees, three years old and about eight feet high. Being the Liberia species, they are coarser in all respects than other coffee trees, but this is the only species which grows successfully at sea-level. The leaves are glossy, dark green, slender, and shapely, some six to ten inches in length, and of firm texture. Most other species have leaves but half this size. During the present year these young trees were charming with dainty snow-white flowers, scenting the air with fragrance but so far producing no cups of coffee.

Looking at these specimens, it is not difficult to picture acres upon acres, laid out in perfect formation, of these beautiful trees trimmed to a uniform size. Such a plantation or "finca" in full bloom presents a vista of rare but fleeting beauty. Against the background of rich dark foliage, the pure white blossoms lie like soft tufts of drifted snow along the length of the drooping branches. There is a striking and apparently unexplainable peculiarity about the flowering of coffee, as if a trace of its ancient mystery still hovered around.* Suddenly, several times a year, seemingly at the signal of an unseen hand, every bud on every plant in a certain district will burst into bloom. In a day or perhaps a week all the plants in an adjoining tract will take their turn at flowering. With all this blossoming it would seem that there would be an overwhelming amount of fruit, but far from all the flowers "set." Indeed, at many of these blooming periods they all drop. When they do "set" it requires from seven to eight months to mature the fruit, at which time the trees again present a pleasing appearance. This time the color scheme is in tones of red and green. If the crop is heavy, and there is at least one heavy crop a year besides several minor pickings, the long branches bend low with their thick encrustment of red cherry-like berries.

The harvesting of coffee and its preparation for market are in many ways similar, although not so exacting, to the processes attending the cacao crop. In the first place, it is customary to keep coffee trees well pruned to aid in picking. Sometimes the trees are shaken and the berries caught on

*Information from Otis W. Barrett.

mats; at other times they are picked or stripped from the branches. Men, women, and children join in this work. In Panama the standard measure for coffee is the five-gallon kerosene tin. Pickers receive from twelve to fifteen cents per tin and average from three to four tins a day. After the freshly gathered berries are brought to the "beneficia" they are handled in Panama as elsewhere, chiefly by machinery. First of all, the fruits must part with their red jackets and their pulp. This is usually done by pulping machines which tear the fruit apart, letting the pulp and skins fall to one side and the seeds to the other. As there is more or less pulp still clinging to them, the seeds are placed in fermenting vats with a little water and allowed to remain for some thirty-six hours, during which time they are frequently stirred. Much less diligence is needed in tending coffee at this time than for cacao.

The coffee seeds are now given a bath. Emerging from the tubbing with their rough parchment coats washed clean, they are hurried off to the drying trays. Under clear skies and with bright sunshine the seeds will dry in three or four days. Again the coffee is more tractable and easier to manage than the cacao seeds. The secret of the coffee's model deportment of course lies in the fact that its precious beans are safely encased in the heavy parchment shells, and so much less liable to mould than the timely cooled cacao seeds. Just at the critical time in the drying of both of these crops a peculiar incident occurs, as if the seeds themselves would reassure their anxious attendants. The cacao conveys its message of encouragement in "whispers," whereas the coffee "purrs" in contentment. Either of these sounds coming from the drying seeds is most welcome to the laborers for it tells them that all is well.

When the coffee is thoroughly dry the parchment shells are broken open by de-hulling machines and the debris fanned away. Then it is that the lovely sea-blue seeds are revealed, glistening in their silver coats. However, even these shining mantles must be laid aside or, in harsher words, polished off. Then crowded into bags of 100 pounds capacity the coffee beans are ready to "take the boat." Arriving at their des-

tination, they must still submit to blending, roasting, and grinding before the world can have its breakfast coffee.

The housewife, strolling about in the Tropical Station and examining different economic plants and trees, may not accumulate much scientific information, but she cannot help feeling a little more intimately acquainted with some of them. She has at least glanced into their home life, sensed their social status, and become somewhat aware of their intensely interesting natures. She has probably wondered at their peculiar characteristics and laughed at their whims. She may even have witnessed some plant bravely struggling with evil-minded little pests. Then when the housewife is back home, busy in her kitchen, perhaps measuring out the coffee or opening a can of tropical fruit, it would not be surprising if she recalls the little sunny garden at the Tropical Station and her visit with the parent plants of the very products she is handling. She may think, too, of the long and tedious processes through which many fruits must pass before they reach her pantry shelves. M. D. H.

NOTES

Recent visitors to the Garden were Mr. Andrew C. Life, professor of plant physiology, University of Southern California, and Mr. H. L. R. Chapman, Superintendent Beal Botanic Garden, East Lansing, Michigan.

Mr. Anton Hogstad, Jr., Pharmacognosist to the Garden, gave an illustrated lecture before the students and faculty of the department of botany, University of Pennsylvania, April 3, on "The Activities of the Missouri Botanical Garden."

The first number of Volume XVIII of the Annals of the Missouri Botanical Garden has been issued, and contains papers by Dr. David H. Linder, Mr. Harry J. Fuller, Mr. Julian A. Steyermark, Dr. Ernest S. Reynolds, and Dr. Edgar Anderson and Miss Dorothea de Winton.

Mr. John Adam Moore and Mr. Julian A. Steyermark, Rufus J. Lackland Research Fellows in the Henry Shaw School of Botany, will make an expedition this summer into the Davis Mountains in Texas, the Guadaloupe Mountains in New Mexico, and other little-visited regions adjacent,

where they plan to collect sets of plants for distribution.

Dr. George T. Moore, Director of the Garden, has given the following talks recently: April 20, before the Ladies' Aid Society, United Hebrew Temple, "The Missouri Botanical Garden"; April 23, before a meeting of the Engineers' Club of St. Louis, "The Plant Commonwealth"; April 24, before Town and Gown, "Plants as Engineers and Architects"; April 28, before the St. Louis Florists' Club, "Some Things We Don't Often See in Plants."

Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk before the South Kirkwood Garden Club, April 10, on "The Use of Native Plants in the Garden." On April 12 he spoke before a meeting of the citizens of Sullivan, Mo., on "The Organization of a Garden Club." A new garden club was organized at this meeting under the name of "The Main Street of America Garden Club of Sullivan."

Mr. George H. Pring, Superintendent of the Garden, spoke before the Woman's Chamber of Commerce at a luncheon at the Town Club, April 2, on "Activities of the Missouri Botanical Garden"; was principal speaker at the Arbor Day celebration of the North St. Louis Business Men's Association, at Chain of Rocks Park, April 10; spoke before the Fathers' Club of the University City High School, April 13, on "Collecting Orchids"; and gave an illustrated talk before the Wydown Men's Club of the First Congregational Church, in University City, April 14, on "Plant Exploration."

STATISTICAL INFORMATION FOR MARCH, 1931

GARDEN ATTENDANCE:

Total number of visitors	42,557

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	71
Total number of books and pamphlets donated	147

PLANT ACCESSIONS:

Total number of seed packets donated	402
Total number of plants donated	125

HERBARIUM ACCESSIONS:

By Purchase—

Blankinship, Dr. J. W.—Plants of Lake County, California	683
Goodman, George J., and C. L. Hitchcock—Plants of western United States	127
Moldenke, Harold N.—Plants of southeastern United States	1,509
Schultz-Korth, Karl, by Dr. J. M. Greenman—Photographs of types and authentic specimens in Berlin Herbarium	72
Smithsonian Institution, by Dr. Wm. R. Maxon—Plants of Haiti	594
Steyermark, Julian A.—Plants of New England, Illinois, and Missouri	488

By Gift—

Botanical Garden, Madrid, Spain, by Dr. E. Balguerias—Photograph of *Swertia cucullata* Sesse and Mociño	1
Fuller, Prof. George D.—*Froelichia floridana* (Nutt.) Moq. from Illinois	1
Grant, Dr. Adele Lewis—Photograph of *Welwitschia*	1
Peebles, R. H., by C. L. Hitchcock—Plants of Arizona	13
Sharp, W. M.—*Senecio Petasitis* DC.—Cultivated specimen from West Virginia	1
von Schrenk, Dr. Hermann—Plants of Texas	14

By Exchange—

Ciferri, R.—Fungi from the Dominican Republic	9
Dudley Herbarium, Stanford University—Plants of California	192
University of California—Plants of China and Jamaica	572

By Field Work—

Kellogg, John H.—Plants of Missouri	198
Total	4,475

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden—farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies. Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Assistant to the Director

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DAVID H. LINDER,
Mycologist

JESSE M. GREENMAN,
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REPRESENTATIVE IN EUROPE

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Missouri Botanical Garden Bulletin

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BRANCH OF HOLLY, SHOWING NEW LEAVES.

AMERICAN HOLLY, AFTER HAVING SHED ALMOST ALL ITS LEAVES.

Missouri Botanical Garden Bulletin

Vol. XIX MAY, 1931 No. 5

ADAPTABILITY OF AMERICAN HOLLY

Pictures of the Garden and records show that twenty-five years ago conifers and the broad-leaf evergreens were well represented in the Garden collection, but lately it has become increasingly difficult to grow them. To-day only seven pines remain in the Garden, and of that large group known as broad-leaf evergreens (Rhododendron, etc.) only the American holly remains. The leaves of all evergreens are shed at some regular interval. In the Pine family they may persist for three, four, or five years. Each spring the oldest leaves are shed, because they are near the trunk of the trees and away from the light and therefore can no longer function efficiently. The majority of the leaves persist, however, and it is this habit which permits the smoky unnatural conditions to do so much harm to evergreens. Deciduous trees remain dormant and leafless during the winter when the atmosphere is smoky, and develop a new set of leaves each spring.

The specimens of holly (*Ilex opaca* Ait.) around St. Louis, in order to live, have shown a remarkable ability to adapt themselves—they have become deciduous. This tendency has been noticed for several years, but not until this spring has it been so general and evenly timed. Within a period of ten days (April 15 to April 25) all leaves were shed and new bronze-green leaves appeared. Small trees of *Ilex opaca* have been planted in the Garden from time to time, but with the same results. They make good growth the first summer, some-

times live through the winter, but seldom survive the following summer. Lately all attempts to grow evergreens have been confined to Gray Summit, and there a splendid collection of conifers and broad-leaf evergreens are now growing.

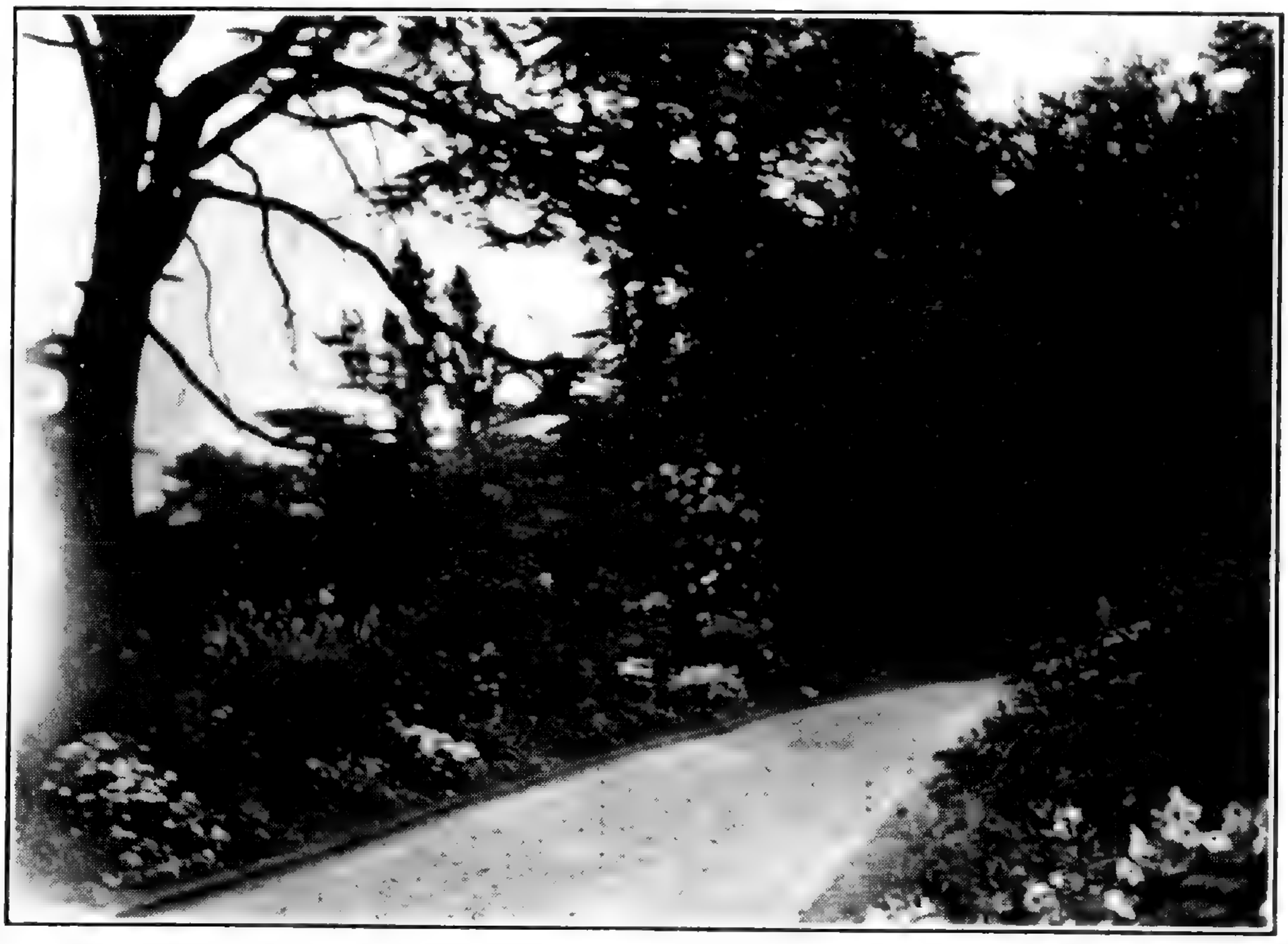
A. P. B.

TERMITES AND ANTS

In the "Philippine Agriculturist" for February, 1931, is an article by Dr. Leopoldo B. Uichanco, of the University of the Philippines, in which he suggests a new and simple treatment for exterminating ants and termites. Since ants in lawns and homes around St. Louis are particularly bad this year (probably on account of the mild winter), the following directions have been condensed from Dr. Uichanco's article, for the convenience of BULLETIN readers.

In the case of termite nests, a shallow trench was dug where the termite tunnels were connected. This was filled with water until the soil was so thoroughly drenched that absorption became very slow. Enough waste engine oil or kerosene (used crankcase oil is excellent and can usually be obtained free from a garage or gas station) was then poured into the trench to make a very thick film on the surface of the water. As the water soaked downwards, the oil was drawn by surface tension under the ground and through the communication galleries of the termites into the nest. Previous trials with oil alone had failed because the oil did not penetrate into the soil sufficiently to reach the main termite colonies. Besides the fact that more oil had to be used, the treatment resulted merely in shifting the direction of march of the ravagers.

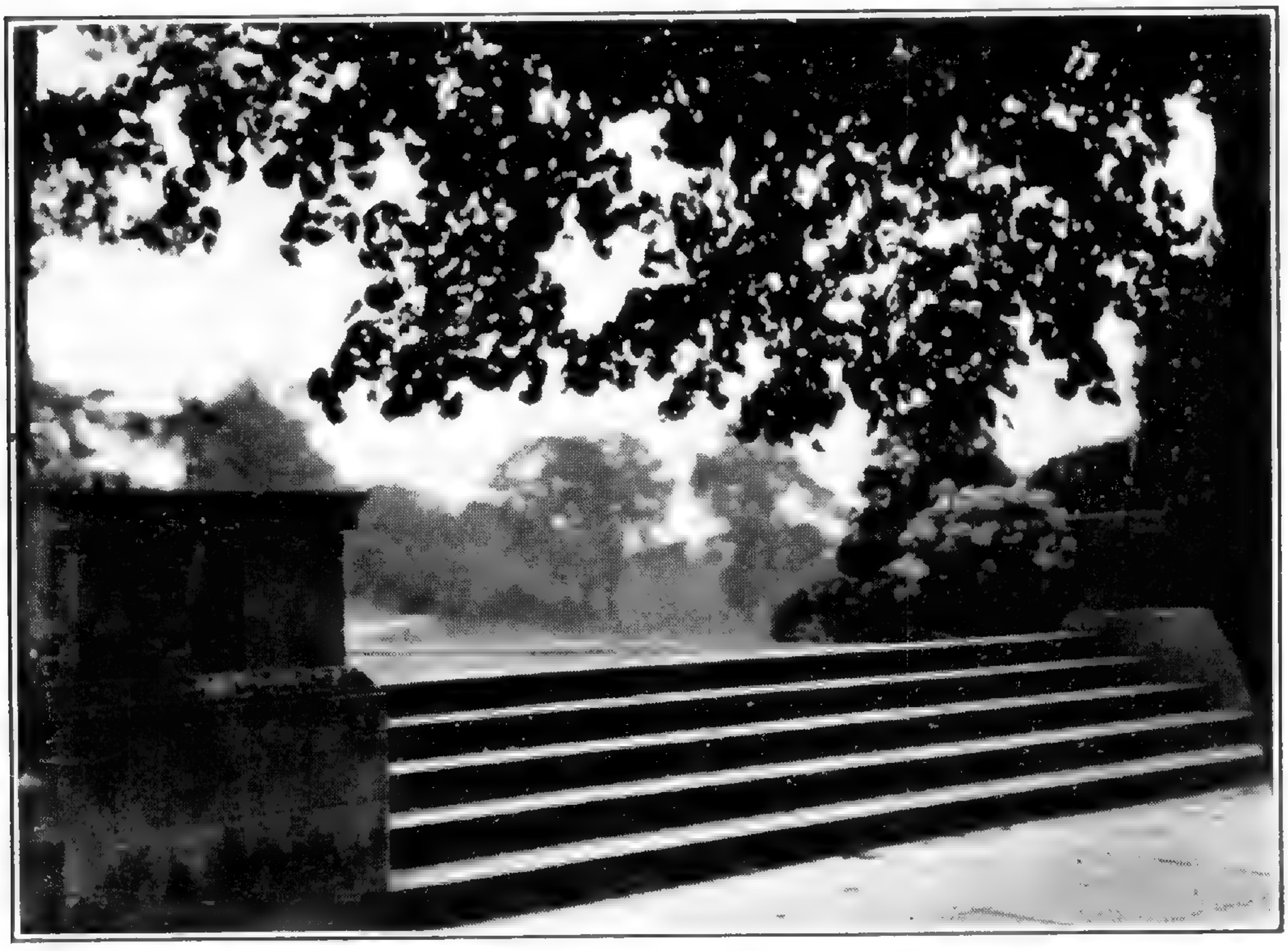
One treatment was in every case found sufficient to destroy an entire colony. The day following the operation termites were sometimes seen building tunnels, but these were the work of the workers that had been caught in the upper parts of the building during the treatment and shut off from their nests by the oil. In some cases the building of these tunnels continued for two or three days, but after this period the last remaining representatives of the colony disappeared.



PATH THROUGH GROUNDS OF MILL HILL SCHOOL, SHOWING OLD CEDAR PLANTED BY PETER COLLINSON.

MAIN BUILDING OF MILL HILL SCHOOL. PETER COLLINSON TREES AT RIGHT.

SYCAMORE TREE PLANTED BY PETER COLLINSON



TERRACE AT MILL HILL SCHOOL.

There has not been a single case of recurrence of infestation from the same source following any of the treatments.

Its simplicity, the ease of obtaining the materials, and its efficacy against subterranean termites are among the desirable features of the method. The practice has been found to work with equal success on ground-inhabiting species of ants which are a frequent nuisance around houses and yards. When treating ants' nests, however, it was found unnecessary to dig a trench. The ground in which the openings of the nests were located was merely soaked thoroughly with water before oil was added. More water was then poured so as to give the oil better distribution. Several quarts of water and a cupful of oil are all that are needed for treating an average ants' nest. Because of the injurious nature of mineral oils, the method should not, of course, be used if the nests are located at the bases of tree trunks or other valuable plants.

In Webster Groves there is very commonly found a species of ant which is light yellowish or white (though it is a true ant and not a termite), which, while not dangerous to dwellings, is very unpleasant. It works mainly in the spring and builds its galleries beneath cracks in the cellar floors, bringing the excavated soil up through the cracks. In April the sexual winged forms emerge and swarm about the cellar in large numbers. On account of their light color, they are mistaken for the dreaded "white ants" and cause great alarm. Ordinary methods of extermination are not usually successful, since the nest is underneath the cement floor and can be reached only through a narrow crack. Dr. Uichanco's method was tried in two houses this spring and was found completely successful. The crack through which the ants were emerging was soaked at intervals for two days, then the oil was applied in a thin stream, nearly a quart being used in the case of a heavy infestation. A few stragglers were seen in the next day or two, but since that time they have completely disappeared.

E. A.

HENRY SHAW'S ALMA MATER AND PETER COLLINSON

AUTHOR'S NOTE: HOW THE ARTICLE CAME TO BE WRITTEN.—Most of my year in England was spent bent over a microscope in a little laboratory just outside of London. One Saturday afternoon in early spring the librarian came dashing in and said, "*Will* you show a whole lot of people around? Everybody else seems to be away, and this whole crowd has turned up. I'll have time to show them the grounds, but will you show them the laboratory, and demonstrate some of your slides under the microscope"? So I gladly turned to, quite as if I really belonged to the place, and showed a class from one of the London evening schools how the slides were made and what they looked like after they were made, and tried to explain why we were studying them.

After the demonstration we went into the library for tea. In English laboratories visitors always arrive some time during the afternoon, and always stay for tea, which usually means fancy cakes, buns, and piles of bread and butter. During tea time I got into conversation with the leader of the group and found that he was a Science Master at Mill Hill School. Had it not been for one circumstance that name would have meant nothing to me, but it so happens that the very fine photographs of that school which won a prize at the World's Fair in St. Louis were turned over to the Garden. They were hung beside the main staircase, and the labels stated that they were photographs of the school where Mr. Shaw had studied as a boy. I had gone up and down past them for seven years, and so I knew at once just where Mill Hill School was and just what connection existed between the School and the Garden.

On two occasions I went out to the School and talked before groups of boys. I met several of the Masters, including Major Norman C. Brett-James, the historian, who has written very delightfully about the school and about the old Quaker botanist, Peter Collinson. Most of the following account is taken (some of it verbatim) from his "Story of Mill Hill Village."

Mill Hill School, Mr. Shaw's old Alma Mater, is pleasantly set among old trees just at the northern edge of modern London in the county of Middlesex. It occupies the very crown of a steep little hill, and its broad lawns and ample playing fields slope away attractively and give wide views to the west and north. The School occupies a magnificent site over 400 feet above sea-level and immediately opposite to Harrow-on-the-Hill. From it can be seen Epping Forest on one side and the Chilterns on the other, and Windsor Castle is frequently visible. There is a legend that a former Headmaster promised a half holiday whenever Windsor could be seen from

the play-ground, a safe offer, as trees obscure it entirely from that spot. Surrounding the School are well over one hundred acres, and the unique position of the houses with the ground sloping away so abruptly should preserve the amenities of the school and the village for many years to come.

Mill Hill School was founded in 1807 as a Protestant Dissenter School, most of the great English schools being connected with, or under the influence of, the Church of England. It has had its ups and downs but is now a well-established and outstanding institution, with between four and five hundred scholars and splendidly equipped buildings. It has been unusually fortunate in some of its masters, having numbered among them the distinguished Dr. Sir James Murray, the editor of the famous Oxford English Dictionary. His Scriptorium, in which much of his earlier work was done, was given to the School when he left, and was used as a reading-room by the boys. It burned down in 1902, and the "Old Boys" replaced it by a modern building for the same purpose, to commemorate Dr. Murray's work.

To American botanists the School is interesting, not only for its connection with Mr. Shaw, but because it is built on the site of Peter Collinson's home and a number of his old trees are still standing. Peter Collinson, it will be remembered, was the friend and correspondent of Linnaeus and Benjamin Franklin, and was one of the most eminent botanists of the eighteenth century. It is one of the curious features of history that one age often forgets the doings of its predecessors, and Collinson has suffered severely in this respect. His son and Dr. Fothergill wrote short appreciations of him, and A. B. Lambert, the famous botanist, started to write his life, but it has been left to Maj. Brett-James to do justice to a man who was famous in his own day and was universally liked by persons of all creeds and classes. He appears in his letters as a charming old man with the courtly manners associated with Quakers, an enthusiastic lover of Nature and of science in all its branches, a keen politician with little discrimination and some stupid prejudices, and a man who numbered among his friends most of the eminent Whigs and not a few Tories, several prominent Roman Catholics and

many Dissenters, and most of the foremost figures in scientific research in the century in which he lived.

He was born on January 28, 1693 or 1694, in a house opposite Church Alley, St. Clement's Lane, Lombard Street, and was the son of Elizabeth Hall, of Southwark, and of Peter Collinson, afterwards of the Red Lion, Gracechurch Street. His father's family came from the Lake District, but had been settled in London for two generations. His father, whose quarrel with a fellow Quaker was made the subject of a most trenchant pamphlet, was a merchant who built up a considerable business in men's mercery, and Peter and his brother, James, increased it by taking advantage of the growing trade with America.

Collinson dated his love of botany from the age of two, when he was sent to be brought up by his grandmother at Peckham. She had a garden which was quite famous for its hedges and shrubs cut into fantastic shapes. Collinson eventually succeeded to the property, which was perhaps situated in Meeting House Lane, and for twenty-five years he kept up the gardens there. In 1724 he married Mary, daughter and heiress of Michael Russell, of Ridgeway House, and Dollis Farm, Mill Hill, and the Chauntry, Sproughton, near Ipswich. In 1749 Collinson came to live at Mill Hill, and four years later his wife died.

Collinson's life was not remarkable for incident, and though he was in touch with many movements of importance he never made any effort to bring himself before the public eye. Much of the time he could spare from business he devoted to botany, and he was always ready to advise his friends in the laying out of their gardens. He was a Fellow of the Royal Society, and a Foundation Member of the reconstituted Society of Antiquaries; and the Royal Societies of Sweden and Berlin honored him with membership. He was taken ill while on a visit to Lord Petre at Thorndon Park, in Essex, in August, 1768, and he returned to Mill Hill to die. All that could be done to help him was done by the four doctors who attended him, but it was of no avail. He was buried in the Friends' Burial Ground in Long Lane, Bermondsey, now used as a children's playground. Collinson was anxious to

perpetuate his own name, but both the little Peters died and his only surviving children were Michael, who succeeded him at Mill Hill and the Chauntry, and Mary, who married John Cator, of Beckenham Place, M. P. for Callington. His grandson, Charles, had a very large family, but three of his sons died on active service, and there are no male descendants of the name living to-day. There are a number of Cators descended from Mary Cator's nephew, among them being Miss Betty Cator, one of Princess Mary's bridesmaids.

Quakers were greatly attracted to botany in the seventeenth and eighteenth centuries, and gardening received a big fillip from the effort of Evelyn and others, who had picked up their knowledge from France and Holland. Collinson collected material for the lives of the early gardeners and endeavored to do justice to their pioneer efforts. He himself was a pioneer, especially in exotics from America, and he was responsible for bringing into England over 170 new plants. A catalogue of his plants was found among his papers, and was published nearly a century after his death. He was an intimate friend of Sir Hans Sloane, the great naturalist, and contributed many rarities to his collections. When Sloane died Collinson helped to secure his treasures for the nation, and was thus almost one of the founders of the British Museum.

His business connections with America made an exchange of seeds possible, and he secured a collector in John Bartram, of Philadelphia, who for over thirty years sent him seeds in exchange for those of English shrubs or for a money payment. These were distributed by Collinson to many landowners all over the country, and thus he is responsible for much of the beauty in English parks to-day. A manuscript list of these enthusiasts is in the British Museum, and it includes the Dukes of Norfolk, Richmond, Bedford, Northumberland, Manchester, Portland, Argyle and Marlborough, the Earls of Essex, Ilchester, Macclesfield, Rochford, Alderman Beckford, the Hanburys, Penns and Barclays, well known in Quaker circles, and Collinson's especial friends, Lord Petre and Dr. Fothergill. With almost all these folk he was on terms of intimacy. The Duke of Richmond was his "affec-

tionate friend.'' Earl Rochford wrote, ''Honest Peter and I eat ham and eggs together,'' and the letters that passed between him and Lord Petre are of extraordinary interest, since Petre was a devout Catholic and had relations (Earls of Derwentwater) who took part in the Jacobite Rebellions.

The garden at Peckham has entirely vanished, but the Mill Hill garden which surrounds the School House is still treasured. Of Collinson's trees there are three cedars (two of them from Goodwood), an evergreen oak, golden holly, an oriental plane, a splendid deciduous cypress, some fine chestnuts, remains of the old Portugal laurel, and many others. From the Mill Hill garden Mr. Shaw got his first knowledge of the bald cypresses which he later planted so plentifully in Tower Grove Park and around his garden. The largest cypress is now a splendid specimen, about the size of those at the Missouri Botanical Garden, and this American tree throws a pleasant shade across the lawn where English boys play cricket. Loudon, the great botanist, wrote an account of the gardens in 1835, when the Linnaean Society had a garden party to celebrate the visit of their name-giver. It is only tradition that Linnaeus had planted the twin cedars one hundred years before, although we know from Collinson's letters that Linnaeus did visit Mill Hill. Collinson was on friendly terms with this great Swedish botanist who gave him immortality by attaching his name to a genus (Collinsia) of perennial Labiates with yellow leaves. They corresponded for years, and Collinson endeavored, apparently without much success, to convince Linnaeus that swallows did not spend the winter under water. He knew of their migrations from his friend, Sir Charles Wager, who observed the swallows on his ships when sailing in the Mediterranean. Wager was an Admiral who saw service at Cartagena against Spain, and eventually became First Lord. He was encouraged to collect by Collinson, and he became a most successful amateur gardener.

Benjamin Franklin was in England for a number of years as representative of the people of Pennsylvania, and became a very good friend of Collinson's, by whom he was introduced to the Royal Society. Franklin's experiments in electricity

were made possible by Collinson, and it was he who published Franklin's book of researches both in England and France. The Public Libraries of Philadelphia and Darby, and the local Philadelphia Boys' School owed a great deal to Collinson, who was their honorary agent for thirty years. Franklin came on several occasions to Mill Hill, and in 1917 the 150th anniversary of his visits was suitably celebrated at the School. When Collinson died Franklin wrote to his son as follows:—

> "Dear Sir,
>
> "Understanding that an account of our dear departed friend Mr. Peter Collinson is intended to be given to the Public, I cannot omit expressing my approbation of the design, as the characters of good men are exemplary and often stimulate the well-disposed to an imitation beneficial to mankind, and honourable to their successors. He encouraged the design of a subscription library in Philadelphia by making valuable presents to it and procuring others from his friends. And for 30 years he undertook the choice collecting and shipping of all our books without ever charging for his trouble . . . In 1745 he sent me an account of the new German experiments in electricity together with necessary instruments to repeat them. . . This was the first notice I had of that curious subject which I often afterwards prosecuted with some diligence, being encouraged by the friendly reception he gave to my letters. Please to accept this small testimony of mine to his memory, for which I shall ever have the utmost regard."

Collinson was responsible for much of the planting of trees at Goodwood, and spent many happy days there with two successive Dukes of Richmond. Henry Fox, Lord Holland, who ran away with Richmond's daughter and was the father of Charles James Fox, was another of Collinson's intimate friends, and Holland House was a favorite place for the old Quaker to visit. Many gardens in the neighborhood of Mill Hill were enriched by gifts of Collinson, whose unselfish and often unrewarded efforts to improve the countryside deserved a better fate than that which has so far followed them.

Collinson is honored at Mill Hill, and the garden, his "little paradise," is well cared for. Two of the boarding-houses have names associated with his memory—Collinson and Ridgeway. His old house, in which Mr. Shaw lived as a

boy, was unfortunately pulled down in 1825, when it was showing signs of collapse. An indication of Collinson's wide range of interests is given in his correspondence. The following extracts are typical of the hundred or more letters to Bartram which are still extant.

"I caught a perch in my pond and left half of it on the hook. The great mud turtle, whom I have not seen for two years, ate it, and now I know the poacher who has cleared the pond of fish. . . The King has appointed thee his botanist with £50 each year. Please send me some plants; my inclination and fondness to natural productions is agreeable to the proverb, 'Like the parson's barn, refuses nothing.' . . . If thou callest on the Virginians thou must be dressed in drugget clothes, and be clean, neat and handsomely attired. I hear thee talk much of Pitt and his retirement. He was glad of his pension and slipped his neck out of his collar when it best became him to serve his country. The loss of my plants affects me more than the loss of Pitt. We have a good man at the helm, Lord Bute, and a brave King, and have gained Louisiana without Pitt. . . I am here retired from the bustle, and hurry of town, meditating on the comforts I enjoy. The old Christmas log is burning and the fire of friendship is ablaze."

E. A.

NOTES

The St. Louis Florists' Club held a meeting at the Missouri Botanical Garden, May 14. After the business program they made a tour through the grounds.

Dr. Hermann von Schrenk, Pathologist to the Garden, gave an address before the Missouri Historical Society, April 14, on "Termites"; and spoke before the Engineers' Club of St. Louis, April 30, on "Uses of Creosoted and Other Treated Timbers."

The annual flower sermon, for which Mr. Shaw provided in his will, was preached at Christ Church Cathedral, May 10, by the Rev. Beverley D. Tucker, Jr., D. D., of Richmond, Virginia.

Mr. Kazuo Gotoh, of the University of Taihoku, Formosa, Japan, formerly a graduate student at the Garden, has been spending several weeks in the Henry Shaw School of Botany, investigating the cytology of the genus Trillium.

Dr. Winifred Brenchley, of Rothamsted Experiment Station, Harpenden, England, visited the Garden, May 20, and spoke before the graduate seminar of the Shaw School of Botany, on "Types of Work at Rothamsted Experiment Station."

Recent visitors to the Garden include Prof. Alex. Laurie, professor of horticulture, Ohio State University; Mr. Paul A. Siple, junior member of the recent Byrd Antarctic Expedition; and Dr. Fanny Fern Smith (Mrs. Everett Davis), of Charlottesville, Virginia.

The students and instructors in the department of botany of the University of Missouri, under the leadership of Dr. H. W. Rickett, assistant professor of botany, visited the Garden, May 9. After a tour through the grounds they were shown the herbarium and library.

Mr. G. H. Pring, Superintendent of the Garden, spoke before the Auxiliary of the St. Louis Medical Society, April 24, on "Plant Curiosities"; before the Carondelet center of the Young Women's Christian Association, April 28, on "How Orchids Grow"; and before the Garden Club of Washington, Mo., May 12, on "Orchid Exploration."

STATISTICAL INFORMATION FOR APRIL, 1931

GARDEN ATTENDANCE:

Total number of visitors..... 33,872

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	50
Total number of books and pamphlets donated	291

PLANT ACCESSIONS:

Total number of seed packets donated.....	498
Total number of plants donated.....	208

PLANT DISTRIBUTION:

Total number of plants distributed gratis.....	35

HERBARIUM ACCESSIONS:

By Purchase—

Bush, B. F.—Plants of Missouri.....	214
Société Anonyme des Arts Graphiques, by courtesy of Dr. J. Briquet—Photographs of specimens in the De Candolle Herbarium	4
Valeur, E. J.—Plants of the Dominican Republic.....	153

By Gift—

Anderson, Dr. E.—Plant of horticulture.....	1
Berlin Botanical Garden and Museum—Fungi from Brazil, Celebes, and Samoa.....	3
Bettis, Mrs. James R.—Plant of Missouri.....	1
Grant, Dr. A. L.—Plants of South Africa.....	15
Hitchcock, C. L.—*Lycium Cooperi* Gray from California..	1
Kerbosch, M.—Economic plants of the Dutch East Indies	175
Matthew, E. O.—Plants of Arizona and Mexico.....	4
Steyermark, Julian—Plant from Maine.....	1
von Schrenk, Dr. Hermann—Pines of Mexico.....	3
Woodson, Dr. R. E., Jr.,—*Marchella hybrida* from Missouri	1

By Exchange—

Herbarium of the Botanical Museum, Munich by Dr. Karl Suessenguth—Photograph of *Lycium Marti* Sendt.....	1
Brooklyn Botanic Garden by Dr. H. K. Svenson—*Lycium* sp. from Galapagos Islands.....	1
Bureau of Science, Manila—Plants of the Philippine Islands	100
Farlow Herbarium, Harvard University—Mosses and lichens	58
Overholts, L. O.—Parasitic fungi of Missouri, Pennsylvania, etc.	55
Riksmuseets, Botaniska Avdelning, Stockholm—Plants of Europe and the West Indies.....	1,317
Royal Botanic Gardens, Kew, England—Photographs of herbarium specimens	16
U. S. National Herbarium, Washington, D. C.—Plants of South America	31

U. S. National Herbarium, Washington, D. C.—Plants of Western United States	60
University of California—'California Fungi' Nos. 1-300 and miscellaneous fungi 112	412
By Field Work—	
Kellogg, John H.—Plants of Missouri	164
Total	**2,791**

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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THE AMERICAN BOTTOM AND THE CHARACTERISTIC PLANTS OF THE REGION

The term "American Bottom" is commonly applied to the region commencing at the bluffs at Alton and extending south to Prairie du Pont Creek in St. Clair County. It is bounded on the east by a chain of bluffs in the State of Illinois and on the west it reaches but a few miles across the Mississippi River into Missouri. The term is more broadly applied to that part of the Mississippi flood plain in Illinois extending southward from the bluffs at Alton to the confluence of the Kaskaskia River with the Mississippi. The territory is about one hundred miles long, and covers approximately 500 square miles, or 320,000 acres.

During the Revolutionary War, about 1781, a small band of enterprising emigrants from the eastern colonies moved into Illinois, a part of them settling near Bellefontaine in Monroe County and another part in the Mississippi Bottom. It was the settlers in the Mississippi lowland who gave the section the name "American Bottom." In 1887 it was considered the largest and most fertile body of alluvial soil in the United States. Some of it had been cultivated for more than 150 years without improvement of the soil and yet production was luxuriant. Almost all the early French settlements were made in the American Bottom.

Due to its relation to the Mississippi River the American Bottom has been frequently inundated. The first time on

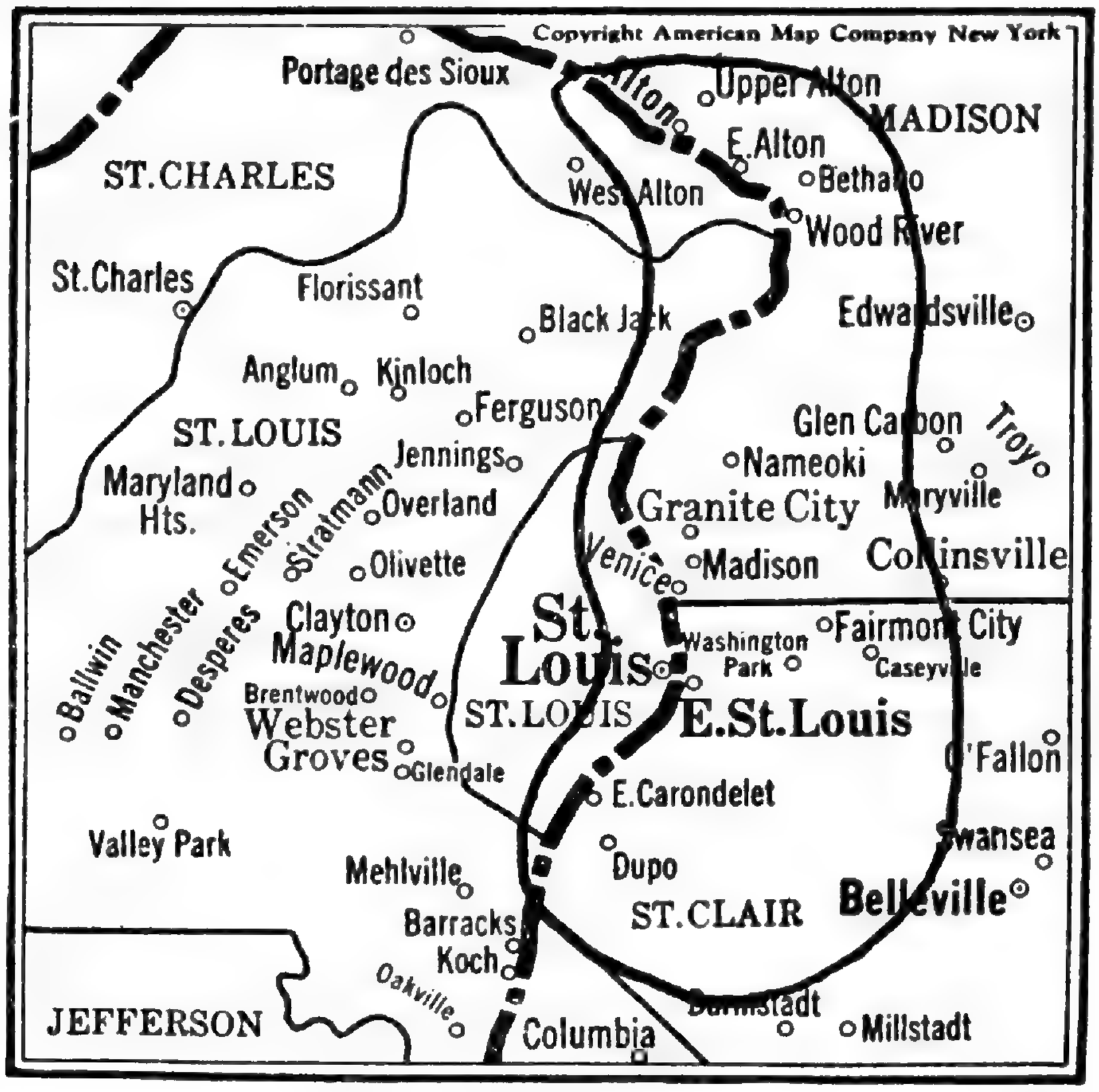
record was in 1770, when the river overflowed the banks opposite Fort Chartres. At that time the river was three-fourths of a mile from the Fort, but it continued to advance until 1772, when one of the walls of the Fort was washed down by the river's overflow. An extraordinary inundation was in 1784, when there was a deep overflowing of the American Bottom. The inhabitants were forced to make temporary encampments on the high land, and some of them cultivated the land on the hills. Many of the people of Cahokia left that town and founded a settlement on the rocky bluffs southeast, which they called Bon Succour. The next very high water was in 1844, a flood which almost destroyed the villages of Cahokia, Prairie du Pont, Prairie du Rocher, and Kaskaskia. In 1851 there was another flood, and still others in more recent years.

For a more complete picture of the nature of the American Bottom one must consider the geology of the region. The Pleistocene, the Carboniferous, and the Silurian are represented in the Missouri section, though not all of these periods are exposed. The Neocene, Eocene, Cretaceous, and Jura-Trias are entirely lacking here and in the neighboring territories both in Missouri and in Illinois. In the Illinois section, the Quaternary, Carboniferous, and Silurian systems may be recognized. The coal measures are found in the Illinois portion, as well as in the Missouri section above the mouth of the River des Peres. The latter district is a portion of the Illinois coal field.

The alluvium in this region is partly derived from the Missouri River, which flows into the Mississippi about ten miles north of St. Louis. It is composed mainly of sand, with coarser material toward the bottom. Clay or a mixture of clay and sand overlays the sand. These deposits, which are numerous but variable both in size and locality, are also the beginnings of sandbar formations. On the west bank of the Mississippi occur wider or narrower bottoms, flooded at times of high water only. Their subsoil, to a depth of several feet, is a heavy loam laid down by the river. Tall annuals cover these banks during the summer and winter, and the thick mat of decaying vegetation forms a rich black soil. As a re-

sult of the nature of the shore south of St. Louis, terrace formations are absent.

Loess, the loamy clay, overlays the St. Louis limestone by sometimes as much as fifty feet. Worthen considers it possible that the loess "was accumulated when the present valley of



THE AMERICAN BOTTOM

the river was occupied by a chain of lakes, the waters of which filled it nearly to the height of the adjacent highlands and that it was originally spread over the whole surface of the valley. A considerable portion of it was no doubt removed during the drainage of the valley by the gradual elevation of the surface and other portions have been subsequently removed by the action of river currents." Bouldery

drift underlies the loess and covers the surface along the western bank of the Mississippi bounding the American Bottom on the west.

The ferruginous sandstone of the Chester group is represented in this territory by a thin layer of sandy shale, never more than a few feet in thickness. It directly overlays the St. Louis limestone. Some of the limestone strata are a nearly pure carbonate of lime; others are limestone mixed with sand. They reach their greatest development on the western shore of the Mississippi between the mouth of the Meramec and the mouth of the River des Peres and contain many characteristic fossils. The beds of limestone were first described by Dr. George Engelmann of St. Louis.

Referring to the western boundary of the coal measures, Bowman points out that "at Granite City the sediments rest on the massive bed of the Mississippian limestone, while at Monk's Mound and near Peters they rest respectively on a shale and a sandstone which are undoubtedly coal-measure strata." He regards the line of contact between the Mississippian and the Pennsylvanian formations in the American Bottom as probably somewhere between the eastern ridge of East St. Louis and Monk's Mound. It is probable that the Pennsylvanian formation extended across the flood plain of the Mississippi, since "Coal measures rocks are found not only in the bluffs from Centerville around to North Alton and in sections of deep wells near Monk's Mound and Peters, but beyond the Mississippi in the city of St. Louis and the districts west and northwest." Bowman considers this to have been the condition in the preglacial times, since most geologists are agreed that the river trimmed the present bluff line previous to the glacial epoch.

Hus says: "The Bottoms on the Missouri side, nowhere very wide, have resulted partly from the deposition by the Mississippi of a heavy loam mixed with sand, and partly from the deposition of colluvial soil brought down from the uplands. This soil is rich in lime and in the course of time has been covered by a black humus.

"The sandy islands of the Mississippi have the same origin as the sandy stretches immediately bordering the Mississippi

on the St. Clair County side and which frequently occur farther inland, the remains of a former river bank, of which is found so striking an example at Cahokia, and which, because of the xerophytic character of their ground cover, are readily recognized.

"The American Bottom represents an older as well as a more recent river deposit. This is in places covered by the rich mud of the Missouri combined with a large amount of vegetable matter brought down by the Mississippi. Close to the river its level is but slightly elevated above that of the latter; farther inland its surface rises several feet. Where the land is low and mainly consists of clay it constitutes what is known as the 'wet bottom'; other, higher places, where the soil is sandy and which largely lack the recent river deposit, are designated as 'dry bottom.' The latter is met with on the west side of Horseshoe Lake and in the vicinity of Cahokia. Here and there woods occupy the land and formerly did so to a greater extent, but at present they have largely been cleared away. As is to be expected, sloughs also occupy portions of the land surface, and swamps, the result of slowly draining lakes, are plentiful. Both in the lower part of the American Bottom and close to the bluffs are a number of lakes which receive their water from the numerous creeks descending from the Illinois plateau. The lakes of the American Bottom may be readily interpreted as being parts of the old bed of the river, isolated by a series of cut-offs. The origin of such lakes, which are typical of the swamps of all gulf rivers but especially of the Mississippi, lies in the winding course of rivers through their flood plains. As pointed out by Marbut, these windings or *meanders* are primarily caused by some obstruction which deflects the currents against one of the banks, resulting in the excavation of this bank and deposition on the other. This action causes a slight bend of the river bed. Since the process continues there finally comes about, through deposition on the inner curve and excavation of the outer, a deep bend known as the 'ox-bow.' The size and length of existence of these ox-bows are determined by various factors, among which the greater length of the stream and consequent lower gradient and increased velocity play

important parts. In a meander of great length the difference in water level on opposite sides of the narrow neck will be appreciable and result in the cutting of a small ravine backward from the lower side. This ravine, in times of flood, becomes enlarged and soon forms a new channel for the entire river, forming a cut-off. It may be noted that for each river there appears to be an average width of meander before the cut-off is made. This width, for the Mississippi, is about six miles, but is sometimes exceeded, as at New Madrid. However, it seems but reasonable to suppose that in earlier days when the volume of water carried by the river was greater, and the material coarser and erosion easier, the size of the ox-bows was correspondingly greater. Under this assumption we can interpret the lakes of the American Bottom as the result of a single cut-off.

"A comparison of the St. Louis sheets of the U. S. Geological Survey of November, 1893, and April, 1904, shows the probable existence at one time of an ox-bow fully twelve miles across. Thus the most northern part of the cut-off is formed by Horseshoe Lake; Spring Lake and Grand Marais Lake form the middle part; while Cahokia Lake forms the south bend. In the years which elapsed between the surveys for the two maps (1888-1903) great changes took place, especially as far as the outlines of the lakes are concerned. The 1904 map shows that their area has been greatly reduced. Horseshoe Lake has retreated from its former western boundary; Indian Lake has become a mere swamp, and Spring Lake occupies now about one-twentieth of its original surface, limited to the most eastern portion, the remainder being swamp. All connection with Pittsburg Lake has been lost. Pittsburg Lake remains practically as it was except that here and there it has retreated and portions of it have been diked. Of Cahokia Lake but a small portion of the northeastern part remains as open water, and for the greater part it is a swamp through which flows Prairie du Pont Creek."

Since in the American Bottom there are so many of these depressions which have once been a part of the river bed it might be worth while to consider one of these more in detail. The region of Horseshoe Lake is very interesting from the

point of view of its flora. On the northern shore *Nelumbo lutea* is the prevailing type of plant farthest from the shore. An occasional plant of *Castalia odorata (Nymphaea odorata)* also occurs. *Scirpus maritimus* is the prominent water-margin plant, extending up the marsh shore forty or fifty feet, and the most inconspicuous plant which is found on the lake borders is *Jussiaea repens.* Associated with *Scirpus maritimus* and partially concealed by it is a species of Eleocharis, which becomes very vigorous and abundant in places where the taller bulrush is sparse. In other places the Eleocharis has been forced to the water's edge by *Scirpus lacustris,* which, however, remains secondary to *S. maritimus. Sagittaria latifolia* follows along the shore. *Bidens frondosa* begins in this zone but culminates on the shore side. Diminutive forms, such as Wolffia, Lemna, and Spirodella, are found abundantly in this zone.

The Carices are the most abundant forms, but not so conspicuous as some larger plants which are equally common with each other. This association consists of *Polygonum Muhlenbergii, Boehmeria cylindrica, Apocynum androsaemifolium, Hibiscus militaris, Amorpha fruticosa,* and *Bidens frondosa. Pilea pumila* is very plentiful but not conspicuous. Bordering this zone there is a slight rise of elevation which is sufficient to introduce a few shrubs and trees, and here *Amsonia Tabernaemontana, Cephalanthus occidentalis,* and *Salix longifolia* are prominent. In the shrub zone there are a few climbing plants, *Polygonum scandens, Apios tuberosa,* and *Strophostyles* sp. *Eupatorium coelestinium* is the most common, *E. altissimum* and *Erigeron annuus* are secondary, whereas *Salix amygdaloides* and *Betula lutea* are the most characteristic shrubs. This zone gradually merges into the real tree zone which occupies the old river shore. Immense sycamores *(Platanus occidentalis),* swamp maples *(Acer rubrum),* and *Populus deltoidea* are the typical trees. A dense undergrowth of shrubs is found here, the most conspicuous of which are *Betula lutea, Salix amygdaloides, Adelia acuminata, Ulmus fulva, Fraxinus americana, Crataegus viridis, Cornus asperifolia,* and *Gleditsia triacanthos. Sicyos angulatus, Vitis cinerea, V. vulpina,* and *Tecoma radicans* are the prominent

lianas. *Boehmeria cylindrica, Astragalus canadensis,* and *Oenothera biennis* are the common plants in small clearings. *Ambrosia trifida* and *A. artemisiifolia* have been introduced.

Farther east a small stream enters the lake and along its quiet shores *Jussiaea repens* forms a conspicuous border. *Scirpus maritimus* is wanting and *Polygonum Muhlenbergii* and *Sium cicutaefolium* crowd each other for the next place and then give way to a shrubby thicket of *Salix nigra, S. amygdaloides,* and *S. longifolia,* which in turn are almost succeeded by *Adelia acuminata,* a form which seems so well adapted to this habitat that other forms scarcely exist in this almost impenetrable thicket it makes beyond the willows. There is no ground vegetation and scarcely a willow. An interesting adaptation is shown by the Adelia which accounts in part for this dense thicket growth. Where the long drooping branches touch the wet soil roots are quickly put out and in a short time young and independent trees have originated. Somewhat north of this thicket an axe clearing has been made and willows are beginning to enter. *Typha latifolia* is the commonest plant here, but *Bidens frondosa* nearly equals it. *Sagittaria latifolia* occupies the moister places. *Penthorum sedoides* is also frequent, and seedlings of *Acer saccharinum* are abundant. Bounding the Adelia thickets and the clearings one finds large trees of *Fraxinus americana* and *Acer saccharinum* farther back.

To return now to the consideration of the American Bottom in general—one of the striking features of this territory are the numerous elevations known as "Indian Mounds". A great portion of this bottom is below the high-water level of the Mississippi River and is therefore inundated annually by the overflow of the river, whereas other portions are above the high-water mark and owe their origin to some other cause than the river. It is probable that a considerable portion of the bottom area was originally composed of drift clay and loess, deposited after the valley was scooped out of the subcarboniferous limestone. They filled the valley to a height of fifty to sixty feet above its present level and then were in part removed by subsequent erosion during the period of elevation and drainage succeeding the drift epoch. A proof

of this are many elevations scattered over the surface of this bottom, locally known as "Mounds", the construction of which has generally been attributed to the aborigines or by later inhabitants for religious or other purposes.

According to Worthen, "These elevations vary in height from ten to sixty feet or more above the level of the surrounding bottom and when carefully examined are found to consist of drift clay and loess, remaining *in situ* just as they appear along the river bluffs where similar mounds have been formed in the same way by the removal of the surrounding strata by currents of water." On examination of a section of one of these mounds it was found to consist of fifteen feet of common drift clay at the base, overlaid by thirty feet or more of ash-colored marly sands of the loess, the line of separation between the two deposits remaining distinct and well defined. Hence it is inferred by Hus and Worthen that these mounds are not of artificial formation but simply outliers of loess and drift that have remained as originally deposited, while the surrounding contemporaneous strata were swept away by denuding forces.

The dry bottom on the Missouri side comprises a strip some twenty to fifty yards wide immediately adjacent to the railroad tracks but situated several feet lower. Trees and shrubs are ordinarily isolated and consist of specimens of *Acer saccharinum, Aesculus glabra, Gleditsia triacanthos, Gymnocladus dioica, Prunus serotina, Fraxinus americana, Robinia Pseudo-Acacia, Amelanchier canadensis, Ulmus fulva, Morus rubra, Betula nigra,* with here and there brambles and plants of *Vitis cinerea* and *V. vulpina, Rhus Toxicodendron,* and *Tecoma radicans.* The more common weeds occur frequently, among them being *Myosurus minimus, Ranunculus abortivus, Capsella Bursa-pastoris, Geranium carolinianum, Oxalis stricta, Melilotus alba, Trifolium repens, Potentilla canadensis, Apocynum cannabinum, Verbascum Thapsus, Plantago lanceolata, Cyperus ovularis, Eleocharis tenuis, Agrostis scabra.* Also great clumps of *Clematis virginiana* occur throughout the year.

In contrast to the dry bottom of Missouri, the wet bottom supports a flora of great luxuriance, though not particularly

rich in species. Willows here form the main tree growth, chiefly *Salix cordata, S. longifolia* and *S. nigra,* together with *Populus deltoides.* Numerous vines are *Cissus Ampelopsis, Vitis cinerea, V. palmata* and *V. vulpina, Convolvulus sepium,* and *Polygonum dumetorum* and *P. scandens,* twining among the bushes. *Allium cernuum, Euphorbia humistrata, Prunella vulgaris, Taraxacum officinale, Senecio aureus, Valerianella radiata, Oenothera biennis, Stellaria longifolia, Radicula obtusa* and *Ranunculus abortivus* form a mat, together with the sedges and grasses, mainly *Carex conjuncta, C. granularis, C. vesicaria* var. *monile, Scirpus atrovirens, Alopecurus geniculatus* and *Elymus virginicus.* Here and there single plans of *Hibiscus lasiocarpus* stand out. Clumps of *Iris versicolor* also occur. Different species of *Polygonum,* among which *P. amphibium* var. *Hartwrightii* is the most striking, take possession of large tracts of land. Other species prominent during summer and autumn are *Baptisia leucantha, Lespedeza capitata, Bidens cernua, B. aristosa (Coreopsis aristosa), Eupatorium purpureum, Vernonia fasciculata, Chenopodium ambrosioides, Asclepias incarnata,* different species of *Rumex,* and *Saururus cernuus.* In the fall the Compositae are the most prominent.

The bottoms of the River des Peres, near where it enters the Mississippi, differ markedly from the Missouri bottoms of the Mississippi. The bottoms of the River des Peres show several terraces. On the north side they are covered chiefly with grasses, but trees and shrubs form the striking feature of the bottoms on the south side.

That portion of the Illinois bottom usually designated as a "dry" bottom and possessing a sandy soil supports a rich and greatly diversified flora, in sharp contrast to the drier and higher portions of the Mississippi bottom in St. Louis County, where the soil is a heavy clay. The spring flora is rich in Ranunculaceae and in Cruciferae, such as *Ranunculus abortivus, R. repens, Myosurus minimus, Capsella Bursa-pastoris, Dentaria laciniata, Draba brachycarpa, Radicula sinuata, Cerastium arvense,* and *C. nutans. Geranium carolinianum* and *Oxalis stricta* are also dominant plants. Umbelliferae are present in the form of *Chaerophyllum procumbens* and *Cryp-*

totaenia canadensis. Cyperaceae are numerous and during the summer months many Leguminosae. Here also are found many Compositae, predominant during the autumn. Where there are woods, *Quercus coccinea* var. *tinctoria*, *Q. imbricaria*, *Q. macrocarpa*, and *Q. Muhlenbergii* are found together with *Acer saccharinum* and *Ulmus fulva*.

The wet bottoms of Illinois have been converted almost wholly to agricultural purposes. However, the original flora consisted entirely of trees and shrubs, the formation being frequently interrupted by sloughs, lakes, and swamps. After the spring flora rich in Ranunculi and Crucifers comes a summer flora equally luxuriant, consisting mainly of *Hypericum mutilum*, *Abutilon Theophrasti*, *Cassia Chamaecrista*, *Potentilla monspeliensis* var. *norvegica*, and numerous Compositae.

The swampy grounds of the American Bottom are ordinarily covered with growths of willows, maples, and oaks. In places the flora is shrubby, and *Ilex decidua*, *Gleditsia aquatica*, and *Cephalanthus occidentalis* are found. Herbaceous plants, most of them aquatics, are very abundant. In the fall, Ranunculi and Crucifers disappear as well as various sedges, and at this time some of the Compositae reach their greatest development.

MARY LEDGERWOOD.

A NEW INEXPENSIVE SHADE FOR GREENHOUSES

What to use as a temporary summer shade for a greenhouse is always a matter of interest to gardeners and florists. Particularly concerned is the one who has had the laborious task in the fall of hand-scraping the glass to allow the entrance of much-needed sunshine. The ideal mixture is that which will give the desired shade during the season and yet possesses sufficient adhesive properties to withstand the summer rains. About September the shading should begin to wear off until by winter it has entirely disappeared, permitting full sunshine during the winter. The grower who has been unfortunate enough to use white paint instead of white lead as a base

for his spray will find himself busily engaged scraping off the summer spray from the roof glass.

Various shading materials, including white lead, whiting, benzine, etc., were discussed in detail in the May, 1922, BULLETIN. More recently another material has been used at the garden as a "sticker" with very satisfactory results—ordinary Portland Cement. For a temporary spray in early spring (which by the way is always a rush order) strong enough to withstand several rains, use one part of cement to three parts of whiting. Keep well agitated when spraying and when dry a pure white shade will result. For a permanent summer spray that seems to meet all requirements, including that of peeling off with the first frost, the following formula has proven entirely satisfactory:

Water	3 gallons
Cement (three 4-inch pots)	6 pounds
Whiting (two 4-inch pots)	5 pounds
Powdered glue (one 3-inch pot)	½ pound

Ordinary powdered glue dissolved in hot water is added to the solution of cement and whiting just before spraying upon the roof. Keep well agitated. Remember that cement hardens rapidly and do not make up more than can be used at one time.

G. H. P.

NOTES

The Art Extension Group of the University of Illinois visited the Garden, June 18.

Dr. Hermann von Schrenk, Pathologist to the Garden, spoke before the St. Louis chapter of the American Society of Civil Engineers, May 25, on "Termites."

Mr. G. H. Pring, Superintendent of the Garden, gave an illustrated talk before the Art Section of the Scottish Rite Woman's Club, June 3, on "Orchids."

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Webster Groves Nature Study Society, June 15, his subject being "Ten Thousand Miles After Blue Flags."

The "Sikeston Standard," Sikeston, Mo., issue of June 2, in a plea for highway beautification, has reprinted the address given by Mr. L. P. Jensen, Arboriculturist to the Garden, before the American Institute of Park Executives, at Detroit, in August, 1921.

The following organizations have been guests of the Missouri Botanical Garden Extension at Gray Summit recently: May 4, Kirkwood Garden Club No. 1; May 5, Garden Club of Webster Groves; May 21, South Garden Club of Kirkwood; June 7, St. Louis Horticultural Society, and the Garden Clubs of Sullivan, Washington, New Haven, and Gray Summit, Mo.

Recent visitors to the Garden include Miss Catharine L. Lieneman, instructor in botany, North Carolina College for Women, Greensboro, N. C.; Mr. George Baldwin, orchid grower, of Mamaroneck, N. Y.; Mr. Lloyd C. Cochran, assistant in plant pathology and graduate student, Michigan Agricultural College, East Lansing, Mich.; and Dr. R. A. Fisher, Chief Statistician, Rothamsted Experiment Station, Harpenden, England.

The second number of Volume XVIII of the Annals of the Missouri Botanical Garden has recently been issued, and contains the following papers: "A Monograph of the Genus Sidalcea," by Eva M. Fling Roush; "Revision of the Genus Frasera," by H. H. Card; and "Notes on the Distribution of Some Rocky Mountain Plants," by George J. Goodman.

Mr. L. P. Jensen, Arboriculturist to the Garden, spoke before the citizens of New Haven, Mo., May 19, on "The Value of a Garden Club to the Community." The Garden Club of New Haven was organized at this meeting. On June 5, Mr. Jensen gave an illustrated talk before the members of the Webster Groves Nature Study Society on "Conservation of Native Plants."

STATISTICAL INFORMATION FOR MAY, 1931

GARDEN ATTENDANCE:

Total number of visitors.....49,121

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought 43
Total number of books and pamphlets donated..... 427

HERBARIUM ACCESSIONS:

By Purchase—

Canton Christian College—Plants of China..... 500
Steyermark, Julian A.—Plants of Missouri and New England 203
Verdoorn, Fr. "Hepaticae Selectae et Criticae" Series II, Nos. 51-100 incl. 50

By Gift—

Anderson, Mrs. William H.—*Muscari comosum* Mill. from Arkansas (escaped from cultivation)..... 1
Beardsley, Miss Martha—*Phoradendron* sp. from New Mexico 1
Bull, Miss Rotha—*Lesquerella densiflora* (Gray) Wats. and *L. auriculata* (Engelm. & Gray) Wats. from Oklahoma 2
Child, Miss Marion (Mrs. Henry Moss)—Plants of Missouri and Ohio..... 600
Peebles, R. H., by C. L. Hitchcock—*Lycium macrodon* Gray from Arizona..... 1
Pring, George H.—*Salpichroa rhomboidea* Miers from horticulture ....., 1

By Exchange—

Gray Herbarium, by Dr. I. M. Johnston—*Grabowskia glauca* (Ph.) Johnston from Chile..... 2
Museo Nacional de Historia Natural de Buenos Aires, by A. Castellanos—Plants of South America..... 161
University of California, by Prof. E. B. Copeland "Plants of California," Nos. 501-600 incl..... 100
University of California at Los Angeles, by Dr. Carl C. Epling—Plants of California and India..... 300

Total 1,922

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
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KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
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DAVID H. LINDER,
Mycologist

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MISSOURI BOTANICAL GARDEN BULLETIN

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TRIUMPH TULIPS

Missouri Botanical Garden Bulletin

Vol. XIX SEPTEMBER, 1931 No. 7

TRIUMPH TULIPS

In recent years two new strains of tulips have been attracting considerable interest among bulb enthusiasts abroad. They are the "Mendel" tulips, said to be the result of crossing the early "Duc van Thol" tulips with the "Darwins," and the "Triumph," hybrids between early tulips and varieties of "Darwins." These new tulips carry large flowers on stiff stems, some of them approaching the "Darwins" in height. They are said to force easily, and in the garden they come into bloom a week earlier than the "Cottage" and "Darwin" tulips.

In the spring of 1928 thirty varieties of tulips were grown in pots at the Garden and flowered at the time of the St. Louis Spring Flower Show, which was being held in the floral display house from March 22 to 25. Last fall the Holland Bulb Exporters' Association of Haarlem sent fifty-eight varieties of "Triumph" tulips for trial, eight bulbs to a variety. These bulbs were planted in the Linnean Garden (pl. 22). With the wonderful array of colors among existing varieties of "Darwin," "Cottage," "Breeder," "Rembrandt" and "Lily-flowered" tulips, it is difficult to select from these new races of tulips varieties that should surpass the old in beauty. There are some very good kinds but there are others that cannot be credited with any outstanding qualities. Mention should be made of the following five white varieties, all of which were considered very good:

KANSAS—18 inches.
MEKBUDA—21 inches.
SILVER STAR—18 inches.
SNOWDRIFT—19 inches.
TORNAX—16 inches.

The next twelve varieties were selected as some of the best in the collection. It is not intimated that they surpass in beauty any of the "Cottage," "Darwin," or other races of tulips of similar coloring, but their earliness is a factor to be considered.

ALTESE—21 inches. A good light violet.

ALARAPH—17 inches. The coloring of this tulip is so unusual as to attract immediate attention. It is almost mahogany, the petals being edged with yellow.

BOSTON—21 inches. The flower is a pale rose-violet with a pink center, the edges of the petals salmon-rose.

CASTOR—25 inches. This is a good tall variety having a stiff stem. The flower is dark violet.

COLORADO—19 inches. A good orange-colored variety.

HYDRA—17 inches. A dark scarlet.

HERAUT—23 inches. Lilac, with pointed petals.

JOHN VAN LOON—19 inches. Soft rose.

LORD CARNARVON—22 inches. This tulip will undoubtedly become popular. Standing among the other varieties of this group it instantly attracted attention. The flowers are equally showy, whether fully open or closed. The petals are pointed and are banded with pink.

MR. ZIMMERMAN—18 inches. The petals are rose-pink, white at the base. In coloring the flower is similar to Lord Carnarvon, but the petals are not as pointed.

MY MARYLAND—23 inches. This is a tall variety; color is rose and white.

SAGITTARIUS—22 inches. The rounded flower held on erect stems is white, shaded cream, with a flush of rose. This is a very good light-colored tulip.

P. A. K.

THE KOREAN CHRYSANTHEMUM

To continue the blooming period into the autumn until hard frosts lay low all plant life is the aim of every gardener. By a careful selection of varieties of the so-called hardy chrysanthemums, in some seasons, continuous bloom in the flower border with a variety in color may be achieved. To

TRIUMPH TULIPS IN LINNEAN GARDEN

KOREAN CHRYSANTHEMUMS

have flowers in late September and early October one must rely mostly upon plants of the Composite family, all having daisy-like flowers. Just to mention a few, the Michaelmas daisies, New England asters, boltonias, Tartarian asters, cosmos, dahlias, various helianthus, and chrysanthemums are all used at the Garden.

The Korean chrysanthemums (*Chrysanthemum coreanum*) is a plant that asks no favors, yet is reliable for a blooming period of two weeks, usually the first two weeks of October. It is entirely hardy, has withstood the drought of the last two summers, the foliage is unaffected by diseases or insects, and it is easily propagated by division in the spring. The plants attain a height of 2½ to 3 feet and do not need staking. The flowers are faintly flushed pink when first open but soon fade to white; in fact, it would be better to describe them as single, white flowers. The illustrations (plate 23) clearly show the habit of the plant and the profusion of bloom in early October.

P. A. K.

A SPRING-CLIP LABEL HOLDER

One of the most vexing problems in staging the annual chrysanthemum show at the Garden has been to label single-stem varieties in such a way that the labels were always with the proper varieties and in such a position as to be easily seen. Various methods have been used in the past, such as pulling a portion of a leaf through a hole in the label, slitting the card and fastening it to the stem of the plant, tying the label to the stem, or placing the card in a slit at the top of a bamboo stake. While all of these methods accomplished their purpose to some extent, none of them were entirely satisfactory.

The label holder pictured (pl. 24) is the best for labeling tall plants requiring a bamboo support, and is very easily made from ordinary spring clothes-pin clips. A piece of No. 14 wire is coiled around a half-inch rod or stick to form the holder for the label, and the opposite end of the wire inserted through the coil of the spring in the clothes-pin.

Such a label holder remains in position wherever placed, and by bending the wire the card is held at any angle desired. It can be used to the greatest advantage with chrysanthemums, but it also is very useful for labeling many other types of plants. The holder can be applied to hard-wooded plants without any injury to the stem, but soft-wooded subjects, even though the stem be quite firm, will be wilted or have their growth restricted by the tension of the spring clip. The label holders in use at the Garden have been dyed green by dipping, and the cards are green pyralin measuring 2 x 3 inches.

P. A. K.

GAS TREATMENT FOR THE PEACH TREE BORER

Due to the number of requests received at the Garden for a remedy for the peach tree borer, the following article from "Fruit News Notes," No. 10, is reprinted by permission:

"The peach tree borer is by far the most destructive insect attacking the peach. In the past, worming the trees by means of a knife and a long stiff wire was the only known method of eradication. At best this practice was slow, costly, injurious to the tree, and generally unsatisfactory.

"During the past few years the gas given off by paradichlorobenzene has been employed very successfully in combating this pest. The material is a white, crystalline solid which vaporizes slowly at ordinary temperatures and forms a gas which is heavier than air. This gas will injure the tender roots and woody tissues under the bark of most plants. Consequently it is not recommended for use around trees under six years of age, a time when the bark on peach trees is quite thick. Some growers have used this material safely on trees under six years by reducing the amount and duration of the application.

"The material should be used at the rate of ¾ to 1½ ounces per tree, depending upon the age, and should be applied about September 25th, in the Ozarks. By this time practically all of the eggs have hatched and the young borers are just entering the trees. At this time they are most easily

CHRYSANTHEMUM, SHOWING USE OF SPRING-CLIP LABEL HOLDER

killed for they are small and have not penetrated very far into the tree. The soil is likely to be dry then, making vaporization more rapid. From 14 to 21 days is necessary to kill over 90 per cent of the borers when the soil temperature averages 55° to 60° F. A shorter time will suffice when the temperature is higher.

"Method of application:

"1. Remove with a hoe the weeds, sticks, stones, etc., from around the trunk for a space 6 to 12 inches, making a fairly smooth, flat area. Remove any thick masses of gum on the trunk.

"2. Measure out the correct amount of paradichlorobenzene into some container such as a pill box or small bottle and distribute it in a narrow band 2 inches from the tree. Do *not* place the crystals against the trunk for serious injury might result.

"3. Place 4 to 6 shovels full of dirt over the crystals, mounding up toward the trunk, and then tamp down with the back of a shovel.

"Precautions:

"1. Get pure paradichlorobenzene.

"2. Tear down the mounds after 3 or 4 weeks.

"This station will be glad to render advice and assistance in every way possible to further the development of the fruit industry in the State.

"C. R. PHIPPS, Entomologist,
"Missouri State Fruit Experiment Station."

ADDITIONAL EARLY HISTORY OF THE GARDEN

From time to time there have appeared in the BULLETIN articles relating to the life of Mr. Shaw and to his beneficence in St. Louis ("Henry Shaw's Contribution to Art in St. Louis," September and December, 1918; "Some Early History of the Garden," December, 1918; "St. Louis—1819," June, 1926; "The Early Days of 'Mr. Shaw's Garden'," September, 1930), etc. The following account from Mr. Richard Smith Elliot's book, "Notes Taken in Sixty Years," St.

Louis, 1883, gives an additional bit of Garden history and an appreciation of the founder by one of his contemporaries:

"It was the season of growth and bloom, thirty years ago. A shower in the night had given us a summer morning so fresh that the sun's heat was unheeded as we breathed the purified atmosphere. The gloom of our real estate office was cheered by thoughts of the flowers we should see in the gardens and by the wayside in our evening drive through the suburbs; for even the sickly plants in the city had an aspect of unusual vitality, as if they might yet open their rusty buds.

"A gentleman who had been engaged in active commerce in Saint Louis from 1819 until his retirement in 1840, came in with a bunch of roses in his hand. It was not rare to see him with flowers, and we knew that he had them in profusion at his pleasant residence in the midst of the beautiful tract bordering upon the King's Highway. He had given up commerce in goods, wares and merchandise, but had only changed from the toil for gain to the cheerful labor of wise and tasteful disbursement. We knew that with industry as unwearied as that of the counting room, he was beautifying his rural home; but we had never thought of any purpose beyond the customary enjoyment of a retreat from the cares of an active business life.

"Looking at a map on the wall, he remarked, as if it were a mere commonplace announcement, that he intended to have a Botanical Garden, with proper accessories, free for citizens and strangers to visit; and that he had in view the donation of a tract of land to the city for a public park, on condition that it should be properly improved. If I recollect rightly, this was the first communication of his intention to any one. Mr. Leffingwell and myself were the oldest dealers in real estate in Saint Louis, and although his plans were as yet immature, it was natural that he should advise us of what he had in contemplation as affecting the value of adjacent properties. There was no parade of generosity, or of unusual public spirit, but the statement was made as unpretentiously as if it involved nothing more than an ordinary act of daily life. If a photograph had been taken as he stood there, thirty years ago, pointing with his cane to the

map, disclosing his benevolent designs and indicating the broad acres to be donated, the picture would be worthy of a place in the Historical Society's gallery.

"The intelligent reader has already identified our visitor as Mr. Henry Shaw.

"Tower Grove Park, with its three hundred acres, to the improvement of which the City of Saint Louis has contributed only a sum comparatively insignificant—with its colossal statues in bronze of Shakespeare and Humboldt, and its marble busts of Mozart and Rossini—with its roads, walks, trees and flowers—is the creation and gift of Henry Shaw to the people of Saint Louis; and not only for the land, statues, busts and other adornments are they indebted to him, but also for years of care in the general superintendence of the improvements, and for the knowledge and taste that money cannot command, but without which the Park that Saint Louis is so proud of could not have existed in its present attractiveness.

"At the home of Mr. Shaw, the Botanical Garden, and its attached Library and Herbarium, have been growing for thirty years, and have afforded pleasure to hundreds of thousands of visitors. With its plant-houses and open grounds, which are a museum of living vegetation representing nearly all climes—with its Herbarium of innumerable dried specimens, classified and arranged—and its Library comprising all the literature worth noting of Botany and Horticulture—the Garden and its accessories, in the opportunities afforded for the study of these allied sciences are unequalled in the western hemisphere. An ample estate is understood to have been set apart for the support of the Garden through all time; and while Mr. Shaw has not disclosed his determination, he has, I doubt not, arranged to dispose of it in a manner harmonizing with the princely munificence which has brought it to its present condition.

"No corporation, or municipality, or government, on this side of the Atlantic, has done so good a work as the unostentatious citizen of St. Louis; and with my natural desire to have all debts paid—if means can be found—I have been puzzled to find out a recompense for Mr. Shaw, even though he has never asked or cared for it.

"If one has plenty it is an easy thing to give away part of it for some one else to enjoy and take care of; and I imagine it to be a sort of compulsory pleasure to bequeath an estate, which cannot trouble the giver after the bequest takes effect. But to gain by patient toil a fortune in trade, and then, instead of resting, deliberately go to work to plan and to execute, through long years, entirely for strangers to one's home, many of them naturally thankless, and for the folks we call posterity, that one can never know anything about—this is a sacrifice of one's self away beyond the money outlay, and I don't see how we are to pay for it.

"For nearly a third of a century, Mr. Henry Shaw has been the self-dedicated servant and benefactor of the public—thinking and planning, and lavishing his means, without intermission or rest, in order that present and future generations should have pleasure and instruction. Let any one reflect on what he has gone through; the cares inseparable from the management of properties; the inability of city legislators for a time to comprehend his munificent gift of the park, thus delaying the improvement of it; the stupidity of some of those employed to work out his plans; throng after throng of visitors, entertained with urbanity and politeness, evincing wonderful patience and fortitude; the self-restraint required to preserve his temper when overrun by crowds, some of the persons composing them too ignorant to comprehend the replies to their own questions; and the ten thousand other annoyances not to be escaped by one in his position. Reflect on this, and say if such devotion can be adequately compensated?

"The esteem, respect and gratitude of his contemporaries—the possible appreciation of posterity—these are all we can give or promise. Any further reward must exist in his own consciousness of having lived effectively for the benefit of mankind.

" 'No thought nor care for gain
No foolish wish for glory's gilded letter,
Have bought these efforts of his heart and brain,
But only that the world might be the better,
For one who has not spent his life in vain'."

A NEW PLANT FOR MISSOURI

On Monday, June 29, 1931, Mr. C. L. Elam and the writer were collecting composites in the suburban area of St. Louis just north of Washington University. Our especial interest was to collect specimens of *Helianthus petiolaris* Nutt., a small colony of which we observed growing there several days before. An interesting find was a rather vigorous specimen of *Picris Sprengeriana* Poir. We observed only the one plant growing along the Rock Island Railway track, just north of the University. The specimen has been deposited in the Herbarium of the Missouri Botanical Garden. According to Dr. J. M. Greenman, this species is a native of southern Europe. So far as known to the writer, this species has not been reported previously in North America. It is hoped, however, that it will not become established in this country, since, if established, it might become a pernicious weed.

J. Arthur Turner,
Stowe Teachers College, St. Louis.

NOTES

A party of 4-H Club boys and girls from Vincennes, Indiana, visited the Garden, July 30.

Mr. G. H. Pring, Superintendent of the Garden, spoke before the East St. Louis Rotary Club, at the Broadview Hotel, September 2, on "Some Experiences in the Jungle."

Dr. Mildred E. Mathias, formerly research assistant at the Garden, spent several weeks in the herbarium and library during the summer, working over the collections of plants made on her various tours in the West.

The August number of the "Bulletin of the Pan American Union" (Vol. 65, No. 8) contains an article by Dr. George T. Moore, Director of the Garden, entitled "Latin America and the Queen of Flowers."

Mr. Julian A. Steyermark and Mr. John A. Moore, Rufus J. Lackland Research Fellows at the Garden, recently returned from a two-month's botanical exploration of the mountains of western Texas. They have brought back interesting col-

lections of plants from the Davis, Chisos, and Guadalupe Mountains of Texas, sets of which they are now preparing for distribution.

Among recent visitors to the Garden were Dr. J. W. Severy, associate professor of botany, University of Montana, formerly a Teaching Fellow at the Garden; Dr. H. H. Card, formerly Rufus J. Lackland Research Fellow at the Garden; Dr. Henry Schmitz, professor and chief of the division of forestry, University of Minnesota, formerly Rufus J. Lackland Research Fellow at the Garden; Mr. Myron Arthur Rice, instructor in botany, Clemson Agricultural College, Clemson College, South Carolina; and Prof. C. L. Huskins, associate professor of genetics, McGill University, Montreal, Canada.

Visitors to the herbarium and library during the summer months include Prof. H. I. Featherly, assistant professor of botany and plant pathology, Oklahoma Agricultural College, Stillwater, Oklahoma; Mr. W. W. Ashe, assistant district forester, U. S. Forest Service; Dr. Ethel T. Eltinge, instructor in botany, Mt. Holyoke College, South Hadley, Mass., formerly a Jessie R. Barr Research Fellow at the Garden; Prof. Robert Stratton, associate professor of botany and plant physiology, Oklahoma Agricultural College, Stillwater, Oklahoma; Prof. Frank B. Wann, associate professor of botany, Utah Agricultural College, Logan, Utah, formerly a Teaching Fellow at the Garden; Dr. J. Arthur Turner, professor of botany, Stowe Teachers College, St. Louis; Mr. Edward L. Evinger, junior pathologist, Bureau of Plant Industry, U. S. Dept. of Agriculture, formerly Rufus J. Lackland Research Fellow at the Garden; and Dr. P. A. Munz, professor of botany, Pomona College, Claremont, California.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1931

GARDEN ATTENDANCE:

Total number of visitors in June	**27,212**
Total number of visitors in July	**27,522**
Total number of visitors in August	**35,780**

PLANT ACCESSIONS:

Total number of packets of seeds donated in June	**72**
Total number of packets of seeds donated in July	**4**
Total number of packets of seeds donated in August	**4**

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	**34**
Total number of books and pamphlets donated in June	**106**
Total number of books and pamphlets bought in July	**7**
Total number of books and pamphlets donated in July	**31**
Total number of books and pamphlets bought in August	**58**
Total number of books and pamphlets donated in August	**165**

HERBARIUM ACCESSIONS:

JUNE

By Purchase—

Ciferri, R.—"Mycoflora Domingensis Exsiccata," Nos. 101-200, inclusive; also additional specimens supplementing earlier collections	125

By Gift—

Anderson, Dr. E.—Mosses of Missouri and New England	37
Emerson, Prof. Fred W.—*Nolina Lindheimeriana* (Scheele) Watson from New Mexico	1
Featherly, Prof. H. I.—*Baptisia australis* (L.) R. Br. from Oklahoma	1
Grant, Dr. Adele Lewis—Plants of South Africa	14
Ledman, O. S.—*Heracleum lanatum* Michx. from horticulture	1
Lewis, Miss Mary D.—*Bletia purpurea* (Lam.) DC. from Florida	1
Petersen, Prof. N. F.—*Crepis acuminata* Nutt. from Oregon	2
Sturtevant, B. S.—*Tilia platyphyllos* Scop. var. *laciniata* Koch, from horticulture	1
Walker, Miss Elda R.—*Muscari comosum* Mill. from horticulture	1

By Exchange—

Ewan, Joseph—Plants of California	60
Field Museum of Natural History—Plants of Central and South America	175

New York Botanical Garden, by Dr. H. A. Gleason—Fragments of composite from Venezuela..... 1
Philadelphia Academy of Natural Sciences—Plants of Peru and Chile 36
United States Department of Agriculture, Bureau of Plant Industry, by J. A. Stevenson—Specimens of *Coleosporium solidaginis* (Schw.) Thuem., collected and determined by G. G. Hedgcock..... 150

By Field Work—

Kellogg, John H.—*Gratiola sphaerocarpa* Ell. from Missouri 1

Total 607

JULY

By Purchase—

Arnold Arboretum—Plants of the United States, collected by E. J. Palmer in 1930..... 675
Porsild, Dr. Morten P.—Plants of Greenland..... 438
Stanford, Prof. E. E.—Plants of California..... 200
Werdermann, Dr. E.—Plants of Bolivia and Chile..... 538

By Gift—

Avery, Mrs. Harry C.—Plant of horticulture..... 1
Emerson, Prof. F. W.—Plants of New Mexico..... 3
Featherly, Prof. H. I.—Plants of Oklahoma..... 6
de Lhorbe, Mrs. Wm.—Plants of Illinois..... 3
Hunter, Mrs. A. A.—*Oncidium ebrachiatum* A. & S..... 1
Lodewyks, Miss Maude — *Koelreuteria paniculata* Laxm. from horticulture 1
Mackenzie, Mr. Donald—*Libocedrus decurrens* Torr., from Washington 1
Pring, George H.—Plants of horticulture..... 2
Sharp, Ward M. — *Convolvulus japonicus* Thunb. from West Virginia 1
Shoop, Miss Cora E.—Plants of Missouri..... 2
Turner, J. A., and C. L. Elam—Composite from Missouri 1
Tuttle, Mrs. George M.—*Veronica virginica* L. from Missouri 1

By Exchange—

Botanical Institute, University of Leipzig—Photograph of herbarium specimen 1
Botanical Garden, Madrid — Photographs of herbarium specimens 3

Total 1,878

AUGUST

HERBARIUM ACCESSIONS:

By Purchase—

Verdoorn, Fr.—Schiffner's Exsiccata (Hepaticae of India)	50

By Gift—

Beecroft, W. I.—*Agave Hartmani* Wats. from horticulture	1
Greenman, Dr. J. M.—*Selaginella* sp. from Utah.....	1

By Exchange—

Botanical Garden, Berlin — Photographs of herbarium specimens	6
Clarey, Mrs. Ben L.—Plants of California.....	22
United States Department of Agriculture, by Mrs. Agnes Chase—Grasses of Brazil.....	175
Total	255

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XIX OCTOBER, 1931 No. 8

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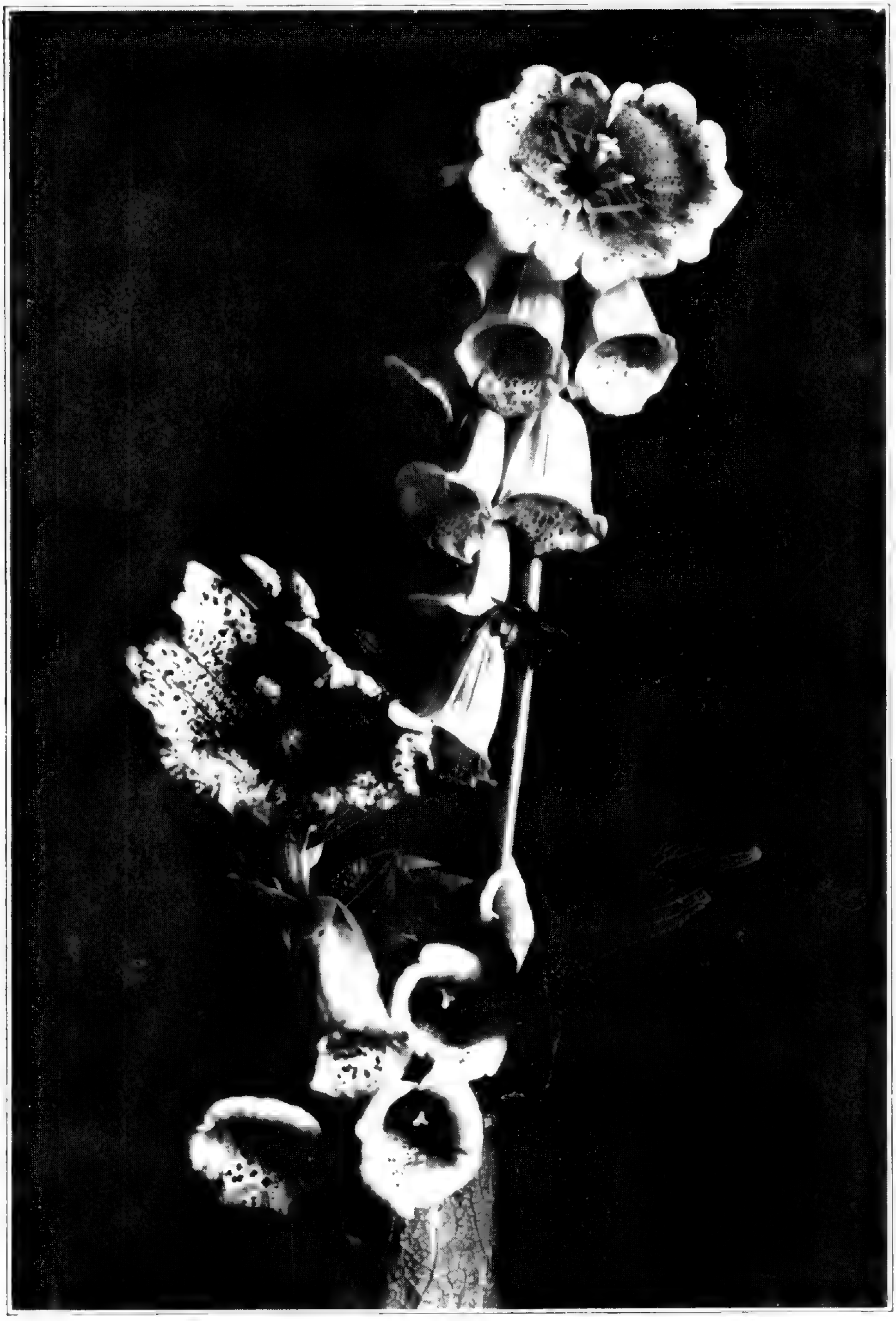

"PELORIA" IN DIGITALIS PURPUREA
(Grown in garden of Mr. Joseph Pulitzer)

Missouri Botanical Garden Bulletin

Vol. XIX OCTOBER, 1931 No. 8

FREAKS IN THE GARDEN

During the summer recently passed, watchful gardeners in many parts of the land have suddenly apprehended certain of their flower charges in the act of behaving in strange and freakish ways, when judged by the laws of conduct so rigidly adhered to by the rank and file of their vegetable fellow-beings. Many of the pleasantest moments of gardening will come with the small and friendly assemblies of fellow enthusiasts gathered to view and discuss some wonder of nature mysteriously sprung from the lovely commonplace of a bed of wall-flowers or sweet nicotine.

The prim foxglove, that charming and dignified inhabitant almost inalienable from the old-fashioned garden, is itself not above occasions of prodigious behavior. Not infrequently it appears to be seized with the desire to produce a flower larger and finer than any it has ever produced before. High upon the stalk, overtopping the other flowers, will appear a gigantic blossom more in the shape of a saucer than the fingers of a glove, for the similarity to which the normal flowers have earned the popular name for our *Digitalis purpurea*. Or again, the same plant may have the impulse to produce many more than the ordinary number of flowers, and, unable to make the stalk more commodious simply by elongation for fear of destruction by high winds, it solves the problem in a clever way by greatly developing the flower space *side-wise*, producing a broad, paddle-shaped inflorescence.

The production of broad, flat stems is a phenomenon which is fairly common among plants. Our grandmothers would have felt cheated by their seedsmen if their cockscomb crop failed to produce fine, velvety, crisp-topped "combs", and in a bed of these plants, if any individuals chanced to look more like delicate, crimson stalks of broom-corn, these were immediately rooted up and cast away. Yet in this case, the undesir-

able plants are actually normal individuals, whereas the plants bearing the "combs" are freaks of the deepest dye. In fact, the freaks have been tenderly cared-for, and the ordinary plants destroyed to such an extent that the latter are diminishing in number steadily, and will eventually disappear in all likelihood.

Plants are excellent mimics. They assume shapes and colors, and exhale odors, pleasant and unpleasant, in such bewildering variety that we can only guess why. Usually our guesses would be pounced upon with much gusto by modern Freudian psychology. Certainly plants go to great pains to assure their natural propagation, and the results are usually so pleasant aesthetically that we should not question their motives. When a plant goes whole-heartedly into the business of mimicry for some suspected reason, we have no more right to call it a "freak" than the man who enters the profession of being a clown for the very practical motives underlying our human economic system. In either case, the impulse is for the betterment, or even the assurance, of life itself, than which there is no stronger.

But many times we find a plant behaving in a manner which is inconsistent as well as odd. These, as in human society, are the real "freaks." We may find, as in *Campanula medium*, the Canterbury bell, that the green calyx has become greatly enlarged and is as gayly colored as the corolla, thus forming the flower of the cup-and-saucer variety which is so popular. Or again, some or all of the stamens may disguise themselves as petals; and in this manner we have acquired many of our "double-flowered" varieties. The pistil also may become petal-like, as in the peony, until the production of pollen and ovules seems to have been almost forgotten in the effort of the flower to make itself as conspicuous as possible.

When a plant goes through these spontaneous and frequently rather quixotic pranks, we are led to suspect that we are witnessing a dress rehearsal; that the plant is not fully decided whether to advertise itself in a somewhat more enticing fashion, probably for the benefit of visiting insects. And it has need of caution in such matters. There are many pitiful cases of plants which have overdone themselves in just such a way, and have developed highly complicated flowers at the expense of the ability to produce fertile seed in sufficient quantity to assure reproduction. These are the ones which have to be carefully propagated from slip or root-cutting.

Science has taken much of the wonder and awe from our observation of natural phenomena. But if our life has been robbed of such emotions, it has been more greatly rewarded by the growing sense of understanding which has taken their place. In order to study plant freaks more intelligently, botanists have had to give names to such abnormalities, just as physicians have given names to human ailments and diseases. Thus we learn that the foxglove (pl. 25) is an example of what is known as "peloria", or the occurrence of an abnormal, perfectly symmetrical flower in an inflorescence composed of normally asymmetrical flowers. The technical name for this condition has been derived from a Greek word, like so many other similar names in botany, and merely means "something which is freakish." It appears that learned men must make up seemingly unintelligible words in order to understand each other! If the large, terminal, saucer-shaped flower is examined closely, it will show itself to be really equal to two of the ordinary, finger-shaped flowers, having about twice the ordinary number of corolla-lobes and stamens, and twice the number of stigma-lobes usually found.

The peculiar flattening of the stem, causing the "cockscomb" also has a name, which in this case is "fasciation." This name refers to the *fasces* of the Roman soldiers, or *lictors,* which were axes with a bundle of rods tied around the handle, thus resembling, very vaguely, the flat, abnormally thickened stems of "fasciated" plants. A few months ago a friend of the Garden grew a stalk of asparagus that would have made the mouth of even an epicure water. It was over a foot long, from four to five inches broad, and only about a quarter inch thick. It looked as though it had been specially created to be lovingly cooked and placed in a shimmer of butter upon a piece of delicately browned toast. But no! The scientists of the Garden, to whom it was taken for examination, observed that it was a highly interesting instance of fasciation, and carefully sealed it within a glass museum jar.

There seems to be no end of the variety of pranks which our plants may perform. Books have been written about them[1], full, as it were, of nothing but anecdotes of plant freaks which must be seen to be believed. And little do we understand them, although they should prove to us that if we were only sufficiently keen-sighted we should find the endless and tireless process of evolution at work before our very eyes.

R. E. W., Jr.

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[1]cf. Masters, M. T. Vegetable teratology, an account of the principal deviations from the usual construction of plants, London, 1868; Worsdell, W. C. The principles of plant teratology. 2 vols. London, 1915.

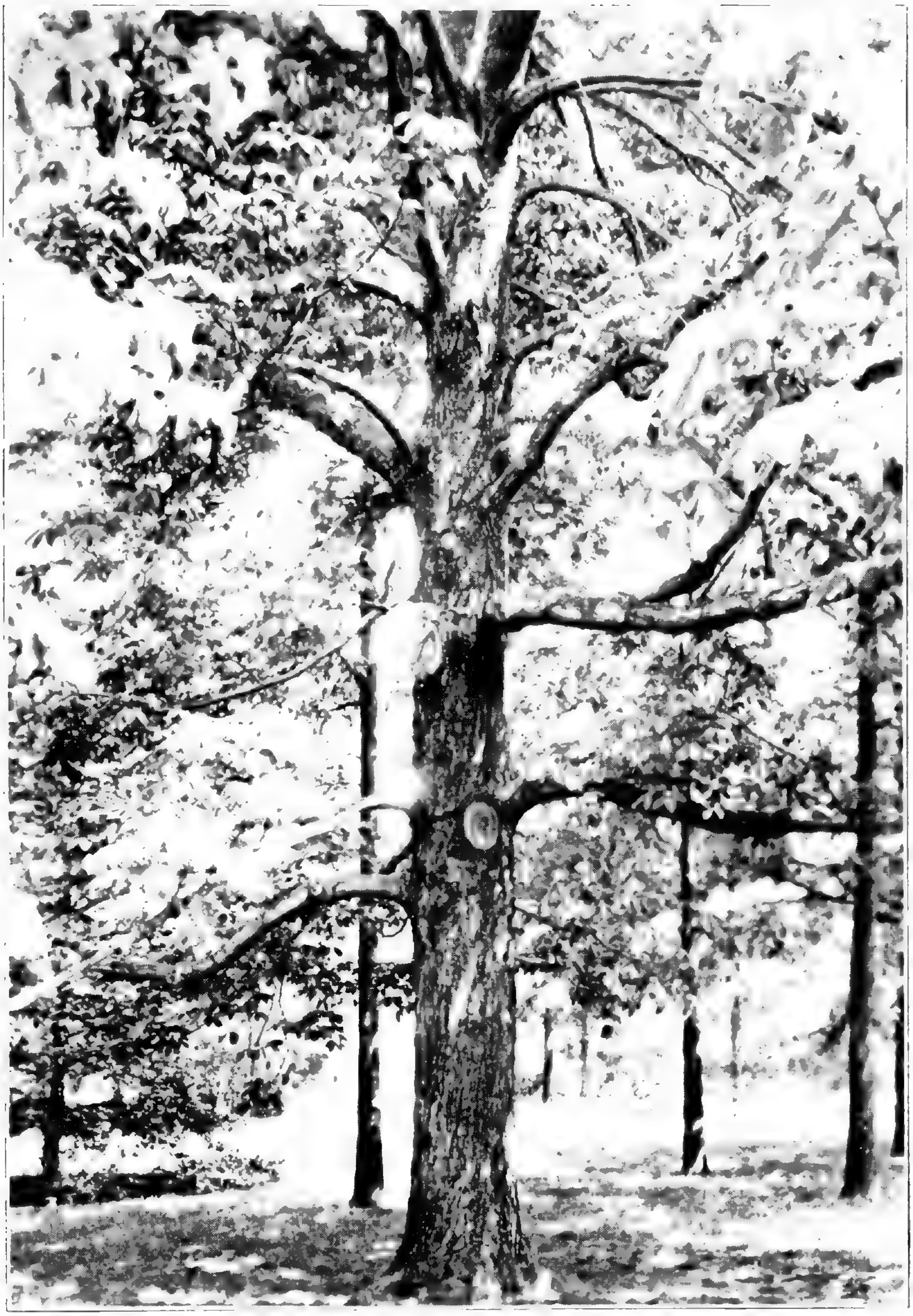
A METHOD OF BRACING WEAKENED TREES

Often midsummer storms whip away the tops of large trees, frequently whole trees are uprooted, and more frequently one or more large limbs are torn away. Breakage usually occurs at a sharp V-shaped fork (fig. 1), ruining the symmetry of that particular tree. In winter, trees with this structural weakness are particularly subject to injury, for a heavy load of ice or snow, when accompanied by wind, may in a few moments undo the care and attention of years. There are several ways of preventing this injury, but the best way is to prune away these double leaders when they form in the small tree. The elm, maple, and often the ash, gingko, and basswood form these forks unless carefully watched. The sweet-gum, pine, pin oak, and tulip, to name a few, seldom or never form them unless injured (pl. 26). A mechanical method of bracing has been developed and satisfactorily used, which will prevent serious injury or even total destruction of a tree.

In addition to breakage resulting from structural weaknesses, many large trees with decayed trunks and limbs break because the weight of ice or snow or the twisting by winds proves too much for their weakened condition. Here again mechanical bracing would have in many cases allowed these trees to stand for many years. This bracing, referred to as cabling, consists of tying the weakened limbs together with a flexible wire rope. This will not always stop breakage of limbs, but it will prevent large limbs from crashing through a roof or burying themselves in a flower border.

Training of the tree from the time it is planted, by the careful use of a pruning shear, is always much more satisfactory than the mechanical bracing necessary to hold poorly formed branches during storms. If a tree naturally grows as a single-leader type, every effort should be made to preserve this upright growing stem at the time it is planted. Instead of cutting back the top at planting time, the side branches should simply be removed or shortened enough to compensate for the loss of roots. Some trees cannot be grown as a single leader, though the formation of sharp forks can to some degree be checked by pruning.

The trunk of a tree is a cylinder with the active or growing portion restricted to the outside layer immediately under the bark. In a sharp "V" fork, the pressure from the additional layers formed at the outside each year forces the two cylinders apart. This allows insects and disease to enter. So poorly are these branches joined that even before the entry of in-



TYPE OF BRANCHING FOUND IN PIN OAK AND SWEET-GUM;
THESE SELDOM NEED BRACING.

TOOLS REQUIRED FOR CABLING.

sects and disease, they are often not capable of withstanding the grinding and twisting to which they are subjected during storms. They often pull apart, never moving in unison, with the result that strains are not transmitted to the single trunk below. In order to distribute the pressures these limbs must be held together with a cable. This forces the trunk to take up the strain, preventing injury to the tree.

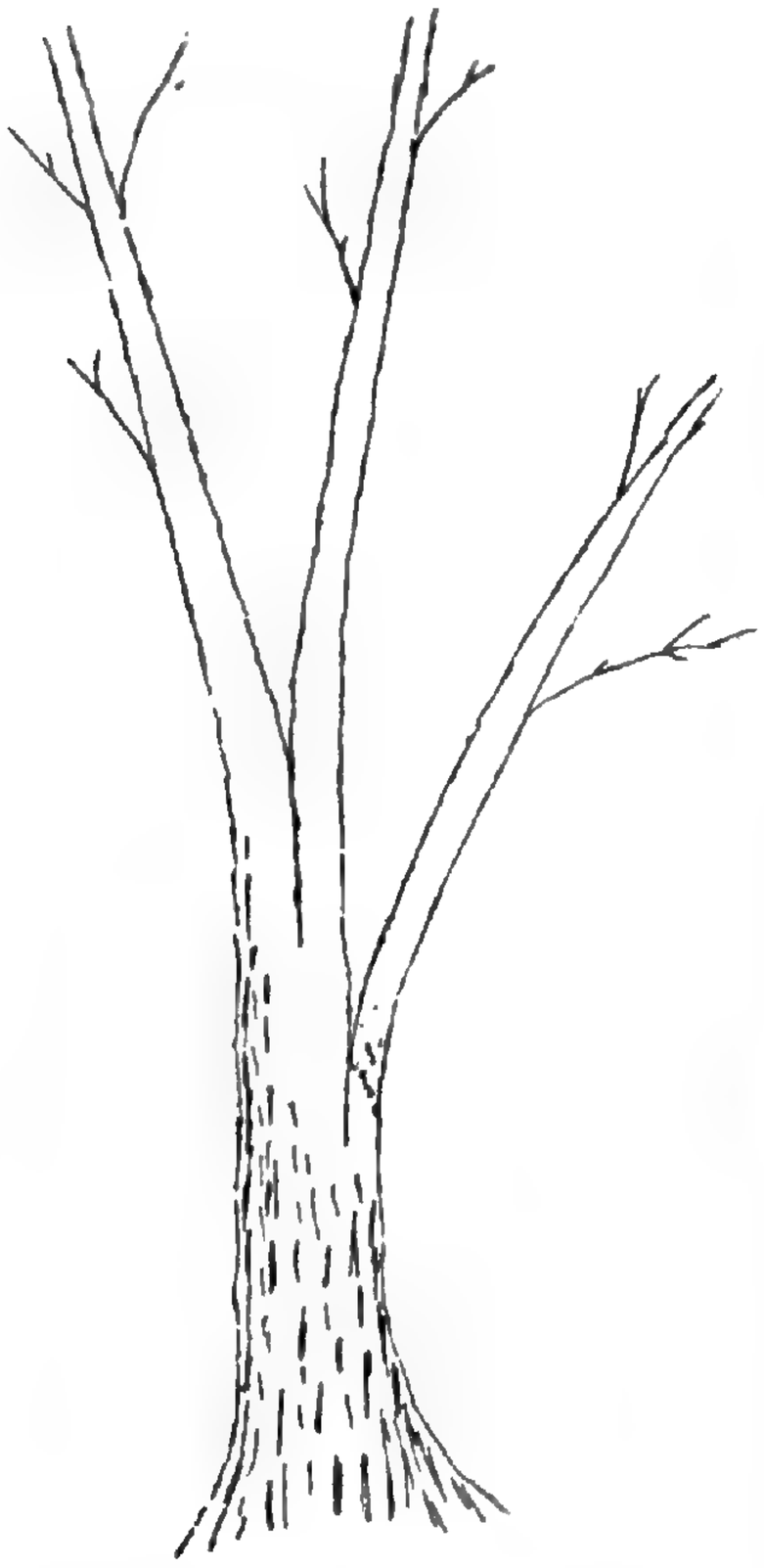


Fig. 1. Two sharp crotches, typical of elm, which careful pruning would have corrected.

Years ago iron bands were frequently placed around a tree to prevent splitting. These bands effectively shut off the flow of sap, and often caused as much harm as might wind. Some of these "banding" devices were equipped with turnbuckles and other ingenious accessories permitting them to be loosened as the tree grew in diameter. These methods all had the same fault; they required some adjustment at least once a year to prevent the girdling of the branch they were installed to protect. Before the introduction of flexible wire, heavy chain was used. The writer removed some chains from elms in New England, which in size and weight closely resembled those used as battleship anchor. Such a chain if properly installed would not wear out nor break, but it could never be stretched taut.

To-day screw hooks are used in place of bands encircling the tree, and flexible cable replaces the chain. These hooks are turned into holes bored in the tree. The large hooks are five-eighths inch in diameter; the smaller are seven-sixteenths, or, for very small trees and light cable, one-quarter-inch hooks will be satisfactory. The cable may be from one-eighth to five-sixteenths inch in diameter. Rope thimbles are used to prevent wearing of the cable. Plate 27 shows some tools used for this work.

The first step in cabling is boring holes for the hooks (pl. 28, fig. 1). The cable to be most efficient should be placed

from two-thirds to three-quarters of the distance up from the fork to be braced. The hooks must face each other to prevent bending when subjected to strain, and must be turned in far enough so that the opening is closed by another half turn after the cable is fitted. After the hooks are in place the distance apart should be accurately measured with a tape-line. If the work is done in winter the cable need not be shortened, but in the summer the cable should be shortened one inch for every ten feet in length. This is necessary to keep the cable taut after the leaves have fallen. Next the cable is cut, enough being left to pass around the thimbles and wrap back (pl. 29, fig. 1) on itself. The cable is now ready for installation. In most cases it will be found necessary to use a block and falls to pull the limbs close enough to permit slipping the cable over the hooks. Paint must be used wherever tools have scratched the bark of the tree or the galvanizing on the cable.

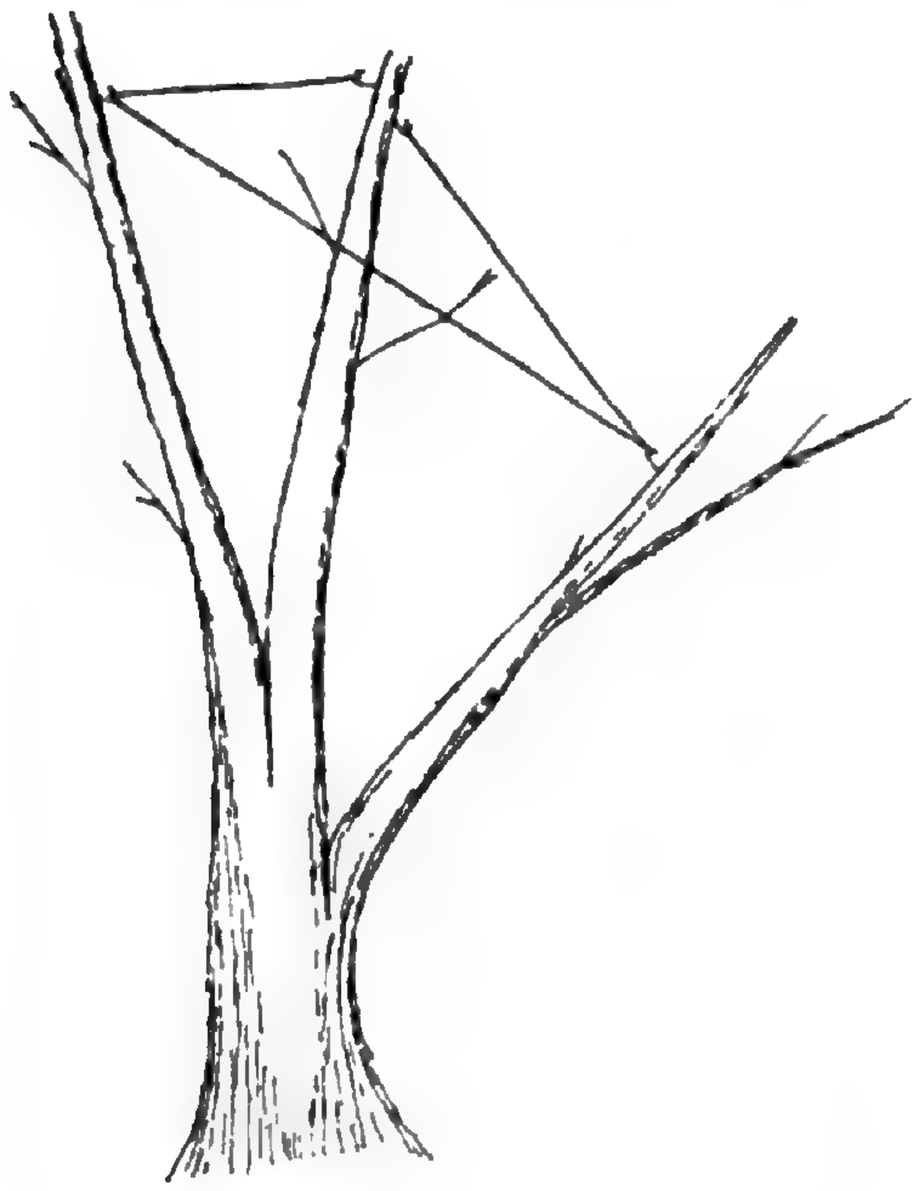


Fig. 2. Type of bracing necessary in multi-leader tree developing sharp crotches.

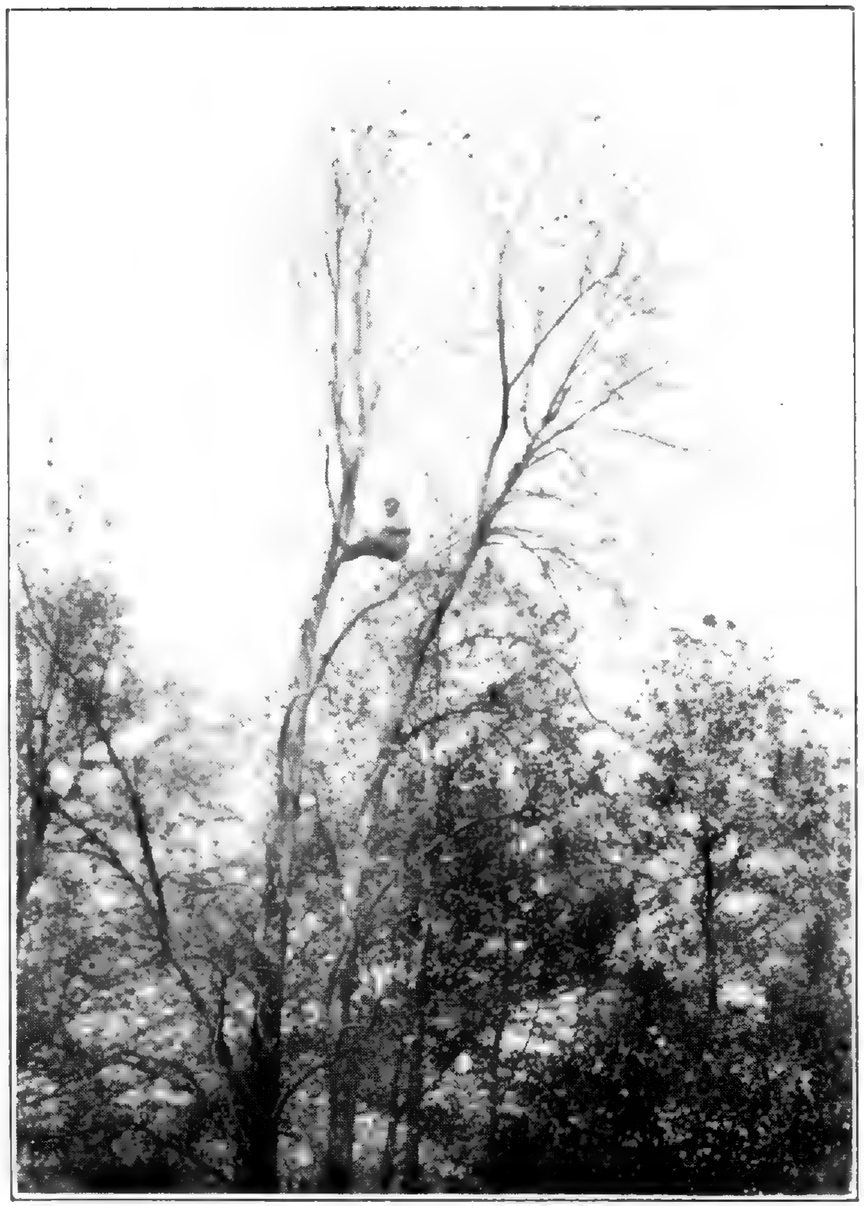
Frequently, as in the case of most large elms, every branch joins the trunk through one of the sharp forks. Then it is necessary to cable every large limb, as in fig. 2. This method successfully transfers all movement to the trunk below the forks. The top then moves and sways as a unit, each limb taking up its share of the pressure. To be most efficient all cables must be equally taut. Sometimes small limbs break off above the cables, but these are quickly replaced if the tree is growing vigorously.

A. P. B.

ARBORICULTURAL DEVELOPMENT IN THE MISSOURI BOTANICAL GARDEN

(Extracts from a paper read by Mr. L. P. Jensen, Arboriculturist to the Missouri Botanical Garden, at the convention of the American Institute of Park Executives, Toronto, Canada, September 29, 1931.)

During the lifetime of Mr. Shaw the location of the Garden was in the suburbs of St. Louis, well removed from buildings



WORKING IN A SLING, MAKING HOLES FOR LAG HOOKS.

INSERTING LAG HOOK.

METHOD OF WRAPPING CABLE.

CABLE AFTER INSTALLATION, SHOWING LAG HOOK TURNED UP.

and factories, but as the years passed the City grew not only to the Garden but far beyond. The excellent collection of coniferous evergreen trees was the first to show the injurious effect of smoke, by which they were subsequently killed. All other trees were badly stunted. How serious the effect of smoke eventually became may be realized from the following quotation from the thirty-fifth annual report of the Director, January, 1924:

"The history of other botanical gardens established within city limits has been that eventually they have been compelled to move to other localities, either because of the difficulty of properly growing plants in a city atmosphere or in order to obtain additional room for expansion. For years it has been recognized that it is not possible to grow to perfection many trees and plants at the Garden, this difficulty being experienced in the greenhouses as well as outdoors, and it was felt that there was no other alternative than to abandon the present location. On the other hand, the necessity for giving up the present accessible location seemed to be unfortunate. By far the greater number of visitors to the Garden came by street car or on foot. Actual counts made on Sunday afternoons when 10,000 or more people were at the Garden showed that not more than 15 per cent came by automobile.

"To move the Garden outside the city to a distance sufficient to insure its favorable location for the next fifty or one hundred years would at once greatly reduce its influence as a recreational and educational institution. The visit of schools and similar groups in a body would be practically eliminated. To abandon the present location of the Garden would likewise involve the moving of the library, herbarium, and laboratory, as well as the two schools maintained at the Garden. With many commercial and educational institutions of the city dependent upon these branches of the Garden for assistance and advice, it would seem unfortunate to make them so much less accessible than they now are. We were thus faced with the absolute necessity of finding a more favorable location for the growing of the material used at the Garden, coupled with the very great desirability of maintaining the efficiency of the Garden by keeping it within the reach of the public, two horns of a dilemma which appear to be irreconcilable. After careful consideration the solution of this problem seems to be to leave undisturbed, at least for the present, the buildings and grounds of the present location, together with its scientific and educational features, but to maintain it as a show place, much as it has been in the past, and to acquire land outside of St. Louis where much of the indoor floral display material and the plants and trees to be used outside can be grown; in other words, to regard the present improved portion of the Garden as the city showroom, and to have the factory away from the poisonous atmospheric conditions of the city where the best possible results can be produced. The primary object of securing land at a considerable distance from the city would be for the purpose above indicated, but steps would be taken at once to develop a real arboretum, and there should also be secured a considerable area of natural forest with its undergrowth,

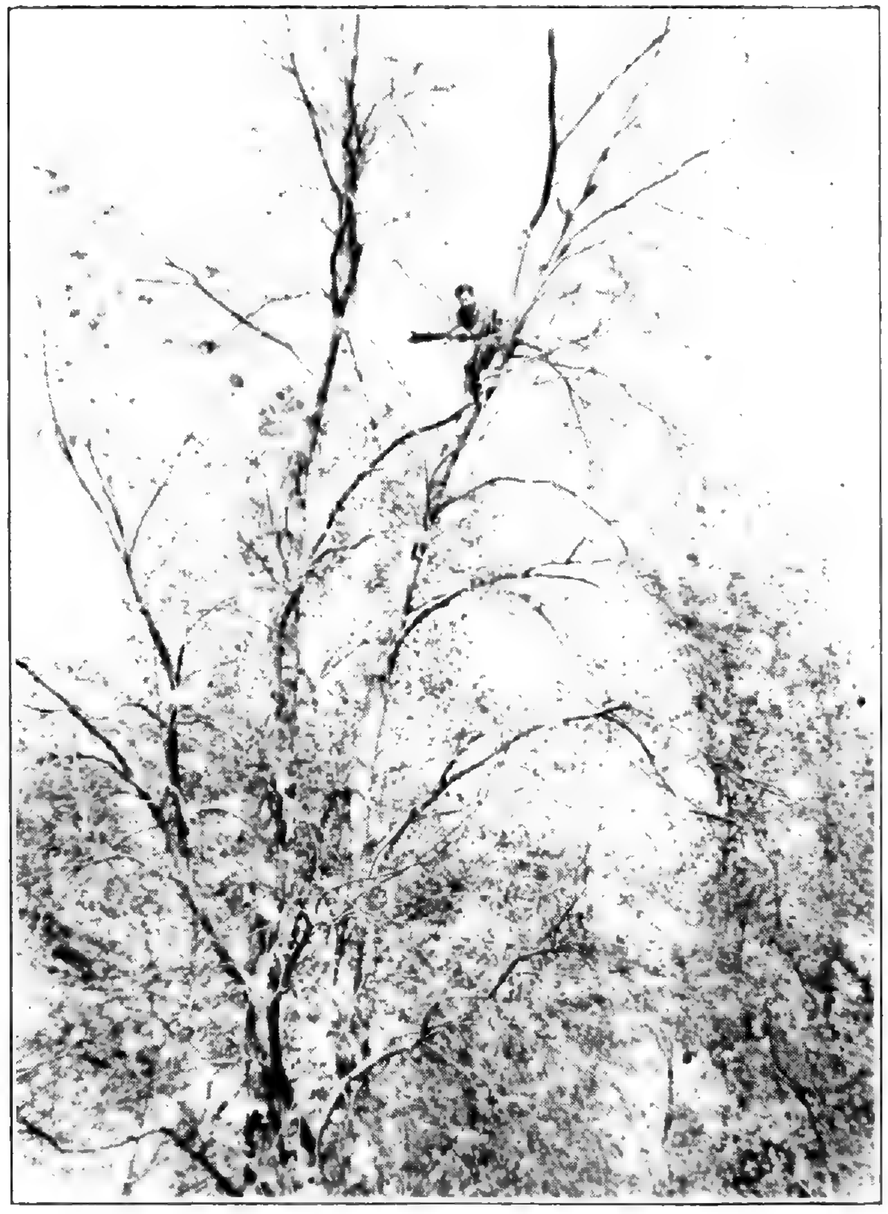
which could be preserved for all time as a reservation. It should also be borne in mind that many years hence this location would probably become the new botanical garden."

Two years were taken to inspect various locations, in an attempt to find one that would have all the requirements for the successful growing of plants and the making of a great botanic garden and arboretum for all future time. The following requirements seemed to be of greatest importance:

1. A location away from the injurious effect of smoky atmosphere, not only temporarily but for generations to come.
2. An area large enough to forestall the necessity of additions in the future, and to have this in one section or unit and not bisected by public roads.
3. The property to be easily reached by means of main highways and railroads.
4. The tract to have diverse conditions of soils and moisture, as well as exposures, plains, hills, and valleys, for the growth of as great a variety of plants as may be grown in the state of Missouri.
5. To contain at the time of acquirement a large area of woodlands and a great variety of native plants.

The tract eventually secured conforms as nearly as possible to all the above requirements, and is known as the Missouri Botanical Garden Extension. It is located in the beautiful foothills of the Missouri Ozarks, one mile west of the town of Gray Summit, thirty-seven miles southwest of the city limits of St. Louis, on the Manchester Road (U. S. 66), the main highway between Chicago and Los Angeles, near the station of Gray Summit on the Missouri Pacific Railroad. It contains 1,600 acres, with the Meramec River flowing through the property for two miles and dividing it in two sections. The south section, which consists of three hundred acres, was bought for the purpose of giving the Garden possession of both sides of the river and thereby prevent undesirable developments. The section north of the river, on which the Garden is now being developed, contains 1,300 acres. The soil varies from dry limestone glades to the river meadows of a rich loess soil formation, with sandstone and sandy soil on the eastern part of the property. Nearly one-half the property is covered with arboreous growth, deciduous material predominating except surrounding the limestone glades and on the limestone cliffs. Here the red cedar (*Juniperus communis* var. *canadensis*) forms the principal arboreous vegetation, but it is intermingled with post oak

CABLE PLACED AT ABOUT TWO-THIRDS THE DISTANCE BETWEEN FORK AND TOP.



CABLE IN PLACE.

(Quercus stellata), dwarf hackberry *(Celtis occidentalis* var. *pumila)*, Carolina buckthorn *(Rhamnus caroliniana)*, southern buckthorn *(Bumelia lanuginosa)*, ninebark *(Physocarpus opulifolius)*, fragrant sumac *(Rhus canadensis)*, and several species of native roses. Along one of the west hillsides the sugar maple *(Acer saccharum)* is common, and along the river and creeks is found an abundance of the red or river birch *(Betula nigra)*, Drummond's maple *(Acer rubrum* var. *Drummondii)*, silver maple *(Acer saccharinum)*, box elder *(Acer Negundo)*, sycamore *(Platanus occidentalis)*, pin oak *(Quercus palustris)*, and several species of willows.

Elsewhere on the upland plains and hillsides where the soil is rich is found the black walnut *(Juglans nigra)*, butternut *(Juglans cinerea)*, Kentucky coffee tree *(Gymnocladus dioica)*, several species of hickory and oak, hackberry *(Celtis occidentalis)*, the thorny and thornless honey locust *(Gleditsia triacanthos* and its variety *inermis)*, and various other trees. As an undergrowth and at the edges of woods there is a variety of small trees and shrubs, among which might be mentioned as the most abundant: smooth sumac *(Rhus glabra)*, dwarf sumac *(Rhus copallina)*, black haw *(Viburnum rufidulum)*, flowering dogwood *(Cornus florida)*, stiff cornel *(Cornus femina)*, panicled dogwood *(Cornus racemosa)*, redbud *(Cercis canadensis)*, prairie rose *(Rosa setigera)*, and Indian currant *(Symphoricarpos orbiculatus)*. The woodlands are in places richly draped with vines, such as native grapes (Vitis), Virginia creeper *(Ampelopsis quinquefolia)*, species of Smilax, and others. A count of the species of plants naturally growing on the grounds resulted in a list of 700, of which 600 were herbs, 64 trees, and 36 shrubs.

The main divisions for the general plan of development are as follows:

1. Service and experimental areas.
2. The Pinetum.
3. Section for exotic plants.
4. Area devoted to North American plants.
5. Orchards.
6. Main display grounds.

The service and experimental areas include the growing houses and nurseries. There are eleven greenhouses, 30 x 100 feet, devoted primarily to housing and growing the Garden's collection of orchids, which is conceded to be the largest and most complete of any similar institution in the world. From the point of an arboriculturist, probably the most interesting feature of the Garden is the nurseries. At present they

comprise an area of about eight acres, and contain more than 1,000 varieties of trees and shrubs. New kinds are constantly coming in from all parts of the world, in the form of seeds, cuttings, or small rooted plants. About one acre of the nurseries is covered with seed-frames in which are grown many thousands of plants.

In the Pinetum, an area of about seventy-five acres, is grown a collection of coniferous evergreens. Several thousand trees have already been set out in this section, and the planting will be completed as the trees in the nursery become sufficiently large to move. There are now 210 species and varieties of conifers, and others will be added until the collection includes all those which prove to be hardy in this section of the country. Since only three coniferous trees are native to Missouri, the red cedar *(Juniperus communis* var. *canadensis)*, the longleaf pine *(Pinus echinata)*, and the bald cypress *(Taxodium distichum)*, and since comparatively few species have been thoroughly tested in this locality, the Pinetum will undoubtedly become a most valuable experimental ground.

The exotic section, which will be devoted to foreign plants, is now being prepared for planting.

Large tracts of land, including the woodland, rocky bluff, and ravines, will be given over to the collection of North American plants. Seven miles of trails have been cleared through these regions, making them accessible for study and affording an opportunity for naturalizing plants along their borders. Advantage has been taken in locating these trails to open up extensive vistas into the surrounding country, greatly increasing the interest and beauty of the property. Along one of these trails was found a natural situation for a great rock garden. Along another, where the soil is of a sandy consistency, with shade, leaf mold, and moisture, are grown ericaceous plants, such as rhododendron and mountain laurel, several thousand rhododendron having already been planted. Showy flowering small trees, as the redbud *(Cercis canadensis* and var. *alba)*, white and pink-flowered dogwood *(Cornus florida* and *Cornus florida* var. *rubra)*, service-berry *(Amelanchier canadensis)*, and wild plum *(Prunus americana)* are being propagated in quantity for planting along these trails.

In a special area, on opposite hillsides, one thousand Japanese flowering cherries and one thousand flowering crab-apples have been set out. To demonstrate the possibility of fruit growing an apple orchard of twenty acres has been established, with an additional area for new varieties of

apples. Plantations of other fruit trees will be made later. An orchard for the growing of all sorts of nut trees has also been started. Comparison is also being made between trees and shrubs grown in the Extension and at the Garden in St. Louis, and much valuable information is being secured thereby.

The establishment of a really great arboretum at Gray Summit, Missouri, should be of great value to horticulturists and park executives, by introducing to them many new trees and shrubs not heretofore known to be adapted to the variable climatic conditions of the middlewestern states.

In addition to the gardens in St. Louis and Gray Summit, the Garden maintains a tropical experimental station of about three acres in Balboa, Canal Zone, Central America.

From what has been indicated in this paper, the Missouri Botanical Garden, with its extensive library on botany and horticulture, its great herbarium, large collections of living plants both outdoors and under glass, is an institution of world-wide influence, whose facilities and resources are available to any one irrespective of nationality. Its correspondents are everywhere, and its publications go to every corner of the globe.

L. P. J.

NOTES

Dr. George T. Moore, Director of the Garden, spoke before the Missouri Historical Society, October 23, on "Henry Shaw and his Garden."

A party of delegates of the Social Order of the Beauceant of the World, en route to their annual assembly, at Atlantic City, visited the Garden, September 21.

Mr. G. H. Pring, Superintendent of the Garden, spoke before the Roosevelt School Mothers' Circle at the Roosevelt High School, September 23, on "Insects and Flowers."

Mr. George H. Pring acted as judge at the flower show of the Adams School, September 25, and that of the Oak Hill School, October 1.

Dr. Moore is the author of an article in "The Modern View," September 10, on "Shaw's Garden—What It Does for St. Louis," and one in the "United States Daily," September 18, on "Missouri's Collection of Orchids."

The "Science News Letter" for September 19 contains an article "Orchids that Look like Girls" in which orchids from the Missouri Botanical Garden are described and illustrated.

Mr. L. P. Jensen, Arboriculturist to the Garden, spoke before the Franklin County School Teachers' Conference, Union, Mo., September 4, on "Planting of School Grounds and Its Relation to Conservation."

Mr. L. P. Jensen attended the convention of the American Institute of Park Executives, at Toronto, Canada, September 28—October 2, and on October 29 read a paper "Arboricultural Development in the Missouri Botanical Garden."

Mr. L. P. Jensen acted as judge at the flower show at Sullivan, Mo., September 18, and has been appointed a judge of the Missouri State Highway Beautification Contest for 1931, sponsored by the Missouri State Highway Department.

Recent visitors to the Garden were Dr. C. B. Davenport, director department genetics, Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbor, N. Y., and Prof. Dwight M. Moore, professor of botany, University of Arkansas, Fayetteville, Ark.

Volume XVIII, No. 3, of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has recently been issued with the following contents: "The Polyporaceae of Colorado," Paul Franklin Shope; "Alpova, a New Genus of Rhizopogonaceae, with Further Notes on Leucogaster and Arcangeliella," Carroll W. Dodge; "The Chromosome Complements of *Allium stellatum* and *Nothoscordum bivalve*," Edgar Anderson; "Hymenomycetous Fungi of Siberia and Eastern Asia, mostly of Wood-destroying Species," Edward Angus Burt.

STATISTICAL INFORMATION FOR SEPTEMBER, 1931

GARDEN ATTENDANCE:

Total number of visitors.....30,627

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	32
Total number of books and pamphlets donated.....	321

PLANT ACCESSIONS:

Total number of seed packets donated.....	26
Total number of plants donated.....	12

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad, B. W. I.....	116
Hassler, Mildred M.—Plants of southern California.....	280
Herter, Dr. G.—Plants of Uruguay.....	116
Jörgensen, Dr. Pedro—Plants of Paraguay.....	218
Killip, Ellsworth P.—Plants of Colombia, collected by Mr. Klug	503

By Gift—

Bettis, Mrs. W. R.—*Pyrus baccata* L. from Missouri.....	1
Clark, Dr. Ora M.—Plants of Texas.....	114
Elrod, Mrs. Jennie M.—*Salix humilis* Marsh. from Oklahoma	1
Greenman, Dr. J. M.—Plants of Utah.....	196
Keck, Dr. David D.—Plants of California.....	121
Kellogg, John H.—Plants of Missouri.....	2
Lewis, H. G.—*Iva xanthiifolia* Nutt. from Missouri.....	1

By Exchange—

O'Neill, Rev. Hugh—Plants of Florida and Brazil.....	137
Total	1,806

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12. to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

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TROPICAL STATION, BALBOA, CANAL ZONE

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Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

MISSOURI BOTANICAL GARDEN BULLETIN

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TROPICAL LILY POND, NEAR MAIN GATE, NOVEMBER 23, 1931

Missouri Botanical Garden Bulletin

Vol. XIX NOVEMBER, 1931 No. 9

ALL-THORN

All-thorn *(Koeberlinia spinosa* Zuccarini*)* is one of the most curious shrubs of the deserts of southwestern Texas and northern Mexico. From a distance it may be recognized by its light green color and by its rather indefinite, hazy, appearance (pl. 32). Upon approaching closely to the plant the cause of this indefinite appearance is very evident. All-thorn apparently consists of nothing but thorns; much branched interlocking vicious thorns; round, green, thorns, tapering abruptly near the end into short, strong, stiff needle-sharp points; thorns so intricately branched that the progress of cattle and horses through thickets of the plant is absolutely impossible. Aside from the inevitable lizards and snakes of the desert, fire is the only thing that can make its way unharmed through a mass of all-thorn.

These wickedly pointed thorns are branches. In their youth they put forth tiny scale-like leaves which very soon drop off, leaving no forage for chance grasshoppers. The green thorns then carry on the food-making processes of the plant. The green cells of the thorns are surrounded by an outer layer of colorless transparent cells having extremely thick outer walls that are impervious to water. Through tiny pores deeply sunken in pits between the cells of the outermost layer, the plant tissues are ventilated.

By dropping its leaves, all-thorn reduces its exposed surface, and thus the area over which the plant might give off water. It manages to get along with a scant supply of water by not using very much. Desert plants have different means by which they get along with a scant water supply. Cacti hoard, in their stems, water against future needs; the century plant stores, in its leaves, the food and moisture that will

be needed many years hence at the time when the plant flowers.

Small clusters of greenish-white flowers look out of place upon the spines of all-thorn. The flowers are constructed on the plan of four, four sepals, four petals, and eight stamens. The pistil later becomes a fleshy, black berry containing one or two seeds.

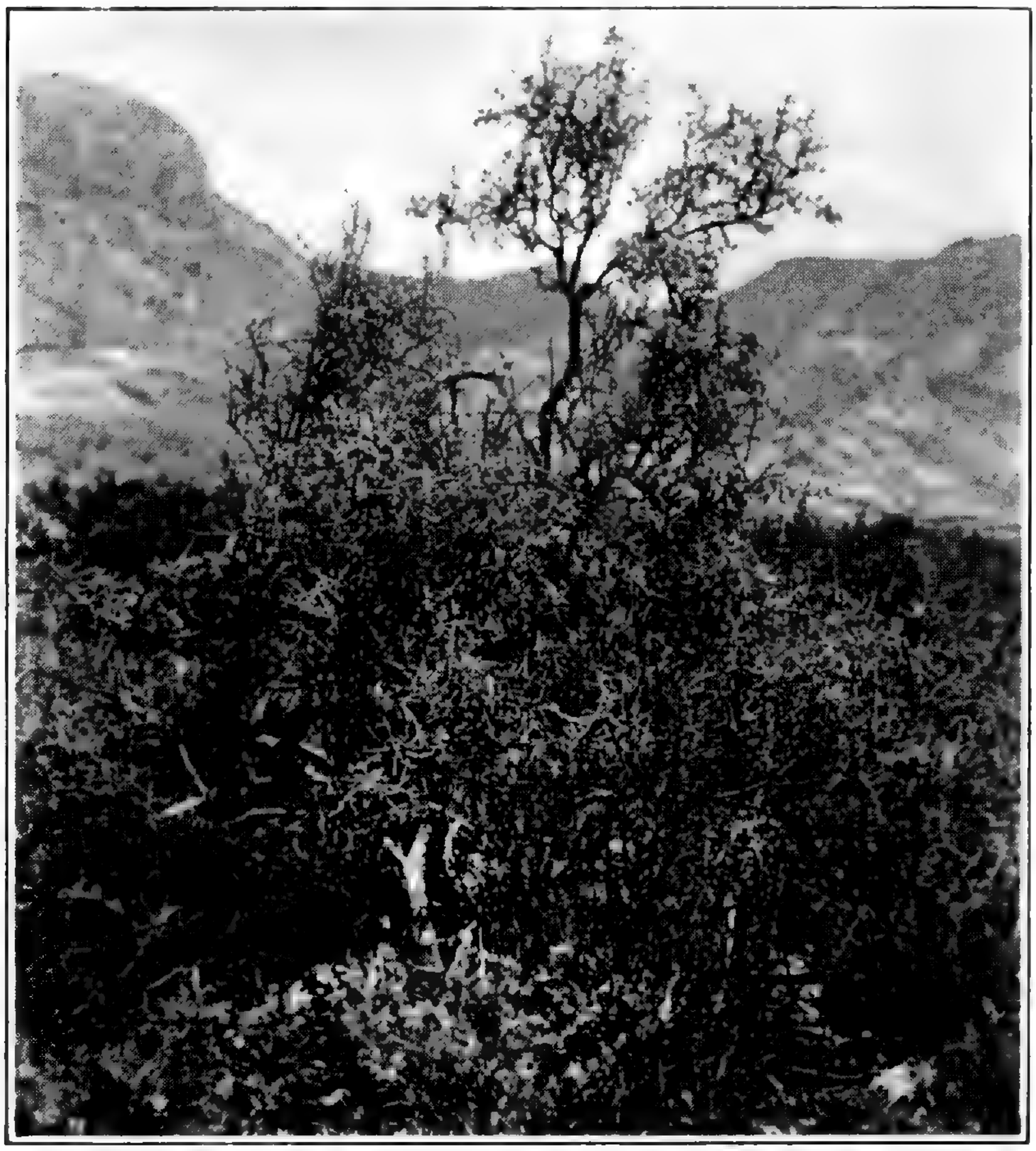
All-thorn was discovered growing in the desert regions of the state of Oaxaca, Mexico, by Baron Wilhelm Karwinsky, some time in the year 1830. He sent specimens to Dr. J. G. Zuccarini, botanist at the Botanic Garden and Herbarium of the Prince of Monaco. In the year 1832 Zuccarini printed the first description of this plant, naming it after a friend—C. L. Koeberlin (it is hoped with the best of intentions). Karwinsky introduced many kinds of Mexican plants, especially cacti, into the gardens of Europe. A genus of the buckthorn family was named in his honor, Karwinskia.

After Zuccarini had distinguished all-thorn as a new kind of plant, he had to say to which group of the flowering plants it belonged. He believed that it belonged in the Pittosporum family. Dr. Asa Gray thought that all-thorn belonged to the Orange family (Rutaceae). English botanists thought it most closely resembled members of the Ailanthus family. Dr. Engler, late Director of the Berlin Botanic Garden, many years ago cut the gordian knot by relegating all-thorn to a new plant family which he described as the Koeberliniaceae. More recently some botanists have come to believe that the Caper family is the one to which all-thorn should be assigned.

JOHN ADAM MOORE.

VEGETABLE MARBLE

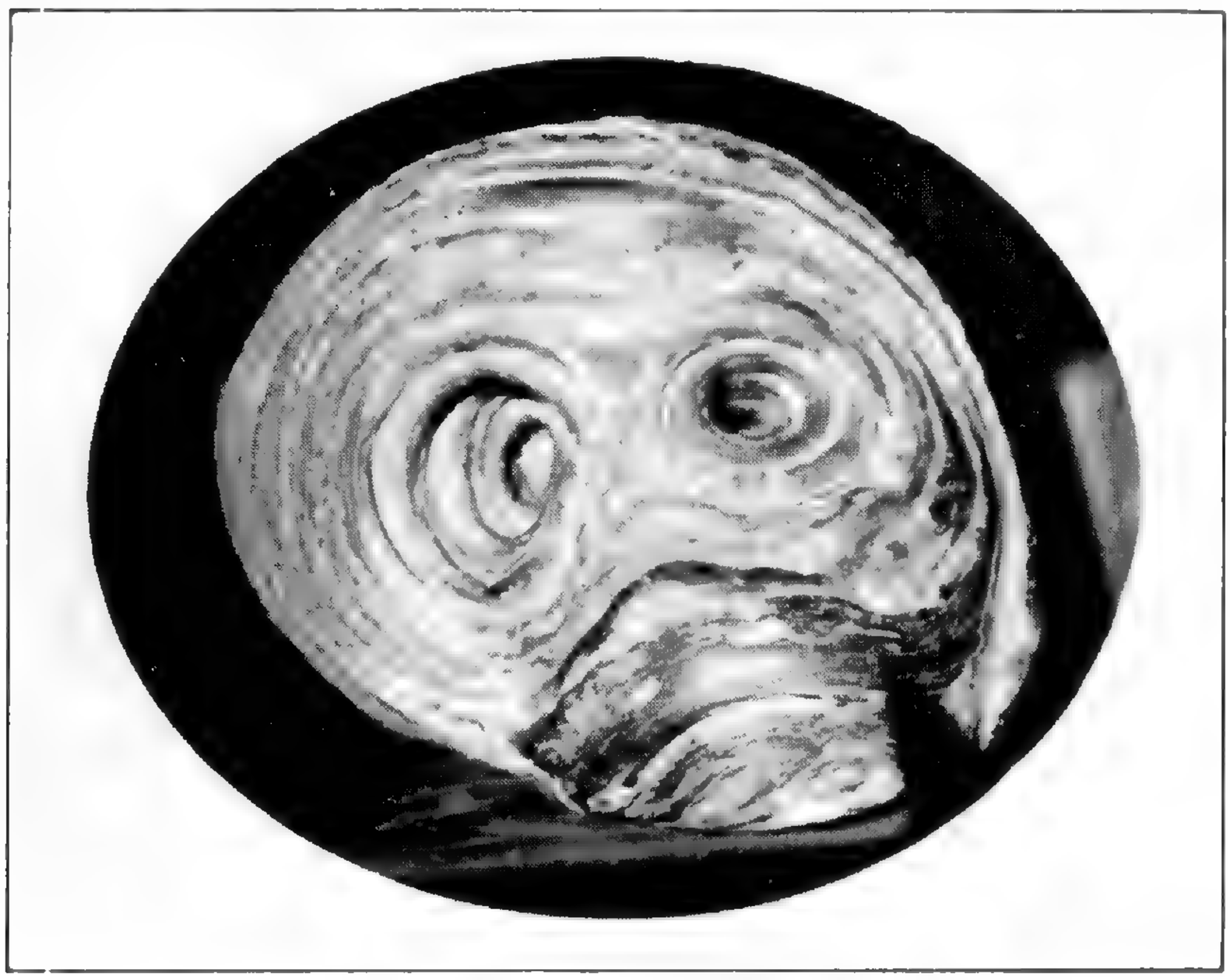
Any one who has admired the ornamental bowls carved from walnut or chestnut burls by skillful Spanish and Italian handcraftsmen has probably marvelled not so much at the graceful shape of the object as at the highly polished wood itself, the grain of which appears to have been swept by some unseen force into a maelstrom of contrasting and inextricably interwoven strata of varying density and color. One can scarcely resist the thought that such wood might be called the marble of the vegetable kingdom, since its beauty vies with that of the most exquisite marbles which have been quarried.

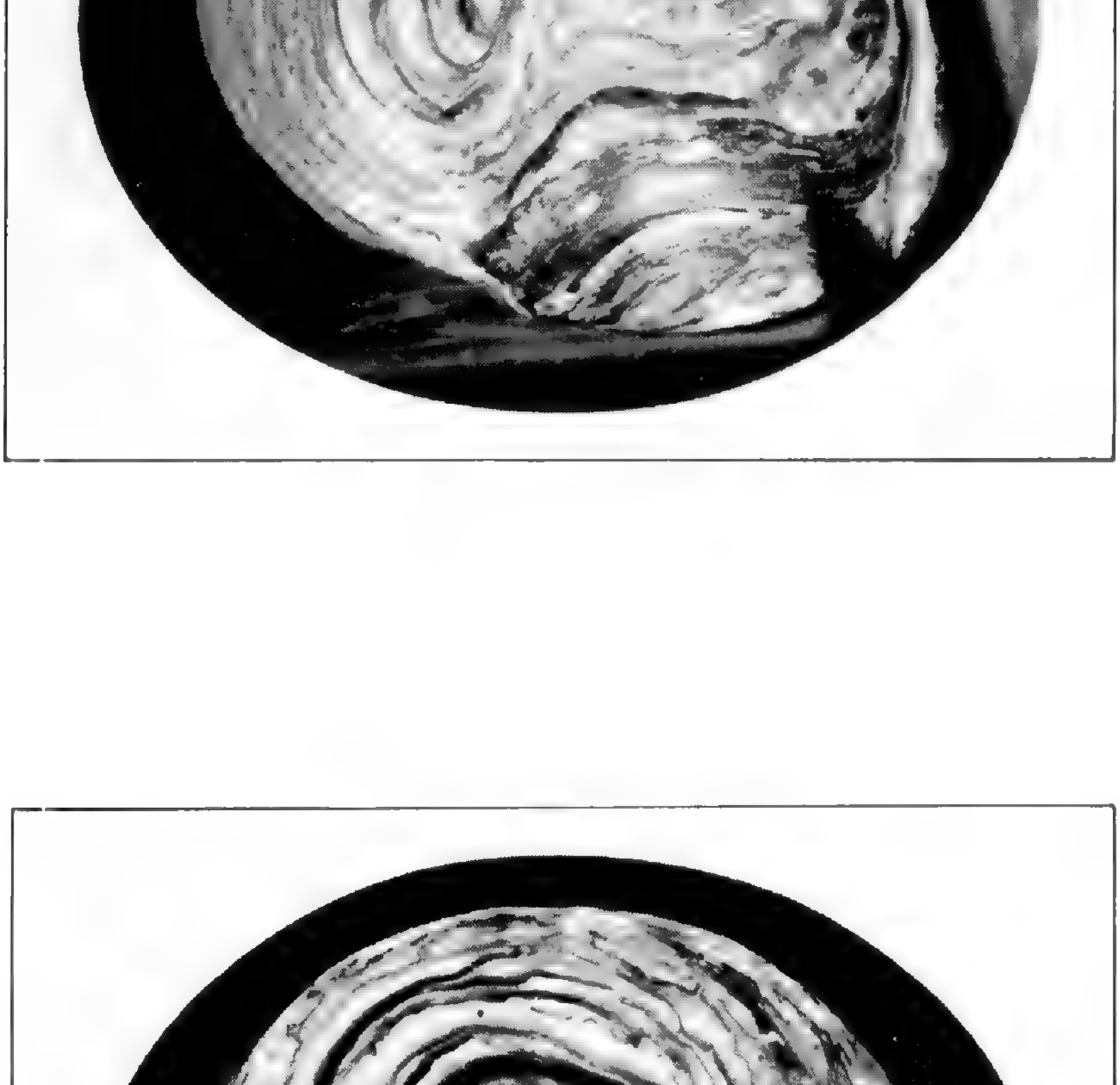


Plant growing near Chisos Mountains, Texas, showing tangled appearance of thorny branches.

Group of branches on which are borne clusters of small greenish-white flowers.

KOEBERLINIA SPINOSA





TWO VIEWS OF A BURL FOUND ON BLACK WALNUT, NEAR SEVENTY-SIX, MISSOURI

Burled wood is not only used as a medium for hand-carved objects, but is also in great demand for veneer work. For such a purpose, very thin slabs are cut from the burl and imposed upon the common wood used as a frame-work for furniture or a piece of interior finish. The beautifully grained sections are then frequently pieced together to form a natural design, as for a table top. It is in connection with its use in fine furniture designing that the similarity of marble and burled wood is most striking, for here they achieve much the same effect.

The analogy of marble and burled wood is a rather dangerous one when we wish to speak of the manner of origin of either. Marble is an example of what is known as "metamorphic" rock, and is in fact usually a sort of limestone which has become greatly changed from its original condition due to the inestimable pressure of the strata of rock overlying it, or to the action of intense heat or the irresistible power of the earth's internal movements. Burls are analogous to marble not only in superficial similarity in the polished product of handicraft, but also because they are a result of some abnormal incident, such as injury or disease in the tree. A small branch may be broken close to the trunk of the tree, for example, and in time the wound is healed over by the constantly multiplying fibers which constitute the wood. The successive layers of wood really inundate the wound, gradually wrapping it up within many folds of tissue for protection against the attacks of fungi and other causes of disease. It is the aggregation of such protective folds of wood, which are made unusually hard and durable as an added protection, which produces the curled and tangled grain so advantageously displayed in the polished surfaces of a piece of fine cabinet work.

In nature, burls assume awkward and occasionally grotesque forms before they are submitted to the skill of the craftsman. A particularly bizarre individual which was recently brought to the Garden by Mr. Lester Dean is reproduced in plate 33. This burl was found about three miles north of Seventy-six, Missouri, upon a tree which was presumably the black walnut, *Juglans nigra* L. It measures nearly a foot in each dimension. The burl apparently was the result of an injury or disease to two small adjacent branches, about which the healing tissue formed in increasing amounts until a natural graft was effected, producing the skull-like aspect.

R. E. W. Jr.

WINTER COURSE IN GARDENING FOR AMATEURS

During the past three years an elementary course in various phases of gardening has been conducted for amateurs at the Garden. Because of the interest that has been manifested in this type of instruction in the past, the course will be repeated in 1932. However, instead of offering it during the spring months, it will commence in January instead of March, since it is believed that the course will be of more value if it can be given earlier in the year. The class will meet in the lecture room of the museum building (entrance at Tower Grove and Cleveland Avenue gate) at 3:45 p. m., Tuesday afternoons of each week. The outline of the subjects to be discussed follows:

January 12—Brief discussion of catalogues, horticultural magazines, and bulletins. Illustrated lecture and instruction on growing plants from seeds and cuttings. The use of hot-beds and cold-frames.....Kohl

January 19—Trees and shrubs:
Prunning of shrubs at planting time.
Summer and winter pruning of trees and shrubs with relation to the time of bloom; i. e., trees and shrubs flowering in spring from buds formed the previous season; those blooming in summer on wood made during the current season.....Beilmann

January 26—Practical demonstration (students participating) in growing plants from seeds and cuttings.....Kohl

February 2—General care of trees; the importance of tree surgery and the use of fertilizers.....Beilmann

February 9—Iris, Peonies, Roses. Illustrated lecture.....Kohl

February 16—Lawns:
Seed lawns: Preparation of the soil, seed selection, fertilizers.
Stolon lawns: Methods of planting by means of stolons and plugging.
Lawns and their subsequent care.
Experimental lawn plots.....Pring

February 23—Transplanting seedlings grown from the seed sown on January 26.....Kohl

March 1—Controlling insect pests. Material to use..Beilmann

March 8—Water gardens. Illustrated lecture.
Construction of pools.
Preparation of soil and planting.
Caring for hardy and tropical water-lilies during growing season.
Propagation by seeds, tubers and leaves.
Breeding.
Winter storage.....Pring

March 15—Demonstration in pruning and spraying, including use of power and hand sprayers and dusters..Beilmann

March 22 —Practical demonstration in the greenhouse of potting seedlings, cuttings and larger plants.
Preparation of soil for sowing seeds outdoors..Kohl

March 29 —Annuals, perennials, bulbs. Illustrated lecture..Kohl

REGISTRATION: No previous notice of intention to join the course is necessary. Registration will take place in the lecture-hall of the Museum Building, Tower Grove and Cleveland Avenues, on Tuesday, January 12, at 3:45 P. M. Registration by letter, with check enclosed, will be accepted after January 1. Subsequent meetings will be held at the same hour on the dates indicated.

FEES: A fee of $5.00 payable at the time of registration will be charged.

PLANTS IN FLOWER IN THE GARDEN ON NOVEMBER 23, 1931

Owing to the unusually mild weather this fall, many things which normally bloom only in the spring have come into flower again. Plates 31 and 34 indicate the condition of the tropical day-blooming water-lilies which, well into November, have retained an appearance not unlike that presented during the hot summer, their normal blooming time. Below are listed, according to location, the plants found in bloom on November 23:

Rose Garden.

Hybrid teas
Hybrid perpetuals
Marie Pavic (Polyantha)
Katherine Zeimet (Polyantha)
F. J. Grootendorst (Hybrid rugosa)
Sarah Van Fleet (Hybrid rugosa)

Main Entrance.

Hardy chrysanthemums

Water Gardens.

Tropical day-blooming water-lilies (Nymphaea)
Hardy water-lilies (Nymphaea)

Iris Garden.

Iris "Quinnipiac"
Iris "Gold Imperial"
Iris "Dora Longdon"
Iris "Autumn King"
Iris "Lustre"

Medicinal Garden.

Mexican agrimony (*Agrimonia mexicana*)
Borage (*Borago officinalis*)
Chamomile (*Matricaria Chamomilla*)
Common rue (*Ruta graveolens*)
Black nightshade (*Solanum nigrum*)

PASTURE.

Shepherd's purse (*Capsella Bursa-pastoris*)
Day-flower (*Commelina communis*)
Galinsoga (*Galinsoga parviflora* and var. *hispida*)
Spiny-leaved sow thistle (*Sonchus asper*)
Wood sorrel (*Oxalis stricta*)
Common chickweed (*Stellaria media*)
Dandelion (*Taraxacum officinale*)

KNOLLS.

Yarrow (*Achillea lanulosa*)
Bear's ear (*Arctotis grandis*)
Ageratum (*Ageratum Houstonianum*)
Tartarian aster (*Aster tataricus*)
Pot marigold (*Calendula officinalis*)
Cockscomb (*Celosia argentea*)
Bachelor's button (*Centaurea Cyanus*)
Korean chrysanthemum
Cosmus
Delphinium (*Delphinium Belladonna*)
Garden pink (*Dianthus plumarius*)
California poppy (*Eschscholtzia californica*)
Gaillardia (*Gaillardia grandiflora*)
Cranesbill (*Geranium sanguineum*)
Sunflower heliopsis (*Heliopsis helianthoides*)
Stella sunflower (*Helianthus* sp.)
Heliotrope (*Heliotropium anchusaefolium*)
Candytuft (*Iberis sempervirens*)
Sweet alyssum (*Lobularia maritima*)
Sander's tobacco (*Nicotiana Sanderiana*)
Geranium (*Pelargonium zonale*)
Petunia
Salvia (*Salvia farinacea*)
Scarlet sage (*Salvia splendens*)
Sidalcea (*Sidalcea malvaeflora*)
Speedwell (*Veronica amethystina*)
Speedwell (*Veronica spicata*)
Violet (*Viola striata*)
Dwarf-flowered zinnia (*Zinnia* sp.)
Mayflower verbena (*Verbena hybrida*)

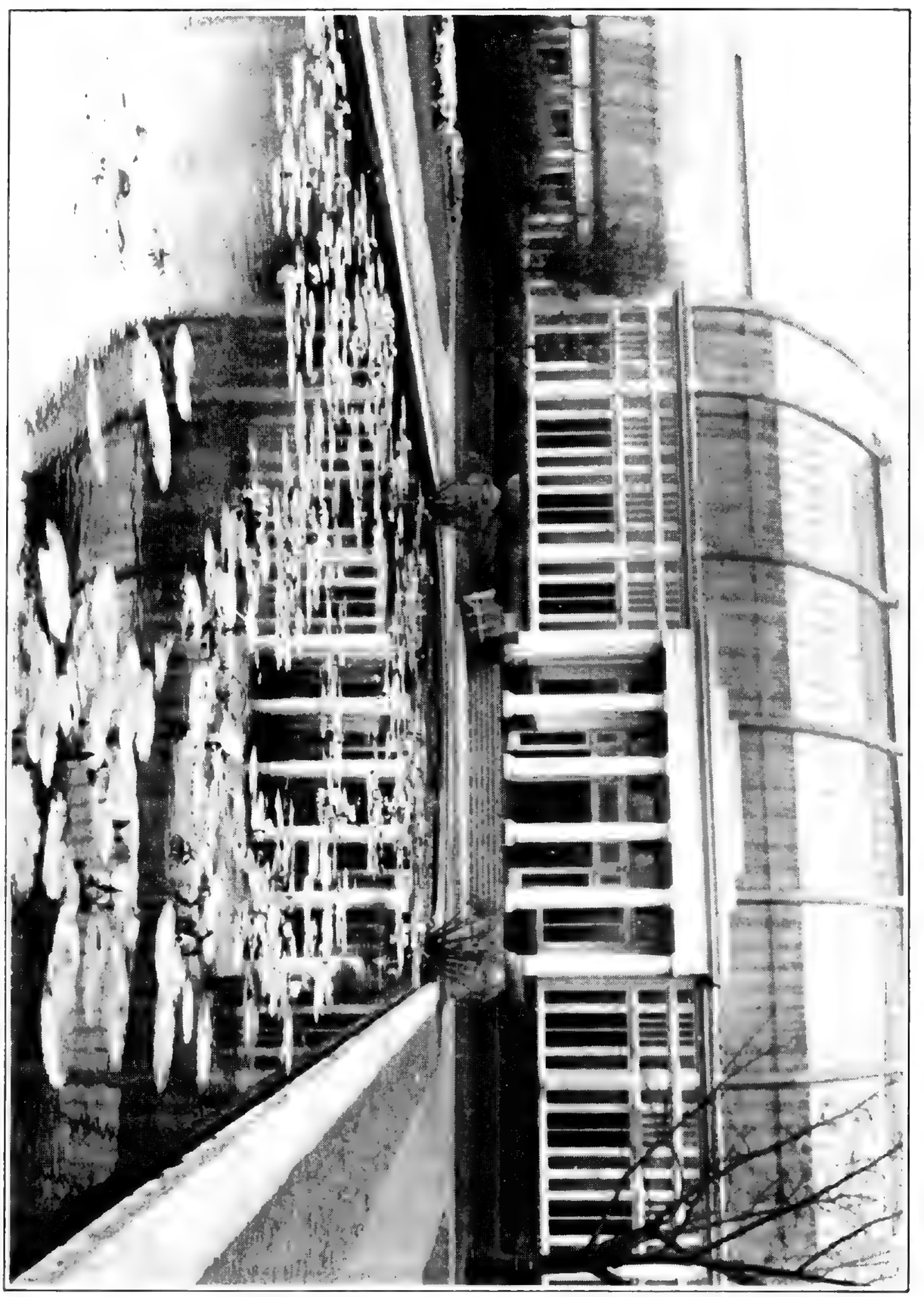
TREES, SHRUBS AND CLIMBERS.

Hawthorn (*Crataegus*)
Japanese quince (*Cydonia japonica*)
Golden-bell (*Forsythia intermedia*)
Fragrant honeysuckle (*Lonicera fragrantissima*)
Hall's honeysuckle (*Lonicera Halliana*)
Woodbine (*Lonicera Periclymenum*)
Saucer magnolia (*Magnolia Soulangeana* var. *Lennei*)
Bridal-wreath (*Spiraea prunifolia*)

GRAY SUMMIT EXTENSION.

White heath aster (*Aster ericoides*)
Aster (*Aster anomalus*)
American bell-flower (*Campanula americana*)
Annual fleabane (*Erigeron annuus*)
Narrow-leaved houstonia (*Houstonia angustifolia*)
Yellow wood sorrel (*Oxalis stricta*)
Tall goldenrod (*Solidago altissima*)
Elm-leaved goldenrod (*Solidago ulmifolia*)
Birdsfoot violet (*Viola pedata*)
Early blue violet (*Viola cucullata*)
Redbud (*Cercis canadensis*)

G. H. P.



TROPICAL LILY POND, IN FRONT OF MAIN CONSERVATORY, NOVEMBER 23, 1931

NOTES

The December number of the Ladies' Home Journal contains an illustrated article by Mr. G. H. Pring, Superintendent of the Garden, on "Glass Gardens."

The botany class of Christian College, Columbia, Mo., and the Biology Club of Central High School, St. Louis, visited the Garden recently and were conducted through the grounds, library, and herbarium by special guides.

Dr. George T. Moore, Director of the Garden, spoke before the Men's Garden Club of the Chicago Region, Chicago, Illinois, November 12, on "What Goes on Inside the Plant," and before the St. Louis Section of the American Society of Civil Engineers, at the Hotel Mayfair, October 26, on "The Plant Commonwealth." The talks were illustrated with moving pictures.

Mr. G. H. Pring, Superintendent of the Garden, has made the following talks recently: before the Parent-Teacher Association of the Avery School, Webster Groves, Mo., October 21, on "Pollination of Flowers"; before the Patrons' Association of the Sherman School, November 6, on "Mimicry in Plants"; before the South Side Republican Women's Club, at the German House, November 20, on "The Development of the Orchid From the Seed to the Mature Plant"; before the Practical Arts Club, November 20, on "House Plants and Glass Gardens."

STATISTICAL INFORMATION FOR OCTOBER, 1931

GARDEN ATTENDANCE:

Total number of visitors 40,599

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	36
Total number of books and pamphlets donated	189

PLANT ACCESSIONS:

Total number of seed packets donated	35
Total number of plants donated	6

HERBARIUM ACCESSIONS:

By Purchase—

Field Museum of Natural History—Photographs of type specimens	17
Moore, J. A., and J. A. Steyermark—Plants of Texas and Wyoming	305
Thompson, J. William—Plants of Washington	2,170
University of Minnesota—Reliquiae Holwayanae, Fasc. V and VI, Nos. 201-300, inclusive; and extra specimens	143

By Gift—

Berkley, E. E.—*Pinus Taeda* L. from Mississippi	1
Grout, Dr. A. J.—North American Mosses	2
Kellogg, John H.—*Chrysopsis* sp. from Missouri	1
Ledman, O. S.—*Monotropa uniflora* L. from Missouri	1

By Exchange—

Epling, Dr. Carl—Plants of southern California	127
U. S. National Museum, by Ellsworth P. Killip—Plants of South America	21
University of Arkansas, by Prof. D. M. Moore—*Gentiana flavida* Gray from Arkansas	1
Total	2,789

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Assistant to the Director

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Pathologist

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ROBERT E. WOODSON, JR.,
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Painter

GRAY SUMMIT EXTENSION

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Arboriculturist

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Farm

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Orchids

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TROPICAL STATION, BALBOA, CANAL ZONE

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Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XIX **DECEMBER, 1931** **No. 10**

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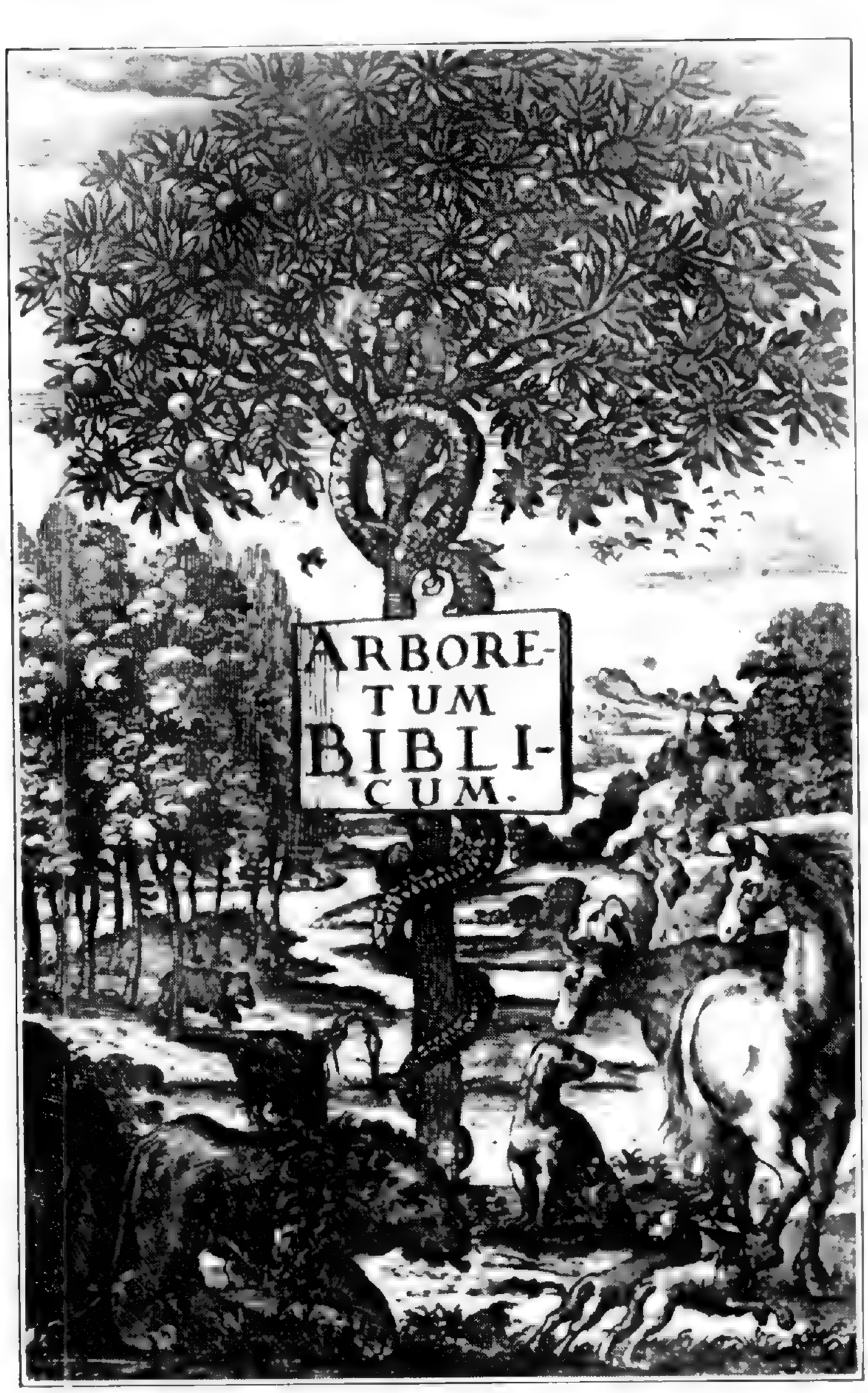


FRONTISPIECE FROM URSINUS', "ARBORETUM BIBLICUM."

Missouri Botanical Garden Bulletin

Vol. XIX DECEMBER, 1931 No. 10

PLANTS OF THE BIBLE

Interest in the plants mentioned in the Holy Scriptures dates from very early times. The oldest book on this subject in the Garden library appeared in 1568. The title in full follows: "Similitudinum ac parabolarum quae in Bibliis ex herbis atque arboribus desumuntur dilucida explicatio: in qua narratione singula loca explanantur, quibus Prophetae, obseruata stirpium natura, conciones suas illustrant, diuinaque oracula fulciunt. Levino Lemnio Sacrarum Literarum studioso auctore." There followed in 1595 Franciscus Vallesius' "De iis quae scripta sunt physice in libris sacris, sive de sacra philosophia." In 1665 Johannus Henricus Ursinus published his "Continuatio historiae plantarum Biblicae, sive 1. de sacra phytologia, 2. Herbarius sacer, & 3. Hortus aromaticus cum sylva theologiae symbolicae recusa." Twenty years later appeared "Arboretum Biblicum" by the same author. This work contains somewhat diagrammatic illustrations of some of the more important plants and goes deeply into the origin of their names, considering the original Hebrew and Greek (pl. 35).

Perhaps the most complete discussion of the plants of the Bible previous to the nineteenth century was by Solomon Pfister, which appeared in 1725. Although published in one volume it is divided into two parts, the first 488 pages being devoted to trees and woody vines and shrubs, and the last 278 pages to herbs. Elaborate indexes referring both to the scriptures and to the names of plants are included (pl. 36).

As the knowledge of the flora of the Holy Land increased, much additional light was thrown upon the plants referred to in the Bible, and the last century produced numerous works along this line. In 1842 appeared the "Scripture Herbal" of Maria Callcott, in which is incorporated most of the infor-

mation contained in the "Hierobotanicon" of Celsius, Rosenmüller's "Mineralogy and Botany of the Bible," and others.

In 1858, J. H. Balfour, Regius Keeper of the Edinburgh Botanic Garden, published a small volume illustrated with colored plates on "The Plants of the Bible: Trees and Shrubs" in which he said: "In the sacred writings there are frequent allusions made to the vegetable kingdom. While plants, like the other works of the Almighty Creator, are well worthy of study they are especially so when we view them in connection with the Scripture. In order to see fully the lesson which is to be taught, it is necessary that we should be acquainted with the plant to which reference is made. Want of knowledge in this respect has hid much of the beauty and force of many a parable."

Henry Shaw appears to have been greatly interested in the subject and grew as many of the plants mentioned in the Bible as could be obtained or determined with reasonable accuracy. It should be remembered that at the time of the various revisions of the English Bible comparatively little attention was given to botany by the revisers. The consequent lack of knowledge concerning plants of a given region led to doubtful or inaccurate translations of the Hebrew and Greek names. Then there is the usual confusion due to the use of so-called "common names." The sycamore tree of the Bible is not the one that we now know by that name. Nor is the mulberry of the Scripture the common tree now so designated.

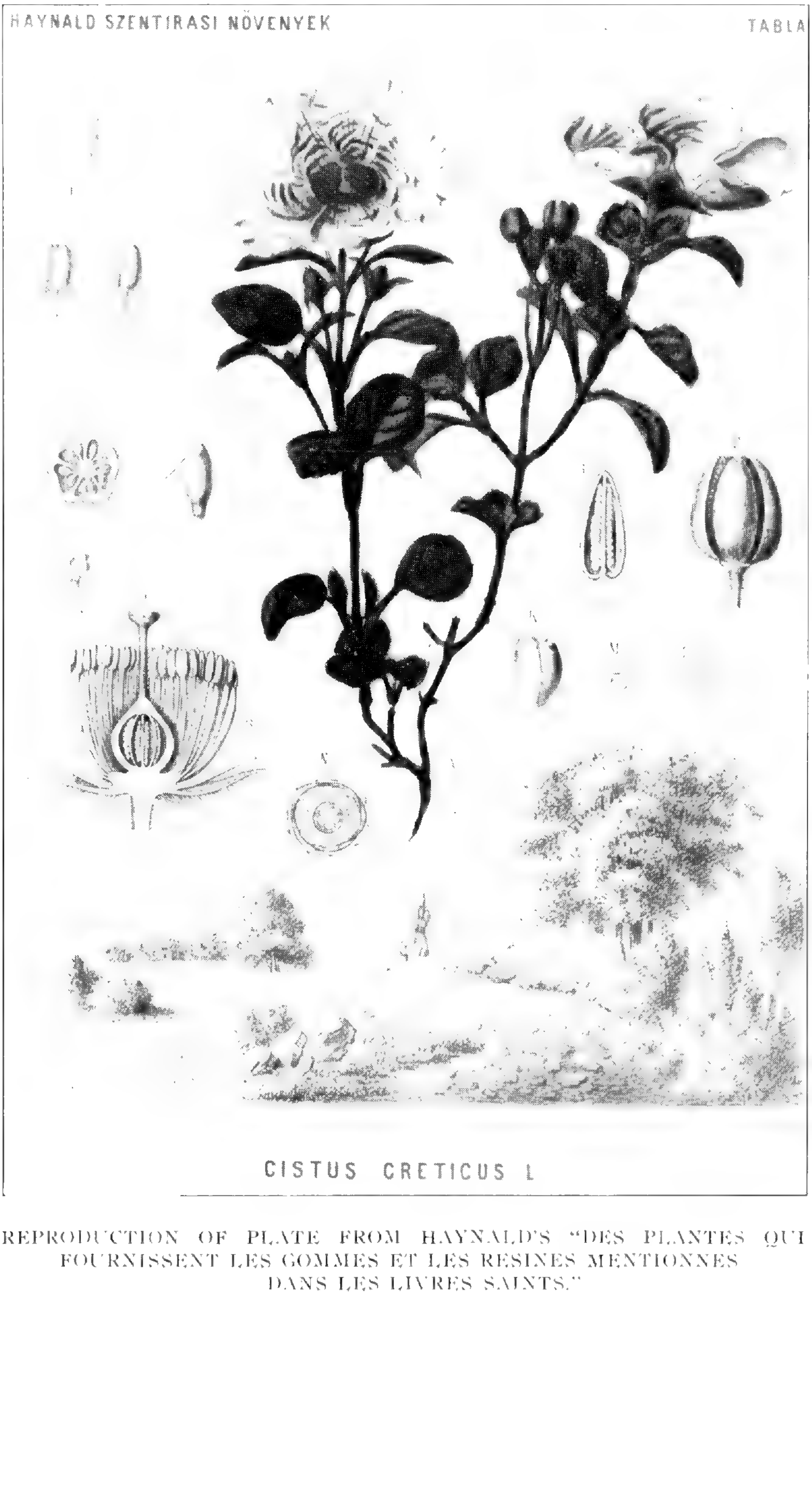
In 1884 Mr. Shaw had printed a little pamphlet entitled "Plants of the Bible at the Missouri Botanical Garden." In this he listed thirty-four plants, mostly trees, giving the names as they appeared in the Bible, followed by the botanical names which were most likely ascribed to them. By far the greater part of this pamphlet was given up to quotations from the Scripture. Under "The fig tree," for instance, is found the botanical name *Ficus Carica* with a page of quotations from the Scripture in which figs or the fig tree are mentioned. The same is true of the vine and other frequently mentioned plants.

Aside from extensive works on the subject, such as Tristram's "Natural History of the Bible," which appeared in 1868, there were numerous articles and pamphlets discussing single plants or groups of plants mentioned in Holy Scripture, as for example, one by the Rev. David Scott on "The mustard plant mentioned in the gospel." Another interesting work of similar character picturing plants for the most

HIEROPHYTICON
SIVE
COMMENTARIUS
IN LOCA SCRIPTURÆ SACRÆ
QUÆ
PLANTARUM
FACIUNT MENTIONEM
distinctus in duas Partes,
Quarum Prior de ARBORIBUS,
Posterior de HERBIS dicta complectitur.
AUCTORE
MATTHÆO HILLERO,
Serenissimi Wirtenbergiæ Ducis Consiliario
& Abbate Regiofontano.
Cui accedit Præfatio
SALOMONIS PFISTERI
Professoris Bebenhusani,
Continens B. Auctoris Vitam, Merita, & Libros
tam editos quam MSStos.

Trajecti ad Rhenum
ex Libraria JACOBI FROEDELIFF
do Ic[illegible]

TITLE PAGE OF SOLOMON PFISTER'S "HIEROPHYTICON."



REPRODUCTION OF PLATE FROM HAYNALD'S "DES PLANTES QUI FOURNISSENT LES GOMMES ET LES RESINES MENTIONNES DANS LES LIVRES SAINTS."

part referred to in the Old and New Testament is "Des plantes qui fournissent les gommes et les résines mentionnés dans les livres saints." This was published in 1894 by the Botanical Department of the National Museum of Hungary, by order of Cardinal Haynald. There are thirteen plates not only depicting the leaves and flowers, natural size, but showing parts of the fruit and flower on an enlarged scale. There is also accompanying each plant a scene in the Holy Land indicating the general habitat of the tree or shrub (pl. 37, *Cistus creticus*). Some of the plates in the copy belonging to the Garden have been beautifully colored by an unknown hand.

There are a hundred or more different plants mentioned in the Bible which can be identified with more or less accuracy. To discuss all of these would be beyond the scope of this article. Mr. Shaw's list included the commoner or better-known trees and shrubs practically all of which are now growing at the Garden. Accordingly only those plants mentioned in the pamphlet printed by Henry Shaw will be discussed here. As previously mentioned he simply gave the common and botanical name of the plant followed by all the quotations from the Scriptures which mentioned the plant in question. It seems desirable that this plan be expanded somewhat. While some scriptural references are given, the quotations have been omitted.

Almond *(Prunus Amygdalus)*. Ecclesiastes XII.5; Jeremiah 1.11, 12; Numbers XVII.8; Exodus XXV.33. Both the tree and the fruit of the almond are frequently mentioned in the Scriptures, it being a native of Palestine. It is one of the earliest trees to put forth its blossom before the leaves, which apparently gave rise to its Hebrew name "shaked," i.e., "hasten." This explains the passage in Jeremiah where the Lord asked the Prophet "What seest thou? And I said, I see a rod of an almond (shaked) tree. Then said the Lord unto me, Thou hast well seen: for I will hasten (shaked) my word to perform it." From the fact that Jacob told his sons to take almonds as a present to Joseph, it has been inferred that the tree did not grow in Egypt and that notwithstanding the famine in Canaan the tree continued to bear fruit there. The almond fruits served as the model for the ornaments of the candlesticks in the Tabernacle, and to this day the glass drops used for ornamenting branched candlesticks are termed "almonds" by English workmen.

Aloes *(Aquilaria agallocha)*. Proverbs VII.17: Song of Solomon IV.14; Psalms XLV.8; John XIX.39. The Hebrew

word thus translated refers to a large tree which produced a precious gum and perfume. Consequently, it has been generally identified with *Aquilaria agallocha,* a tree which attains a height of a hundred feet or more, from which the perfume is extracted. Aloes of the Bible is quite a different plant from the bitter aloes used in medicine *(Aloe Perryi).*

Apple. Deuteronomy XXXII.10; Proverbs XXV.11; Song of Solomon II.5; VII.8; Joel I.12; Zechariah II.8. Most of the authorities agree that the Hebrew word "tappuach" should not be translated "apple" in the sense that we now use it. The common apple barely exists in the Holy Land, the climate being too hot. Some have translated the word as "quince," whereas a considerable number of commentators render it "citron." Mr. Shaw evidently accepted this idea since he gives *Citrus Medica* as the Latin name for the apple tree. From the passages in which the "tappuach" is mentioned, the fruit must have been not only sweet and agreeable, but with a delicate perfume and beautiful in appearance, and the tree must have been large enough to afford a grateful shade. None of the fruits mentioned meet with these conditions, and Tristram inclines towards the apricot as being the only fruit which has all the requirements. While it is true that the apricot is not a native of Palestine, neither is the apple, the quince, or the citron. However, the apricot tree is quite common throughout the Holy Land and, with the single exception of the fig, is one of the most abundant fruits of the country.

Bay Tree *(Laurus nobilis).* Psalms XXXVII. 35. The plant called "bay tree" is supposed to be the sweet bay, *Laurus nobilis* of botany. It is not very common but occurs in northern and western Palestine. Royle says: "The reason why the laurel is not more frequently mentioned in Scripture is probably because it was never very common in Palestine, as otherwise, from its pleasing appearance, grateful shade, and the agreeable odor of its leaves, it could hardly fail to attract attention."

Box Tree *(Buxus longifolia).* Isaiah XLI.19; LX.13. The species of box found in Palestine is *B. longifolia,* which slightly differs from the garden box, *B. sempervirens.* It is a small evergreen tree growing to a height of twenty feet or more. The prophet Ezekiel (XXVII.6), when describing the commerce of Tyre, uses the word "asshur" which is supposed to be a contraction of "Teasshur," or "box." Consequently instead of reading "The company of the Ashurites have made thy benches of ivory," the passage should be trans-

lated "The benches of the rowers have they made of box-wood, inlaid with ivory."

Calamus or Sweet Cane. Exodus XXX.23; Song of Solomon IV.14; Isaiah XLIII.24; Ezekiel XXVII.19; Jeremiah VI.20. Mr. Shaw designated this plant as *Acorus Calamus,* the common "sweet flag." It is extremely doubtful, however, whether this is the plant meant. In fact, botanists have been unable to decide just what was meant by the word as translated. It was apparently the name given to some aromatic substance obtained from a foreign species of reed. A comparison of the passages indicates that it was not a sweet cane like the sorghum which later was cultivated extensively in the valley of the Jordan. It must have been an aromatic cane imported from the East, probably a species of Andropogon. Royle calls it *Calamus aromaticus* and Sir Gilbert Blane believed it to be spikenard.

Camphire *(Lawsonia inermis).* Song of Solomon I.14; and IV.13. This plant in no way resembles the true camphor *(Laurus Camphora).* Lawsonia is a shrub well known in the East, growing eight to ten feet high, with pale green foliage and clusters of white and yellow blossoms of a powerful odor. Not only is the perfume of the flower highly prized, but a paste is made of the dried leaves which is used to dye the palms of the hands, the soles of the feet, and the nails.

Cedar of Lebanon *(Cedrus Libani).* There is frequent reference in the Old Testament to cedars and particularly to the Cedar of Lebanon. In passages where the Lebanon cedar is mentioned there can be no question as to the reference being to *Cedrus Libani.* The Scriptures use this tree to typify grandeur, might, and lofty stature. It was the prince of trees, to the plant world what the lion was to the animal world. The crowning insolence of Sennacherib was when he boasted: "Am I come up to the height of the mountains, to the sides of Lebanon; and I will cut down the tall cedars thereof." (Isaiah XXXVII.24).

Chestnut *(Platanus orientalis).* There can be little question that the chestnut of the Bible was the oriental plane tree or sycamore. The Hebrew name "armon" signifies "naked," referring to the well-known characteristic of this tree's annually shedding its outer bark.

Cinnamon *(Cinnamomum zeylanicum).* Exodus XXX.23; Proverbs VII.17; Song of Solomon IV.14; Revelations XVIII.13. The cinnamon was highly valued as a spice and

perfume, it being one of the principal ingredients employed in the manufacture of precious ointments for the Tabernacle.

Elm. Hosea IV.13. There is no authority whatever for regarding this tree as being the true elm. Celsus was very uncertain about it and pronounced no opinion. Tristram says: "The tree is undoubtedly the terebinth *(Pistacia terebinthus)*."

Fig *(Ficus Carica)*. Frequently mentioned in both the Old and New Testament, and one of the few plants which is found wild in all parts of the Holy Land. Not only was it prized for its fruit, but no protection against the sun was more complete than the dense foliage of the fig tree. The fact that the tree puts forth its fruit buds before its leaves gives point to the incident recorded in the Gospels where Jesus cursed the barren fig tree. Although "the time of figs was not yet," still, as the tree was in full leaf, it might have been expected that figs would also have been found.

Grape Vine *(Vitis vinifera)*. This vine, its fruit, and the wine made from it are often referred to in the Bible. It was one of the most valuable and important fruits cultivated by man in a temperate climate. Coupled with the olive and fig, it typified the fruitfulness of the Land of Promise.

Husk or Carob Tree *(Ceratonia Siliqua)*. Luke XV.16. The tree is very common in Palestine. The leaves are something like those of the ash but dark, glossy, and evergreen. The tree bears flat pods from six to ten inches long which, before they harden, have a sweetish taste when chewed. They are sold for food in stalls in oriental towns but are chiefly used for the feeding of cattle and horses, especially for pigs. Both Horace and Juvenal speak of the pods of the locust tree as the food of the very poorest and most miserable. The tree is grown in all countries bordering on the Mediterranean, and in Malta it is cultivated for the pods which are exported to England under the name of "locust beans" where they are sold for food for horses.

Hyssop (possibly *Capparis spinosa)*. Exodus XII.22; Numbers XIX.18; First Kings IV.33; John XIX.29. Few biblical plants have caused more discussion than the hyssop. Celsus devotes forty-two pages to the question without arriving at any conclusion. Putting together all the passages in which hyssop is mentioned, we find that it was a plant which grew in Egypt as well as in the desert of Sinai and in Palestine; that it grew out of chinks in walls and cliffs and that it produced a stem three or four feet in length. All these

requirements are met by the caper *(Capparis spinosa)*. Royle, referring to Pliny, states that the caper has always been supposed to possess cleansing properties which fulfils another requirement for the plant. It is the bud of the flower of this plant that is pickled and used for sauces.

Lily. Song of Solomon II.2; VI.2; Matthew VI.28. There has been much discussion as to what particular flower is designated by the Hebrew and Greek names translated as "lily." The Hebrew word "shusan" is used by the Arabs in practically its same form to apply to any brilliantly colored flower that at all resembles the lily. The only true lily found in the Holy Land is the red "Turk's cap" of our garden and this is not common. Perhaps the tulip, because of its color, abundance, and locality, comes nearer to the flower referred to by Jesus when he said "Consider the lilies of the field" than any flower having a lily-like habit. However, those familiar with the country are more inclined to think that the reference was to the anemone *(Anemone coronaria)*, now well known in our gardens. This is found everywhere on all soils and in all situations. It covers the Mount of Olives, is abundant in the plains, and is especially luxuriant on the shores of the Lake of Galilee. The anemone also meets every requirement of the allusions in the Song of Solomon.

Mint (Mentha). Luke XI.42; Matthew XXIII.23. There are various species, wild and cultivated, in Palestine, the common one being *Mentha sylvestris* which occurs on all the hills and is much larger than the garden mint.

Mulberry Tree *(Populus tremula)*. Second Samuel V.23,24; First Chronicles XIV.14. Commentators are not agreed as to the tree intended, though there is nothing to support the translation of the Hebrew word "becaim" as "mulberry." There is every reason to believe that the aspen or trembling poplar is the tree meant. The true mulberry is mentioned in the New Testament (Luke XVII.6) under the name "sycamine."

Mustard *(Sinapis nigra)*. Luke XIII.19; Mark IV.31; Matthew XIII.31. Much ingenuity has been expended in attempting to prove that the mustard is not a Sinapis at all but a tree of a totally different order, *Salvadora persica*. It was so listed by Mr. Shaw but Hooker and others have effectually disposed of this idea. The difficulty seems to have arisen from the fact that in the Scriptures it is called a tree but this may be regarded as a typical oriental figure which is not to be taken literally. The common mustard of Palestine is

Sinapis nigra, where it occurs wild and is also cultivated for its seed. Travellers have recorded this herb growing as tall as a horse and its rider.

Myrrh *(Balsamodendron Myrrha)*. Exodus XXX.23; Esther II.12; Psalms XLV.8; Proverbs VII.17; Matthew II.11; John XIX.39. The name of this well-known spice is similar in all languages and there is no question as to its identity. Classical writers repeatedly mention myrrh and also that it was procured from Arabia. Balsamodendron is a low, thorny tree, something like the Acacia, with small, bright leaves. When the bark is punctured a viscid white liquid oozes out which rapidly hardens on exposure to the air. This gum is the myrrh of commerce. The wood and bark of the tree emit a pungent odor.

Myrtle *(Myrtus communis)*. Nehemiah VIII.15; Isaiah XLI.19; LV.13; Zechariah I.8. This was always a favorite tree wherever found. Although no myrtles now occur wild on the Mount of Olives, the tree exists in many of the glens about Jerusalem and near Bethlehem and about Hebron. It is met all through central Palestine and is still employed by the Jews in the Feast of the Tabernacle. In the bazaars of Jerusalem and Damascus the flowers, leaves, and berries are offered for sale as a perfume. The bark and roots are used for tanning the finest Turkish and Russian leather, to which they give a peculiar delicate scent.

Nettles (Urtica). Proverbs XXV.31; Isaiah XXXIV.13; Hosea IX.6. All commentators agree that the Hebrew word "kimmosh" is properly translated as "nettle," referring to Urtica of which there are several species in Palestine. The most common is *U. pilulifera,* often grown to a height of six feet, the sting of which is much more irritating than that of our common nettle. Of the meaning of the Hebrew word "charul" there is some doubt (Job XXX.7; Zephaniah II.9). This would appear to be different from the ordinary nettle, and Tristram believes it to be the prickly Acanthus *(A. spinosus)*, a very common and troublesome weed on the plains of Palestine.

Oak (Quercus). Genesis XXXV.8; Joshua XXIV.26; Isaiah I.29 and 30; II.13; Judges VI.11. No less than six Hebrew words from the same root are rendered "oak" in the English version of the Bible. Three species are common in Palestine, the most abundant being *Quercus pseudococcifera*. Hooker writes: "It covers the rocky hills of Palestine with a dense brushwood of trees from eight to twelve feet

high, branching from the base, thickly covered with small evergreen, rigid leaves and bearing acorns copiously. On Mount Carmel it forms nine-tenths of the shrubbery of vegetation and is almost equally abundant on the west flanks of the Anti-Lebanon and many slopes and valleys of Lebanon. Even in localities where it is not now seen its roots are found in the soil and dug up for fuel.'' The most famous oak of this species was the so-called ''Abraham's oak'' near Hebron which, until its destruction, was regarded as the finest tree in southern Palestine. The trunk was twenty-three feet in diameter and the branches had a spread of about ninety feet.

Olive *(Olea europaea)*. Genesis VIII.11; Exodus XXVII.20; Deuteronomy XXIV.20; Romans XI.17 and 24. No tree is more closely associated with the history of man and the development of civilization than the olive. It has been known and cultivated from earliest time. The olive is abundant in every part of the Holy Land and may be regarded as a characteristic tree of the country. The outer fleshy part of the fruit yields the oil of commerce and the wood of a rich amber color and fine grain is still used in the finest cabinet work. It was used in the temple of Solomon.

Palm *(Phoenix dactylifera)*. Judges IV.5; Deuteronomy XXXIV.3; Exodus XV.27; Psalms XCII.12. The palm tree has always been intimately associated with Palestine. The name by which the country was known to the Greeks and Romans ''Phoenicia'' signifies ''The land of Palms.'' It does not now exist, however, as abundantly as in former times. It is probable that at one period the whole Jordan valley, from the shores of Gennesaret to the end of the Dead Sea, was covered with palms. From the grace and beauty of the tree it was frequently taken as a woman's name and the palm leaf was a favorite architectural ornament. It is a common saying among the Arabs that the palm has as many uses as there are days of the year. Besides its employment for building purposes, a pleasant milk is made from its juice, wine is distilled from its sap, sugar is manufactured from the syrup, the growing tips are boiled as a vegetable, mats, baskets, and all sorts of utensils are manufactured from its leaves. In times of drought horses are fed on the fruit stalks and camels on the crushed seeds. Its fruit, the date, is of course a food staple wherever this palm flourishes.

Bulrush or Paper Reed *(Cyperus Papyrus)*. Exodus II.3; Isaiah XIX.6 and 7; Job VIII.11. This plant is without doubt the celebrated papyrus of Egypt, the material used in the manufacture of paper. It formerly abounded on the Nile

but is now extinct in Egypt and exists only locally in Africa and in a few spots in Palestine.

Pomegranate *(Punica Granatum)*. Numbers XIII. 23;XX.5; Deuteronomy VIII.8; Song of Solomon VIII.2. The pomegranate was usually cultivated in Egypt, and several towns and villages in Palestine bear the Hebrew name "Rimmon" or "Pomegranate." The juice was used for a cooling drink and sometimes fermented into a light wine. The bark and rind of the fruit have been used medicinally but chiefly for tanning. The fruit and flower both served as inspiration for architectural ornamentation or for embroidery design.

Rue (Ruta). Luke XI.42. Rue is a well-known herb frequently cultivated in the gardens. There are some four or five wild species in Palestine.

Shittah tree (Acacia). Exodus XXV.10; XXXVII.1 and 4; Deuteronomy X.3; Isaiah XLI.19. There can be no question as to the identity of this tree with the Acacia, the only timber tree of any size in the Arabian desert. It flowers in dry situations where no other tree could exist. The wood, called "Shittim wood", is hard and close-grained, of an orange brown color, and admirably adapted for cabinet work. Species of Acacia yield the gum arabic of commerce which exudes from the tree spontaneously. The bark is used for tanning leather. The burning bush of Moses (Exodus III.2) was probably the Acacia and the presence of the tree gave the name to several places mentioned in the Scriptures, such as the "Valley of Shittim" and the last camping place of Israel in the "Plains of Shittim."

Sycamine *(Morus nigra)*. Luke XVII. 6. Undoubtedly the black mulberry. A good illustration of mistranslation is found in calling the aspen "mulberry tree," the mulberry, "sycamine," and a species of fig "sycamore." Both the white and black mulberry trees are common in Palestine.

Sycamore *(Ficus Sycomorus)*. Second Chronicles I. 15; IX. 27; Amos VII. 14; Luke XIX. 4. This tree, variously called sycamore, fig, or fig mulberry, is a species of fig and should not be confounded with the tree called Sycamore. It is one of the common trees of Egypt, and its wood was employed for the manufacture of mummy cases as well as articles of furniture. It is very light and porous but quite durable. It is a favorite wayside tree where its shade is most welcome, and is very easy to climb because of its short trunk and wide lateral branches forking out in every direction.

Walnut tree *(Juglans regia)*. Song of Solomon VI. 11.

The Hebrew word "egog" has been rendered "nuts," but apparently the name refers only to the Persian walnut, sometimes incorrectly called "English walnut." This tree, which of course should not be confused with the common black walnut, is a native of Persia and was introduced into western Asia and Europe. It is still cultivated in parts of Palestine where it is valued not only for its fruit but for the oil extracted from the green nuts. Because of its habit of growth it produces a grateful shade and the fragrance of its leaves made it a favorite in the gardens of Solomon.

Willow (Salix). Psalms CXXXVII. 2; Isaiah XLIV. 4; Ezekiel XVII. 5; Leviticus XXIII. 40. Two Hebrew words are translated "willow" in the Scripture. In all the passages the trees were invariably associated with water courses, and while several species are probably involved there seems to be no question about the translation. The willow is represented in Palestine by several species, and there are few parts of the country where one or more may not be found.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, gave a demonstration of Wardian-case gardens, at the School of Floral Design, Soldan High School, December 15.

Mr. G. H. Pring, Superintendent of the Garden, has been re-elected president of the St. Louis Horticultural Society, and has been reappointed chairman of the committee on school gardens of the Society of American Florists and Ornamental Horticulturists.

Dr. George T. Moore, Director of the Garden, spoke at the dinner of the Unitarian Laymen's League, Church of the Unity, December 3, on "Some Plant Problems"; and before the College Club of St. Louis, December 15, on "Some Inside Facts About Plants."

In the November BULLETIN there was printed a list of plants in flower on November 23, in the city Garden and at Gray Summit. As further evidence of the unusual season now being experienced it is interesting to note that *Forsythia intermedia* and *Lonicera fragrantissima* were both in full bloom on December 26.

Attention is called to the "Winter Course in Gardening

for Amateurs'' announced in the November BULLETIN. Registration for the course will take place in the museum building at the Garden, January 12, at 3:45 p. m. Registration by letter, accompanied by check for $5.00, will be accepted after January 1.

Recent visitors to the Garden include Dr. Martha L. Beardsley, professor of biology, Sioux Falls College, Sioux Falls, South Dakota; Dr. Paul F. Shope, assistant professor of biology, University of Colorado, Boulder, Colorado; Mr. John A. Cameron, instructor in zoology, University of Missouri, Columbia, Missouri; Mr. J. F. Stanfield, instructor in biology, Knox College, Galesburg, Illinois; Mr. Frederick Dunlap, Missouri State Forester, Columbia, Missouri.

The fourth number of Volume XVIII of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, has recently been issued with the following contents:

''The Effect of Monochromatic Ultra-Violet Light of Measured Intensities on Behavior of Plant Cells.'' Alexander F. Bucholtz.

''The Cytology of *Funaria flavicans* Michx. with Special Reference to Fertilization.'' Martha L. Beardsley.

''New or Otherwise Noteworthy Apocynaceae of Tropical America.'' Robert E. Woodson, Jr.

''New South American Asclepiadaceae.'' Robert E. Woodson, Jr.

''Some Effects of Ultra-Violet Radiation upon the Calcium and Phosphorus Content of Higher Plants.'' F. Lyle Wynd and Harry J. Fuller.

''Studies of the Effects of Different Lengths of Day, with Variations in Temperature, on Vegetative Growth and Reproduction in Cotton.'' Earl E. Berkley.

STATISTICAL INFORMATION FOR NOVEMBER, 1931

GARDEN ATTENDANCE:

Total number of visitors 58,024

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	32
Total number of books and pamphlets donated	215

PLANT ACCESSIONS:

Total number of seed packets donated	2
Total number of plants donated	1,170

HERBARIUM ACCESSIONS:

By Purchase—

Goodman, George J.—Plants of Utah	780
Moore, J. A., and J. A. Steyermark—Plants of southwestern Texas	315
Schipp, W. A.—Plants of British Honduras	123

By Gift—

Bull, Miss Rotha—Plants of Oklahoma	4
Bush, B. F., by J. H. Kellogg—Plants of Missouri	105
Shoop, Miss Cora—Plants of Missouri and Idaho	2

By Exchange—

Field Museum of Natural History—Plants chiefly of South America	72
University of Minnesota, by Dr. C. O. Rosendahl—Plants of Minnesota	314

By Transfer—

Moore, Dr. G. T.—Hybrid water-lilies collected by G. H. Pring	3
Total	1,718

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Figures in italics refer to page numbers of plates and cuts.

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1931

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

JANUARY

(Floral Display House)
Orchids, Primroses, and Cyclamen.

FEBRUARY

(Floral Display House)
First half month—Orchids.
Second half month—Cinerarias.

MARCH

(Floral Display House)
March 1-15—Bulb Show.
March 19-22—St. Louis Florists' Show.

APRIL

(Floral Display House)
Azaleas, Roses, Schizanthus.
(Outdoors)
Pansies, English Daisies, Early-flowering Shrubs.

MAY

(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias, Marguerites, Lupines, and other spring annuals.
(Outdoors)
Bulbs (early in month), Hardy Water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY

(Outdoors)
Tropical plants. Annuals. Economic Garden — farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Outdoors)
Tropical Water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)
Tropical Water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)
Dahlia (novelties and newer varieties).

NOVEMBER

(Floral Display House)
Chrysanthemum Show.

DECEMBER

(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
Curator of Herbarium

ERNEST S. REYNOLDS,
Physiologist

CARROLL W. DODGE,
Mycologist

ROLAND V. LAGARDE,
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ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

W. F. LANGAN,
Chief Engineer

A. P. BEILMANN,
Trees and Shrubs

J. CUTAK,
Exotics

A. D. FORRESTER,
Plant Recorder

J. H. KELLOGG,
Herbaceous and Nursery

J. LANGAN,
Assistant Engineer

A. PEARSON,
Painter

GRAY SUMMIT EXTENSION

L. P. JENSEN,
Arboriculturist

G. GOEDEKE,
Farm

D. MILLER,
Orchids

R. E. KISSECK,
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TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER.
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.