JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

VOLUME VII

WITH 7 PLATES AND 43 FIGURES

1906

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

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OF

The New York Botanical Garden

Vol. VII. January, 1906. No. 73.

CIRCULAR RELATIVE TO MEMBERSHIP.

At a meeting of the Board of Managers of the New York Botanical Garden held October 2, 1905, the following classes of members were established, to take the place of the arrangements hitherto in force:

1. Annual Members, to pay a fee of $10 a year.

2. Life Members. Annual Members may become Life Members by the payment $250 at any one time.

3. Sustaining Members, to pay from $25 to $100 a year, and to become Fellows for Life when their payments have aggregated $1,000.

4. Fellowship Members, to pay $100 or more a year and to become Fellows for Life when their payments have aggregated $1,000.

5. Fellows for Life, to contribute $1,000 or more at any one time.

6. Patrons, to contribute $5,000 or more at any one time, either by gift or by bequest.

7. Benefactors, to contribute $25,000 or more at any one time, either by gift or by bequest.

N. L. Britton,
Director-in-Chief.

THE STUDENTS RESEARCH FUND.

The fees paid in by students of the Garden have always been credited to a fund known as the Students Research Fund, designed to furnish aid to especially worthy students who would otherwise be unable to carry out investigations for which they were particularly fitted.

Only the interest on the fund is, however, to be used, the principal accumulating through the fees of successive students. The fund was thus established by the Board of Managers, on previous recommendation of the Scientific Directors. It now amounts to a little more than $2,500, and interest upon it has accumulated to about $300.

The Board of Managers made an appropriation from this income at their annual meeting in January, 1905, which has enabled the Scientific Directors to make their first grant from this fund for the purpose of aiding an original investigation.

The recipient of this first grant is Mr. C. B. Robinson, a student of the Garden, who is preparing a monograph on the North American stoneworts (Characeae). Mr. Robinson is a graduate of Dalhousie College, Halifax, Nova Scotia. Subsequently to his graduation, he studied at Cambridge University, England, and is at present a graduate student of Columbia University and a candidate for the degree of Doctor of Philosophy from that institution. The subject chosen by him for investigation at the Garden was made available by the unsurpassed collection of these interesting plants, which are inhabitants of shallow water, formed by the late Dr. Timothy F. Allen, of New York, and presented by him to the Garden in 1901, a description of which is published in JOURNAL **2**: 53–54. 1901.

N. L. BRITTON,
Director-in-Chief.

DR. MACDOUGAL'S NEW WORK.

The following letter is self explanatory:

CARNEGIE INSTITUTION OF WASHINGTON,
WASHINGTON, D. C.,
December 15, 1905.

DR. N. L. BRITTON,
Director-in-Chief,
New York Botanical Garden.

Dear Sir: The work of the Desert Botanical Laboratory, with which I have been connected as an adviser since its foundation, and the other botanical investigations under the auspices of the

Carnegie Institution have assumed such importance that it has been deemed advisable to organize a Department of Botanical Research in the Institution. I have been elected Director of the newly established department, and wish to accept the appointment. I must therefore ask that you relieve me of the duties of Assistant Director of the Garden at a date convenient to yourself, not later than January 1, 1906.

I wish to express my appreciation of the action of the Scientific Directors by which I have enjoyed unexcelled opportunities for research during the six and a half years of my term of service in the Garden, and also to thank you for the interest shown in my work, and for the considerate manner in which my administrative duties have been adjusted.

The investigations on heredity and evolution in which I have been engaged for some time have now reached the stage of greatest fruitfulness, and I would esteem it a great favor if I were granted the use of facilities in the Garden for the continuance of this work. I would expect to give the matter personal attention during a few months each year, and to arrange for assistance during the remainder of the time.

One of the chief functions of the newly organized department will be to coöperate and give assistance in every practicable manner in botanical investigations of all kinds, and it is hoped that the resources of the Desert Laboratory, and other facilities of the department may be of service to you in the promotion of your work on the cactuses, and in other work in progress at the Garden.

Yours very truly,

D. T. MacDougal.

The resignation of Dr. MacDougal has been duly accepted, and the following preamble and resolutions have been adopted by the Scientific Directors and confirmed by the Board of Managers:

New York Botanical Garden,
Bronx Park, New York City.

December 16, 1905.

Whereas: In the resignation of Dr. Daniel T. MacDougal, Assistant Director, the New York Botanical Garden loses the services of a most efficient administrative officer and valuable scientific investigator:

Resolved: That the Scientific Directors of the New York Botanical Garden, while regretting the loss, from the staff, of one who has rendered such important services, extend to Dr. MacDougal most hearty congratulations and good wishes in his entering upon a new field of scientific activity as Director of Botanical Research in the Carnegie Institution of Washington, and, in recognition of his work at the Garden, invite him to meet with us as an advisory member of this Board.

Resolved: That the facilities of the Garden for continuing the investigations on heredity and evolution carried on here by Dr. MacDougal be and hereby are tendered to the Carnegie Institution of Washington.

In thus severing his official connection with the Garden, Dr. MacDougal takes up work of the highest importance. His field of operations will be a varied one, his time being partly spent at the Desert Botanical Laboratory of the Carnegie Institution at Tucson, Arizona, partly in directing botanical and horticultural investigations at other stations of the Carnegie Institution, and partly at the New York Botanical Garden in continuing his studies on heredity and evolution, it having been arranged that his experiments carried on here shall be continued under the supervision of an assistant with the coöperation of members of the Garden staff.

N. L. BRITTON,
Director-in-Chief.

ADDITIONAL MEMBERS OF THE GARDEN STAFF.

The resignation of Dr. D. T. MacDougal as Assistant Director has brought about a reorganization of work at the Garden. Dr. W. A. Murrill, who has been serving as a Curator for parts of two years, having succeeded to the position left vacant by the resignation of Professor F. S. Earle to accept the work of directing the Cuban Agricultural Experiment Station, has been appointed First Assistant, and the duties of Mr. Percy Wilson, Administrative Assistant, have been increased. Dr. C. S. Gager, who has pursued investigations at the Garden for some time under the direction of Dr. MacDougal, has been appointed Director of the Laboratories. Mr. R. S. Williams, who has done much field work on behalf of the Garden during the past five years in the Yukon Territory, Bolivia, and the Philippine Islands, has been appointed an Assistant Curator. Mr. C. B. Robinson, who has been a student of the Garden, giving special attention to the study of the Stone-worts, and to the Philippine Island collections formed by Mr. Williams, has also been appointed an Assistant Curator.

N. L. BRITTON,
Director-in-Chief.

FOSSIL PLANTS ALONG THE CHESAPEAKE AND DELAWARE CANAL.

"Rivers," said the philosopher Pascal, "are roads that move, and carry us whither we wish to go." In colonial Maryland this was true in a larger degree, perhaps, than in any of the other colonies. The main highway of early Maryland was the Chesapeake, which is, says a chronicler of that time,* "a bay in most respects scarcely to be outdone by the universe, having so many large and spacious rivers branching and running, and each of these richly supplied and divided into sundry smaller rivers, spreading themselves out to innumerable creeks and coves." Instead of mileage, compensation for boat-hire was allowed to the delegates to the General Assembly from Kent and Anne Arundel counties.†

It was quite natural, then, that the minds of the citizens should early turn to the feasibility of constructing an artificial water-way between the headwaters of the Chesapeake and Delaware bays, in order to avoid the roundabout sail of some four hundred miles which was so fatal to Lord Howe's Revolutionary campaign in this region. We find this canal seriously considered as early as 1767 and again in 1799 and 1812, being finally completed during the first quarter of the last century. It runs nearly due east and

* Makemy, A Plain and Friendly Persuasive, London, 1705, p. 5.

† Maryland Archives, vol. 1, Assembly Proceedings, pp. 143, 284.

west across the divide between the two bays, and is a most beautiful and attractive spot, the delight alike of the ornithologist and the botanist.

A striking element in the flora here is the number of arborescent forms which are to be found on account of the intermingling of northern and southern forest types. Among them are the chestnut, sycamore, tulip-tree, willow oak, chestnut oak, red and black oaks, walnut, hickory, gum, persimmon, sumac, dogwood, sassafras, etc. These include a large number of forms noted for the beauty of their autumnal coloration, which enhances a visit to this region during the latter part of the year. Among the noteworthy herbaceous plants at the time of my visit were the spiranthes (*Gyrostachys*), the showy rhexias, or meadow-beauties, with their reddish-purple blossoms, and the equally showy bidens, or marigolds.

The sands and clays of the Cretaceous formation which mark the ancient continental coast-line and outcrop in a narrow interrupted belt from Martha's Vineyard and Block Island to Alabama, cross the canal diagonally. To prevent land-slips the cut was made very wide, often two hundred feet or more. Subsequent erosion has sculptured these high banks into characteristic "bad-land" scenery and, were it not for the abundant vegetation which fringes the top of the banks, one might well imagine himself in southwestern Dakota or Wyoming. In one spot we find a black lignitic clay, replaced in a short distance by a great bank of white "sugary" sand containing amber. Here we find the greenish marly sand of the Matawan formation, while orange iron-stained sands vie with reddish sands in their prominence — the whole forming a variegated and beautiful picture. Large logs of lignite lie in the ditches where they have weathered out of the banks.

The fossil plants occur in lenses of dark sandy clay, which is rather loosely consolidated, and the leaf-impressions commonly carry much lignite, so that they shrink in drying and do not furnish very permanent specimens. The locality along the canal which has yielded the plant-remains is in the State of Delaware a few miles east of the Maryland line, between Pivot and High bridges. This point is known as Deep Cut, for the reason that the banks marking the summit of the divide at this point are fully one hundred feet above the water. Among the more striking forms collected were leaves of a Sabal-like palm, numerous leaves of figs and laurels, a large *Osmunda*, many twigs and some cones of *Sequoia*, besides many other curious and interesting relics of the vegetation which flourished in the swamps and on the hillsides along this old coast when the climate was much warmer than now, when man was hardly a promise, and the dominant forms of life were huge reptiles like some of those which have been so admirably restored during recent years by well-known investigators at the American Museum of Natural History.

EDWARD W. BERRY.
MARYLAND GEOLOGICAL SURVEY,
BALTIMORE, MD.

THE COCO DE MER, OR DOUBLE COCOANUT.

In the Indian Ocean several hundreds of miles to the eastward of Zanzibar, and about four degrees south of the equator, is a group of islands known as the Seychelles. These were discovered by the Portuguese as early as 1505; were occupied by the French in 1743; siezed by the British in 1794, and formally ceded to them in 1814. Here at the time of the French occupation in 1743 was discovered a beautiful palm, the fruit of which had been known for many years, but the origin of which had been one of the mysteries of those early times. As in those times mysteries always gave rise to most fabulous tales, so was it with this unknown fruit, which, on account of its obscurity, was accredited with most wonderful properties and given a worth far in excess of its intrinsic value. It was known as coco de mer, coco de Salomon, and coco des Maldives, this last name being applied because so many of these nuts had been found floating in the sea near the Maldive Islands. It was averred by these ancient people that it was not a product of the earth but of the sea, and the Malay and Chinese sailors insisted that it grew on a tree deep in the water off the coast of Sumatra, but that the tree instantly disappeared when they dived down to see it. The negro priests were firm in the belief that it grew near the island of Java, its branches protruding above the water, and that here a monstrous bird had its home, from which it made nightly sorties to the land, killing tigers, elephants and other large animals: they further asserted that ships were attracted by the waves which surrounded the tree, an attraction from which there was no escape, and that the sailors fell an easy prey to this voracious bird. One can well understand with what care the poor superstitious sailors of the Indian Archipelago must have avoided this spot.

Not only did these tales serve to bring the fruit into notice, but its reputed value as an antidote to poisons made its acquisition greatly to be desired by the princes of Hindoostan, who, prone to use such poisons on others, were constantly in fear of being made victims themselves of some wily poisoner. It is not strange that they were willing to pay large sums for these mysterious objects which would protect them from their enemies. They firmly believed that water which had been kept in one of these was purified from all harm, and could be drunk with impunity, no matter how active may have been the poison placed in the liquid. The sovereign of the Maldives was not long in turning this to his own advantage as a means of increasing his wealth, for he made it a matter of death for anyone to have in his possession one of these nuts — all were his property, which he disposed of at a high price or used in making royal presents. But in 1743, upon the discovery of the tree which bore these fruits, this value and repute quickly subsided, for, so they must have reasoned, where there is no mystery how can there be any virtue!

One of the earlier accounts of this palm occurs in a book of voyages published in 1776 at Paris.* A plate illustrating the Seychelles themselves and several other plates depicting features of the palm and its fruit are given. It is there stated that many of these palms grow near the shore of the sea, most of the fruit of such trees dropping into the sea and floating upon its surface. The winds waft them, and the currents, the direction of which in those parts is E. N. E., carry them to the shores of the Mal-

* Voyage a la Nouvelle Guinee par M. Sonnerat. Paris. 1776.

dives, the only part of the world where these fruits had been known previous to the discovery of their origin on the Seychelles.

FIG. 1. *Lodoicea maldivica* (Gmel.) Pers., the *coco de mer* or double cocoanut.

The palm is said to grow upon three of the islands of the Seychelles, occurring in all parts of them, the best trees growing in deep gorges. One such gorge on the island of Praslin is known as the Ravine of the Coco de Mer, and is said to be one of the most beautiful spots in tropical climes, the trunks of these charming palms rising to a height of ninety or a hundred feet and bearing aloft a crown of magnificent fan-shaped leaves, often twenty feet long and ten or twelve feet wide.

The accompanying photograph was made from a specimen of this palm which graces the collection installed in house no. 15, of the conservatories, on the central bench near the entrance to the large dome. There are few of these in cultivation under glass, perhaps but four or five in this country, and I believe all of these originated with Mr. Falconer, at Pittsburgh. The Garden was fortunate in securing one of these. Until it became of sufficient vigor, cultural requirements necessitated that it be kept at the propagating houses. It has been recently transferred to the position indicated above. At the base of this plant can still be seen a portion of the seed, its double character being quite evident. On the second floor of the museum building, on the middle shelf of case no. 63, will be found a specimen of this fruit, with the outside husk removed, showing clearly its structure.

The many economic uses of this palm make it of exceeding value to the natives of the Seychelles. The heart of the crown of leaves is eaten as a vegetable, as is done with the cabbage palm. The leaves, perhaps, are the most important, being used extensively in house-building, not only for thatching, but also for making walls and partitions; and the down of the young leaves is used in filling mattresses and pillows. The nuts are made into utensils of various kinds, and the young leaves furnish material for making hats.

A remarkable feature of this tree is the length of time required to mature its fruit, ten or twelve years being necessary for this. The fruits are oblong in shape and weigh from thirty to fifty pounds, and, as sometimes ten of these occur in a bunch, the aggregate weight of such a cluster is considerable. Upon the removal of the outer husk the two oblong nuts are exposed to view, firmly united; it is this character which has given the name of double cocoanut to the tree.

This palm was first given the specific name *maldivica* in

1791 by Gmelin, probably in reference to the place where its fruits were first found, long before the tree itself was known, but under the generic name of *Cocos*. To botanists it must now be known as *Lodoicea maldivica* (Gmel.) Pers. In 1792 it was called *Borassus Sonnerati*, the specific name being given in honor of M. Sonnerat, to whom reference has already been made as an early explorer in those parts. In 1805 Commerson gave it the name of *Lodoicea callipyge* and in 1807 Labillardière added to its aliases by calling it *Lodoicea sechellarum*, the name by which it is commonly known, but this cannot be used, as the earliest name takes precedence.

GEORGE V. NASH.

ORIGIN OF THE AMBER FOUND ON STATEN ISLAND.

In the JOURNAL for March, 1905, an article by the writer was published, entitled "A Recent Discovery of Amber on Staten Island," in which may be found a brief reference to the problem of the origin of the amber. Since then the locality, in the Androvette clay pit at Kreischerville, has been visited on several occasions, in company with Professor Edward C. Jeffrey, of Harvard University, and considerable additional material collected, consisting of a number of fine specimens of amber and numerous logs of lignite, in several of which the amber was found *in situ*.

Professor Jeffrey subsequently submitted some of these lignites to critical examination under the microscope and identified the genera to which they belong. One proved to be a *Sequoia* and another a species of *Araucarioxylon*, allied to the living Norfolk Island pine, and thus determined the origin of at least a part of the amber. These, and other interesting results obtained from the examination of the material collected were included in a joint preliminary paper by Professor Jeffrey and the writer, which was read at the New Orleans meeting of the Botanical Society of America in January. The Society, upon a presentation of the facts, made an award of $200 for the continuation of the work, which will be prosecuted jointly by the authors, and extended, if possible, so as to include similar investigations of the fossil plant remains from other localities in the Atlantic coastal plain. In a recent communication from Professor Jeffrey he says: "I quite agree with you as to the very great possibilities connected with our proposed field of investigation. There are at least a dozen promising lines of work suggested by the material already in hand from Kreischerville."

ARTHUR HOLLICK.

NOTES, NEWS AND COMMENT.

The effects of the unusually mild weather have been conspicuous among the plants in the Garden. During the earlier part of the month, dandelions were in bloom on the lawns, the flowers and leaves of *Spiraea Thunbergii* were opening in numbers, and the catkins of certain willows were appearing about two months in advance of their usual season.

The main park driveway, extending from the Bronx Park railway station of the New York Central Railroad past the lakes and over the fruticetum plain and north meadows to the Newell Avenue entrance at Williamsbridge, was thrown open for use in December.

Volume 22, part 2, of the North American Flora, appeared December 18, 1905. The main portion of the work is devoted to the Saxifragaceae and Hydrangeaceae, by Small and Rydberg, while several minor families are treated by Britton, Small, Wilson, and Rusby.

The clear limitation of the species of the fleshy fungi requires (1) an extensive study of the plants in the field, with careful notes of the fresh conditions and (2) extensive search of the older literature and illustrations of the species described from Europe to properly correlate the species common to the two continents. This is now being undertaken for the American species containing a milky juice, which have been commonly known under the name of *Lactarius*, by Miss Gertrude S. Burlingham. Many of our species are apparently identical with those of Europe and often appear to have a wide geographic distribution on both hemispheres. Others are apparently local or at least are known at present only from a very limited area, and apparently are less able to maintain the struggle for existence. This group of fungi contains a number of economic species and presents a great diversity in the character of the fluid which fills the entire tissue of the plant. Miss Burlingham has an interesting field and will combine with the systematic study of the group some investigations as to the nature of this milky fluid and its susceptibility to rapid change so apparent in certain species. This milk varies in color in various species from pure white to saffron yellow, orange, purple, and even deep prussian blue.

Miss Caroline Coventry Haynes is continuing the studies on the classification of the Hepaticae to which she has devoted a portion of her time during the past four years. During the present year she expects to give considerable attention to the arrangement of the Hepaticae in the Garden herbarium, to which she has contributed numerous specimens of her own collecting in New Jersey, Massachusetts, northern New York, and North Carolina. A number of American Hepaticae, including one of the peculiar taxonomic interest, she has now under cultivation in one of the propagating houses of the Garden. Miss Haynes published notes on "Some interesting Hepaticae from Maine" in *Torreya* for March, 1903. About a year ago, she took charge of the hepaticological work of the Sullivant Moss Chapter and in this connection has contributed to the *Bryologist* "Notes on a Colony of Hepatics found associated on a dead Fungus" and illustrated articles on "*Telaranea nematodes longifolia*" and "*Cephalozia Francisci.*" With the beginning of its ninth volume (1906) she becomes one of the assistant editors of the *Bryologist.* Miss Haynes has now, also, ready for publication descriptions of two new species of *Aytonia* from the island of Jamaica, and has prepared detailed and artistic drawings illustrating the habit and structure of these hitherto unknown plants.

The total precipitation in the Garden during December, 1905, amounted to 2.64 inches. Maximum temperatures of 54° on the 8th, 53° on the 13th, 54° on the 18th, and 53.5° on the 29th were recorded; also minima of 23° on the 10th, 18° on the 15th, 22° on the 25th, and 24.5° on the 28th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM NOVEMBER 16 TO DECEMBER 30, 1905.

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PICTURE COLLECTION.

2 photographs of Bronx Park (1894). (Given by Miss Vail.)

1 photograph of Dr. Hollick. (Given by Dr. Arthur Hollick.)

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23 portraits of botanists. (Given by Dr. N. L. Britton.)

PLANTS AND SEEDS.

33 plants for conservatories. (By exchange with Mr. Berger, La Mortola Garden, Italy.)

4 plants for conservatories. (Given by Mr. G. Travis.)

8 plants from Nebraska for conservatories. (Given by Dr. C. E. Bessey.)

13 plants for Conservatories. (Purchased.)

51 aquatics. (Purchased.)

1 plant for conservatories. (Given by Prof. F. E. Lloyd.)

9 plants for conservatories from Panama. (Collected by Mr. J. F. Cowell.)

6 plants for herbaceous collections. (Collected by Dr. H. H. Rusby.)

40 plants for conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

40 plants from Mexico for conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

1 plant for conservatories. (Given by Mr. F. R. Pierson.)

4 plants for morphological garden. (Collected by Mr. P. Wilson.)

3 plants for nursery. (Collected by Mr. K. K. Mackenzie and Mr. W. W. Eggleston.)

37 plants for conservatories. (By exchange with Plant Industry, Washington, D. C.)

47 plants for herbaceous grounds. (Collected by Mr. W. W. Eggleston.)

6 plants for nursery. (Collected by Mr. W. W. Eggleston.)

13 plants for conservatories. (Collected by Mr. W. W. Eggleston.)

11 plants for morphological garden. (Collected by Mr. W. W. Eggleston.)

11 plants for conservatories. (By exchange with Mr. Frank Weinberg.)

5 plants from Bermuda for conservatories. (Collected by Dr. N. L. Britton.)

7 plants for morphological garden. (Collected by Dr. D. T. MacDougal.)

8 plants for herbaceous grounds. (Collected by Dr. D. T. MacDougal.)

36 plants from Pennsylvania for herbaceous grounds. (Collected by Dr. J. S. Shafer.)

2 plants for morphological garden. (Collected by Dr. J. S. Shafer.)

81 plants for conservatories. (By exchange with Department Parks, Borough of the Bronx.)

4 plants from Bermuda for conservatories. (Given by Mr. R. H. James.)

12 plants for nursery. (Given by Mr. E. Brainerd.)

4 plants for conservatories. (Given by Mrs. H. L. Britton.)

15 plants from Burmuda for conservatories. (Collected by Mrs. E. G. Britton.)

4 plants for herbaceous grounds. (Collected by Mrs. E. G. Britton.)

26 plants from Mexico for conservatories. (Given by Mr. A. De Lautreppe.)

6 plants for nursery. (Collected by Mr. E. Brainerd and Mr. W. W. Eggleston.)

41 plants for conservatories, from Haiti and Grand Turk, W. I. (Collected by Mr. George V. Nash and Mr. Norman Taylor.)

1 plant for conservatories. (By exchange with Harvard Botanical Garden.)

8 plants for nursery. (Collected by Dr. J. S. Shafer and Mr. W. W. Eggleston.)

1 plant for nursery. (Given by Mr. Van Denburgh.)

2 plants for conservatories. (Given by Mr. R. S. Alcock.)

1 plant for conservatories. (Given by Mrs. J. B. Wolf.)

2 plants for conservatories. (Given by Dr. C. C. Curtis.)

6 plants from St. Thomas, W. I., for conservatories. (Given by Mr. J. T. Francis.)

1 plant for herbaceous grounds. (Collected by Mr. A. Müller.)

1 plant for conservatories. (Given by Mrs. Chas. Spaulding.)

9 plants from Arizona for conservatories. (Given by Mr. G. Sykes.)

1 plant for herbaceous grounds. (Given by Mr. B. C. Chamberlin.)

10 plants for conservatories. (Given by Mr. E. C. Jennings.)

1 plant for conservatories. (Given by Mr. R. Richter.)

6 plants from Costa Rica for the conservatories. (Collected by Mr. C. Wercklé.)

1 plant for nursery. (Given by Mrs. S. A. Embury.)

1 plant for conservatories. (Given by Mr. J. Crosby Brown.)

4 plants from Arizona for conservatories. (Given by Mr. H. B. Brown.)

2 plants from Utah for conservatories. (Collected by Dr. P. A. Rydberg.)

4 plants from California for conservatories. (Collected by Dr. P. A. Rydberg.)

1 plant for herbaceous collection. (Given by Dr G. N. Shull.)

2 plants for conservatories. (Given by Mr. Chas. Lanier.)

1 plant for nursery. (Given by Mr. C. C. Godfrey.)

4 plants from Great Bahama for conservatories. (Collected by Mr. L. J. K. Brace.)

20 plants for conservatories. (Given by Messrs. S. Hoyt and Sons.)

3 plants for conservatories. (Given by Professor H. M. Richards.)

1 plant for herbaceous collections. (Given by Mr. Oliver.)

4 plants for conservatories. (Given by Mrs. L. B. Roe.)

3 plants for conservatories. (Given by Mr. J. T. Morris.)

247 plants for conservatories. (By exchange with Fairmount Park, Philadelphia.)

6 bulbs for conservatories. (Given by Mr. H. Jones.)

3 bulbs from Arizona for conservatories. (Given by Mr. G. G. Copp.)

12 plants from California for conservatories. (Given by Mr. S. B. Parish.)

7 cuttings of *Pedilanthus* sp. from Grand Turk, W. I., for conservatories. (Collected by Mr. George V. Nash and Mr. Norman Taylor.)

18 cuttings from Bermuda for conservatories. (Collected by Mrs. E. G. Britton.)

60 cuttings for conservatories. (By exchange with Fairmount Park, Philadelphia.)

20 cuttings from Mexico for conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

3 cuttings for conservatories. (Given by Mr. J. T. Morris.)

34 cuttings from Bermuda for conservatories. (Given by Mr. R. H. James.)

17 cuttings for conservatories. (Obtained at the 1905 Flower Show.)

34 cuttings for conservatories. (By exchange with Department Parks, Borough of the Bronx.)

12 packets of seed from St. Croix, W. I. (Given by Mr. C. O. E. Hansen.)

329 packets of seed. (By exchange with the Botanic Garden, Oxford University, England.)

176 packets of seed. (By exchange with the Botanic Garden, Palermo, Italy.)

2 packets of seed from Utah. (Collected by Dr. P. A. Rydberg.)

4 packets of seed from Haiti and Grand Turk., W. I. (Collected by Mr. George V. Nash and Mr. Norman Taylor.)

30 packets of seed from California. (Given by Mr. S. B. Parish.)

27 packets of seed from the Philippines. (Collected by Mr. R. S. Williams.)

1 packet of seed from Missouri. (Given by Mr. B. F. Bush.)

1,743 plants derived from seed from various sources.

MUSEUM AND HERBARIUM, AUGUST TO DECEMBER, 1905.

21 specimens of fungi from Grenada. (Collected by Mr. W. E. Broadway.)

7 specimens from Greenland. (By exchange with Dr. O. Nordstedt.)

30 specimens "Economic Fungi." Supplement A, nos. 1–30. (Distributed by Seymour and Earle.)

240 specimens from Canada. (By exchange with the Geological and Natural History Survey of Canada.)

25 museum specimens of fungi from the District of Columbia. (Collected by Dr. W. A. Murrill.)

5,126 specimens from Utah and California. (Collected by Dr. P. A. Rydberg.)

118 specimens from Vancouver Island. (By exchange with the American Museum of Natural History.)

50 specimens of *Potentilla* from Siberia and southern Europe. (By exchange with Dr. T. Wolf.)

148 specimens from Quebec. (Distributed by Messrs J. F. Collins and M. L. Fernald.)

2 specimens from Florida. (Given by Dr. S. H. Richmond.)

797 specimens from Wyoming. (Distributed by Professor A. Nelson.)

2 specimens of *Eriogonum* from California. (Given by Mr. A. A. Heller.)

264 specimens from Jamaica. (By exchange with the Department of Public Gardens and Plantations, Jamaica.)

2 specimens of *Opuntia* from Nebraska. (Given by Prof. C. E. Bessey.)

4 museum specimens from Scarsdale, N. Y. (Collected by Dr. W. A. Murrill.)

2,155 specimens of cryptogams from the Philippines. (Collected by Mr. R. S. Williams.)

73 specimens from Nova Scotia. (Given by Mr. C. B. Robinson.)

10 specimens of fungi from Missouri. (Given by Mr. Perley Spaulding.)

8 specimens of fungi from British Columbia. (Given by Mr. A. J. Hill.)

3 specimens from Long Island, N. Y. (Given by Miss F. A. Mulford.)

2 specimens of *Quercus alba* from Carmel, N. Y. (Given by Mr. Clayton Ryder.)

20 specimens of fungi from New York and Connecticut. (Given by Professor L. M. Underwood.)

5 specimens of fungi from Missouri and Wyoming. (Given by Dr. N. M. Glatfelter.)

250 specimens from Guatemala. (Given by Capt. J. Donnell Smith, for the Columbia Herbarium.)

145 specimens from Trinidad and Grenada. (Collected by Mr. W. E. Broadway.)

1 specimen of fungus from Indiana. (Given by Prof. J. C. Arthur.)

4 specimens of fungi from Porto Rico. (Given by Mr. G. P. Clinton.)

44 specimens of cryptogams from Cuba. (By exchange with the Estacion Central Agronomica de Cuba.)

85 specimens from the District of Columbia. (Given by Mr. H. D. House.)

3 specimens of drugs for the economic museum. Given by Messrs. Lehn & Fink.)

1 museum specimen of spruce gum from Maine. (Collected by Dr. W. A. Murrill.)

2 baskets from Mexico. (Given by Dr. J. N. Rose.)

1 specimen of fruit of *Juglans californica*. (Given by Mr. L. R. Abrams.)

2 hats from Haiti, made of palm fiber. (Acquired by Mr. Geo. V. Nash.)

1 specimen of *Ephedra* for the economic museum. (Given by Dr. H. H. Rusby.)

1 fish-trap from Haiti, made of bamboo. (Acquired by Mr. Geo. V. Nash.)

5 specimens of fungi from Grenada. (Collected by Mr. W. E. Broadway.)

4 specimens of *Commelina* from the District of Columbia. (Given by Gen. T. E. Wilcox.)

3 museum specimens of fibers. (Given by Mr. Daniel P. Read.)

2 specimens of the wood of *Taxus brevifolia* from Oregon. (Given by Mr. F. S. Barnes.)

22 specimens of hepatics from Jamaica. (Given by Professor A. W. Evans.)

69 specimens from Jamaica. (By exchange with the Department of Public Gardens and Plantations, Jamaica.)

1,633 specimens of fungi from Maine. (Collected by Dr. W. A. Murrill.)

150 specimens, "Economic Fungi," Supplement C, nos. 1–150. (Distributed by Seymour and Earle.)

2 rice-cleaners from Haiti, made of bamboo. (Acquired by Mr. Geo. V. Nash.)

2 specimens of *Tropaeolum* for the economic museum. (Given by Dr. H. H. Rusby.)

217 specimens of fungi from New Hampshire. (Given by Mr. Percy Wilson.)

44 specimens of fungi from Grenada. (Collected by Mr. W. E. Broadway.)

150 specimens from Canada. (By exchange with the Geological and Natural History Survey of Canada.)

7,240 specimens from the Philippines. (Collected by Mr. R. S. Williams.)

1 museum specimen of *Panaeolus epimyces* from Indiana. (Given by Prof. J. C. Arthur.)

90 specimens of fungi from Trinidad and Grenada. (Collected by W. E. Broadway.)

517 specimens from Cuba. (By exchange with the Estacion Central Agronomica de Cuba.)

36 specimens of hepatics from Hawaii. (By exchange with Prof. A. W. Evans.)

10 specimens of fungi from Nova Scotia. (Given by Mr. C. B. Robinson.)

3 specimens of *Physalis* for the economic museum. (Given by Dr. H. H. Rusby.)

3 specimens of fungi from Washington. (Given by Prof. C. V. Piper.)

1 specimen of fungus from Connecticut. (Given by Mr. C. C. Hammer.)

12 specimens of fungi from Bronx Park. (Collected by Dr. W. A. Murrill.)

125 specimens from the Philippines. (By exchange with the Bureau of Government Laboratories.)

50 specimens of fungi from Scarsdale, N. Y. (Collected by Dr. W. A. Murrill.)

14 specimens of fungi from Grenada. (Collected by Mr. W. E. Broadway.)

10 specimens "Economic Fungi" Supplement B, Nos. 1–10. (Distributed by Seymour and Earle.)

800 specimens of fungi from Ohio Pyle, Pennsylvania. (Collected by Dr. W. A. Murrill.)

10 museum specimens of fungi from Virginia. (Collected by Dr. W. A. Murrill.)

39 specimens of drugs for the economic museum. (Given by Lehn and Fink.)

1 specimen of the wood of *Buxus sempervirens*. (Given by Mr. Geo. A. Skene.)

85 specimens of drugs for the economic museum. (Given by Park, Davis & Co.)

1,350 specimens from Haiti. (Collected by Messrs. Geo. V. Nash and Norman Taylor.)

250 specimens from Grand Turk. (Collected by Messrs. Geo. V. Nash and Norman Taylor.)

3,126 specimens from Bermuda. (Collected by Dr. and Mrs. N. L. Britton and Mr. Stewardson Brown.)

1 specimen of *Pterospora andromedea* from New York. (Presented by Miss A. M. Vail.)

20 specimens from the Old World. (By exchange with the Royal Gardens, Kew, England.)

7 museum specimens from New York and Connecticut. (Given by Professor L. M. Underwood.)

17 specimens of lichens and fungi from Grenada. (Collected by Mr. W. E. Broadway.)

56 specimens from Trinidad and Grenada. (Collected by Mr. W. E. Broadway.)

2 candles made of Bayberry wax from Staten Island. (Given by Miss H. Louise Britton.)

1 specimen of the fruit of *Yucca arborescens.* (Given by Mrs. C. De Kalb.)

1 specimen of the fruit of *Quercus marylandica.* (Given by Dr. C. C. Curtis.)

12 specimens of fibers. (Given by the U. S. Bureau of Plant Industry.)

195 specimens from the Pocono Plateau, Pennsylvania. (Given by Dr. John W. Harshberger.)

1 specimen of the fruit of *Acer spicatum.* (Collected by Mr. R. C. Schneider.)

50 specimens from Ohio Pyle, Pennsylvania. (Collected by Dr. J. A. Shafer.)

2 cocoanuts from Key West, Florida. (Given by Mrs. N. L. Britton.)

1 museum specimen of *Cydonia sinensis.* (Given by Mr. Paul Dana.)

1 museum specimen of the fruit of *Opuntia.* (Given by the New York Horticultural Society.)

1 museum specimen of cotton in the boll from North Carolina. (Given by Mrs. J. H. Eggleston.)

1 museum specimen of the thorns of the honey locust from Bedford Park. (Given by Mr. Q. T. Shafer.)

1 specimen of the pods and the seeds of *Cassia Medsgeri* from Pennsylvania. (Given by Miss Blanche Sherboudy.)

16 specimens of fruits and seeds for the collection of North American dendrology. (Collected by Dr. J. A. Shafer.)

3 specimens of South American Copal. (Given by Dr. H. H. Rusby.)

9 specimens of drugs for the economic museum. (Collected by Dr. J. A. Shafer.)

9 museum specimens from Bermuda. (Collected by Dr. N. L. Britton and Mr. Stewardson Brown.)

1 specimen of spikenard root for the drug collection. (Given by Dr. H. H. Rusby.)

3 specimens of Canary bananas from Bermuda. (Given by Mr. T. J. Harris.)

2 specimens of Jack bananas. (Grown in the conservatories of the New York Botanical Garden.)

6 specimens of fruits for the economic museum. (Given by Mr. P. J. Berkmanns.)

1 specimen of the fruit of *Quercus coccinea.* (Given by Drs. N. L. Britton and C. C. Curtis.)

4 specimens of acorns from near Washington, D. C. (Given by Gen. T. E. Wilcox.)

2 specimens of Bladder-wrack for the drug collection. (Given by Messrs. Lehn and Fink.)

1 museum specimen of *Conopholis americana.* (Collected by Dr. J. A. Shafer.)

185 specimens from Mexico. (Collected by Dr. E. Palmer.)

1 specimen of the fruit of *Quercus heterophylla* from Staten Island, N. Y. (Collected by Drs. N. L. Britton and D. T. MacDougal.)

250 specimens from California and Texas. (Collected by Mr. A. A. Heller.)

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NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

Vol. VII FEBRUARY, 1906 No. 74

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

CONTENTS

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

JOURNAL

OF

The New York Botanical Garden

'OL. VII. February, 1906. No. 74.

PROGRESS OF CONSTRUCTION WORK DURING THE WINTER.

The unusually warm weather of December and January and ısignificant snowfalls have permitted grading operations to go ›rward continuously, scarcely a day having been lost, the work aving been so laid out in advance that both earth and rock ould be excavated to advantage and dumped for filling where ›quired; the surplus rock is being assembled on the lines of ›adways already graded, thus being brought into place for the ıying up of Telford foundations for roads as soon as frost is ut of the ground in the spring.

On account of these advantageous conditions a large amount f the filling necessary between the masonry retaining walls at ıe Mosholu Parkway has been put in place, drawn from the rading operations required at the rear of the museum building r establishing the final surfaces at that point; the removal of ıis knoll, which is now being graded, will greatly improve the ;pect of the museum building and its surroundings from the est and north and the haul to the Mosholu Parkway approach ›erages only about 500 feet.

There is a large amount of surplus stone suitable for Telford undations of roads in these excavations and this is being hauled the unfinished driveway crossing the Long Bridge across the .lley of the Bronx River. It now seems altogether probable at both the Mosholu Parkway approach and the driveway ferred to can be completed and thrown open for use some time the spring.

The completion of the bridge carrying the main park driveway across the valley of the lakes just northeast of the museum building, has made it possible to establish the water levels of the three ponds by means of suitable dams, each provided with a drainage pipe and valve to permit emptying when required. The lake nearest the railway is the largest of the three and the one nearest the river the smallest. The difference in level between the large lake and the middle one is about sixteen inches and that between the middle and lower one about twenty-four inches, the level of the lower lake standing about two feet and a half above that of the Bronx River at average flow. The establishment of these water levels will make it possible to suitably grade and plant the banks of all three lakes. The levels give an average depth of over three feet of water, except at small areas which require a foot or two excavation. The upper lake is fed in part by natural springs, but mainly by the surface drainage of the watershed reaching from that lake southward to the herbaceous garden, conveyed to it by a large drain; it also receives some water from the surface drainage of the western end of the Mosholu Parkway which reaches it through a culvert under the railway; the overflow water from the fountain in front of the museum building will be diverted into this lake by a pipe connecting with the drainage of the watershed mentioned, south of the museum building; it is therefore expected that this whole aquatic system will be kept up to the established levels without use of additional water, which, however, can readily be supplied if required for short intervals from pipes already laid.

Construction work has also included most of the filling needed against the railway and between it and the driveway west of the upper lake preparatory to topsoiling the swale at that point and completing the border screen of trees and shrubs along the railway, all of which it is planned to accomplish in the spring.

N. L. Britton,
Director-in-Chief.

AN INTERESTING ACCESSION TO THE LIBRARY.

A copy of a sumptuous and costly new acquisition, the photographic reproduction of the *Dioscurides Codex Aniciae Julianae picturis illustratus, nunc Vindobonensis Med. gr. I phototypice editus*, is now on exhibition in the Library. This work is of utmost importance in the study of the history of botany, on account of the large number of pictures of plants which were for the most part based on originals presumably of the first century, and are now here reproduced in facsimile for the first time. The original manuscript is one of the treasures of the Imperial Library of Vienna. It is said to date from 512 A. D., and was written and the miniatures painted for the Princess Anicia Juliana of Byzantium, and is the basis of all the early herbals. The work is Vol. 10 of the *Codices Graeci et Latini Photographici Depicti*, a series of reproductions of valuable manuscripts issued under the editorial supervision of Dr. de Vries, the Librarian of the University of Leiden. It consists of two folio volumes bound in heavy oak boards and is a faithful facsimile in black and white of the celebrated painted original, reproducing it down to the smallest fragment. The plates are of great beauty and remarkable for a certain vigorous distinction and decorative character that illustrators of the present day would do well to study. Not the least interesting are the miniatures showing groups of physicians and botanists in conclave, painters at work on plant-pictures, the portrait of the lady Anicia Juliana herself, and lastly a most beautiful ornamental title-page. Historical, prefatory and descriptive matter are by Anton von Premerstein, Carl Wessely and Joseph Mantuani.

Previous to the present facsimile, some reproductive plates of this manuscript were prepared under the supervision of Jacquin, two impressions of which are known to be in existence; the one having been in the possession of Linnaeus is now in the Library of the Linnaean Society of London; the other was sent to Sibthorpe to be used in the compiling of his *Flora Graeca*. This latter copy is now preserved at Oxford.

ANNA MURRAY VAIL.

THE PROTECTION OF NATIVE PLANTS.*

Though it may seem like a lapse into barbarism, I believe the most immediately effectual way to preserve our parks and their wealth of plants and flowers either wild or cultivated, is to thoroughly enclose and police them ; to exclude all but their guardians during the long dark hours of the night and to kill that darkness with an abundance of light. This applies almost entirely to the larger parks, their rugged character and denseness of native growths, which add so much to their charm, making them exceedingly difficult to protect.

The smaller parks are generally level surfaces devoted to lawns with only occasional trees and clumps of shrubbery and are easily kept under surveillance. They contain but little that can be destroyed or seriously injured and during the heated terms, they are places of refuge and relief for an overcrowded people. They have a mission peculiar to themselves, giving glimpses of greenery to many whose lives are as hard and gray as the hives they inhabit and the stony streets they tread. They may prove to be the kindergarten of the greater schools in which it is fondly believed people will eventually learn to enjoy and not destroy. Their character and uses indicate that they should be left free of access at all hours.

Mere expression of opinion rarely proves convincing, while experience is admittedly an excellent teacher. Let us then briefly review what experience has taught are the needs of our greater parks.

Central Park is enclosed with a low, neatly-capped stone fence, ornamental, expensive, but totally ineffectual as a bar to ingress or egress. For years the park was guarded by keepers called by courtesy park policemen but having very little police authority, while the city policemen were considered off post if they ventured within the park. These arrangements proved of material advantage to malefactors of all sorts and many a chase from the outside ended abruptly at the park wall, so easily vaulted. Night after night lilac and other salable blossoms were

*Awarded the second prize of fifteen dollars, competition of 1905, from the Caroline and Olivia Phelps Stokes Fund for the Preservation of Native Plants.

stolen by wagon loads for sale in the public streets and many a bush and shrub was practically destroyed.

During the village history of Harlem, and while it remained a distinctively home center, Mount Morris Park was a delightful resort by day or night and the old wooden fence and nominal guardianship proved all-sufficient because the majority of those who visited it were neighbors and friends and were proud of all that gave dignity or beauty to the little township.

Harlem grew rapidly upon the advent of the elevated road, and the influx of strangers developed many actual dangers in the park. Increase of the park force lessened these dangers, but the thorough lighting of the dark corners of the enclosure proved most effectual. The reason is simple. The light acted as a preventive, while police and park keepers work on the theory that their duties do not begin until an offence has been committed.

The New York Botanical Garden has no fencing and very few restrictions. All sorts of difficulties have resulted and many have yet to be overcome. Many of the peasant class of laborers from the Old World have felt free to select what they chose of the trees for fire wood, for what else could a wild bit of forest like the hemlock grove be good for if not for furnishing its quota of fire wood and fence posts? they argued. Many of our most recently acquired foreign laborers still retain like ideas and carry them to their logical conclusion if not closely watched. The name of those who believe the wild flowers and natural products to be nothing if not legitimate spoil is still legion and the garden suffers in consequence. Flower thieves who steal for profit also invaded the place and in the early spring made generous selection of expensive shrubs which had just been set out.

All these things point to the fact that twentieth century civilization has not developed overmuch regard for the rights, welfare or pleasure of our neighbor. Until it does, extensive lighting, effectual fencing and increased policing of the parks, would seem to be prime necessities.

However, neither iron nor stone seems to me to have fitting place about our more picturesque parks. Hedges should take the place of such material and would detract but little from the natural aspect of the enclosures; or substantial wire fencing might be used to advantage if well hidden with vines and shrubbery.

For the Ultima Thule of all that the most ardent lovers of nature hope to accomplish, not only to the betterment of parks, but in the preservation of wild flowers and the salvation of at least the best of our natural scenery, I would refer you to a people too often called heathen, to a land that is wondrously fair.

Let us visit in spirit far-off Japan and learn to tread hopefully in the pathways she has marked out, for what an eastern people has accomplished a western nation can repeat, though the way be long. There the spirit of the flowers and the love of them has entered into the very lives and pursuits of the people, young and old.

The priests of a temple point with pride to a tree that successive generations of devotees have trained and nourished for a thousand years or more. One such tree, its branches supported by bamboo columns, forms a veritable green-roofed temple in itself, capable of sheltering an audience of some two hundred or more.

There is a family whose members for three generations have been content to devote their time and attention to the cultivation of a single flower, the morning glory, and hundreds visit their little home to await the early opening of the wondrous blossoms.

Like care and attention has developed the wistaria vine until the arbors and summer houses erected for supports are weighted with blossoms a yard long. In the spring time whole communities flock to the orchards to study and admire the blossoms of the cherry and peach. Thus far the growing western regard for like blossoms has only reached the destructive stage and is all too apt to find expression in the breaking off of great branches for the blossoms, which generally scarce survive the journey to the despoiler's home.

The Japanese child is born and reared in an atmosphere of love for the beauties of nature, animate and inanimate. The very screen which hides his slumbers from inquisitive eyes is gay with the counterfeit presentment of trees and flowers and birds.

The artist, born amid such surroundings, learns to observe until a few seemingly random but remarkably bold strokes of pencil or brush serves to fix the semblance of bird or animal, bush or flower to the wonder and envy of the western artist.

The potter bending over his wheel abandons his task for a trip to the woodland or garden for a hint of the design best suited to ornament the vase he has fashioned. The garden, no matter how small, is planned and planted with care with a view to the whole which results in a perfect picture from which it seems nothing could be omitted or altered without marring the beauty of the design. The Japanese gardener has even succeeded in adding grace to the unpromising lines of a straight hedge by so blending it into the general outline as to disguise its harshest effects.

Is it not probable that the love of the beautiful and the ideal that leads to such infinite care and attention to detail is the key-note of the Japanese love of his birthland and of the patriotism that led the nation to give so freely of their all even of life itself for the country's weal?

And have such desires and pursuits effeminized the race or weakened its members? Ask their late enemies and they will tell you nay; while the history of the war is full of lessons in sanitation and humanity to be studied and humbly followed by the most favored and civilized of nations.

Though a long way behind in the study of love and regard for the beauties of nature it is not too much to hope that a like love for the varied and wonderful fruits and flowers, trees and shrubs of America may yet be born in the hearts of the people. Then we may do away with fences and guards.

G. Gordon Copp.

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NOTES FROM THE CONSERVATORIES.

That it is now summer-time in South Africa is denoted by the flowering of the aloes which are so numerous in that country. The odd *A. plicatilis*, with its long strap-shaped leaves in two ranks, is now sending forth its flowers; *A. ciliaris*, with its long, lank stems, is also flowering, as is *A. insignis*, of quite different habit; the common *A. striata Hanburiana*, quite frequent in cultivation, with its broad, flat, gray leaves with a narrow red margin, is sending up its clusters of bright flowers; and another species, *A. macrosiphon*, quite unusual in collections, is at present in full bloom. The gasterias and other genera related to the aloes, representing the lily family so largely in South Africa, are also blooming. All of these plants may be found in house no. 5.

That it is now the time of summer in southern Africa is also shown by the flowering of the heaths from that country, which are now sending forth masses of delicate bloom in houses nos. 13 and 14. In house no. 6 two plants of another south African plant, *Crassula portulacea*, are now laden with their pretty white or rosy flowers. These plants, miniature trees in habit, are well worthy of cultivation. They come from the dry regions of that far off country.

Those who have made journeys to our own southern lands will recall that beautiful rose of those regions with its large flowers of delicate hue — I mean the Cherokee rose. The writer remembers well the beauty of this plant as it grew on fences and hedges in central peninsular Florida. This rose is the *Rosa laevigata* described from Georgia by Michaux in 1803. It is also known as *Rosa Cherokeensis*, *R. Sinica*, and *R. Camellia*. It is said to be a native of China, and to have been introduced into our southern states, where it is certainly now perfectly at home, and one of the charming plants of that region, as all must testify who have seen it in bloom. A plant of this rose, now coming into bloom, will be found on one of the trellises in house no. 13.

In the house which holds the Cherokee rose will be found another attractive plant, but its attractiveness is along an entirely different line — it is brilliant and striking in color. This plant, *Bignonia venusta*, from Brazil, graces a column and part of the rafters, an environment well suited to bring out its habit and to show its effectiveness and use in conservatory decoration, its clusters of rich red flowers hanging down in festoons.

Now in full bloom in this same house is a plant which will delight the heart of all southerners — this is the yellow jessamine of the southern states, where it clambers on fences and over shrubs and small trees, its bright yellow flowers dear to all hearts, for they come as winter wanes, the first harbinger of spring, and a sign that nature is again astir. It is known to botanists as *Gelsemium sempervirens*, and in this country is found growing wild all the way from Virginia to Florida and Texas. It is also known in Mexico and Central America.

In house no. 4 a large group of the banana family forms the principal feauture of interest. A wild plantain, one of this family, is now in full bloom, its bright red inflorescence making it a conspicuous member of the group. If a plantain resembling the common weed of our fields here in the north be looked for, the search will be a long and fruitless one, for this wild plantain of the tropics is quite another plant, its resemblance to the plantain, one of the most valued of food plants of tropical regions and one of the bananas, giving to it its common name. It is *Heliconia latispatha*, a native of tropical America. But a short distance from this plant will be found another member of the banana family, Musaceae, this one from southern Africa — *Strelitzia Nicolai*. This flowered for the first time in the conservatories on March 15, 1903; an account of this, accompanied by an illustration, appeared in the journal for April of that year. At that time the plant was much smaller than it is now, the flowers being borne near its base. It has now developed a trunk and the flowers are borne several feet in the air, so that they are quite readily seen. Another plant, which came to us as *S. augusta*, is also in flower, and proves to be the same as the above. This is a disappointment. We are very desirous of securing a plant of *S. augusta*, which has the entire flower white, instead of a portion of it being blue, as in the other species.

As the banana family is now under consideration I wish to call attention to another member of it, several plants of which are in the group in house no. 4 — this is *Musa textilis*, of the Malayan region. This is of great value as a fiber plant, for it is from the leaf-sheaths of this that the Manilla hemp of commerce and the industrial arts is secured.

I cannot refrain from again calling attention to the charming crested orchid, *Coelogyne cristata*, from the Himalayan region, an account of which, together with a plate, appeared in the Journal for April of last year. A group of these plants, now coming into bloom, will be found on one of the side benches in house no. 12.

GEORGE V. NASH.

February 2, 1906.

THE AMERICAN DRAGON'S-BLOOD-TREE.

In May, 1888, Mr. C. Thieme, while collecting in and about the vicinity of San Pedro Sula, Honduras, discovered at an altitude of 300 meters above sea-level a new and interesting species of *Dracaena*. Subsequent collections have been made by H. von Tuerckheim in Guatemala, and by Adolfo Tonduz and Enrique Pittier in Costa Rica.

This plant, the American dragon's-blood-tree, is a member of the Lily Family, and is closely related to *Yucca*, the Spanish Bayonets. While the leaves of the Yuccas are rigid and sharp pointed, the foliage of the Dracaenas is often flexible and ornamental.

Prior to this discovery, the genus *Dracaena* was known only from the Old World and its occurrence in Central America was wholly unexpected.

Dracaena americana, as this new plant has been named by Captain John Donnell Smith of Baltimore, the distinguished student of the Central American flora, is found from sea-level up to an elevation of 500 meters. For years Dracaenas have occupied a prominent place in the collections of many conservatories and have been highly useful for decorative purposes. Many species are also well adapted for room or table decoration.

At the present time the New York Botanical Garden is the only institution possessing living plants of the American species. These plants were raised from seeds collected by the writer in Honduras during February, 1903, and are now between four and six feet in height. In their native haunts they grow from twenty to thirty-five feet high. They are now on exhibition in the Public Conservatories (in house no. 3), and rank among the rarities of the Garden collection. Other species may also be seen in our collection, in some of which the entire length of the leaves is traversed by bands of creamy-white and various shades of yellow, while others have the greater part of their surface blotched or spotted with white.

Closely related to the American plant, is the dragon-tree of the Canary Islands, notable for the existence of individuals believed to be the oldest living vegetable organism in the world. The age of one tree, in particular, the once famous dragon-tree of Teneriffe, has usually been estimated to be from four thousand to six thousand years, having thus an antiquity comparable with that of the pyramids. This wonder of the plant world was seventy feet or more in height, and survived intact until the year 1819, when, during a terrific storm, one of the large branches was broken off. A similar storm in 1867 stripped the trunk of its remaining branches and left it standing alone.

This tree derives its common name from a reddish exudation known as dragon's-blood, which has been found in the sepulchral caves of the Guanches and is supposed to have been used by them in embalming their dead. It is said to have been at one time an important article of export from the Canaries and has never fallen entirely into disuse. Certain members of the Palmaceae and Papilionaceae also yield a resin called dragon's-blood.

PERCY WILSON.

FIG. 2. *Dracaena americana*, the American dragon's-blood-tree.

NOTES, NEWS AND COMMENTS.

Professor J. C. Arthur and Mr. F. D. Kern, both of Purdue University, Lafayette, Indiana, held research scholarships at the Garden for the month of January. Their attention was entirely devoted to the large collection of plant rusts in the cryptogamic herbarium.

An interesting collection of Japanese plants, sent to us in in exchange for North American plants, has just arrived from Akita, Japan. The collection, containing two or three hundred specimens belonging to various plant groups, was made last summer by Mr. Yuushun Kudo on Mt. Moriyoshi, at an altitude of 7,000 ft.

Mr. H. H. York, a graduate of De Pauw University, for some time Fellow and Assistant at the Ohio State University, from which institution he also holds the degree of Master of Arts, and now a Fellow in Botany at Columbia University, took up systematic work at the Garden last fall with a view of monographing the North American plants of the Mallow Family. This family is a very homogeneous one, and both genera and species are rather poorly differentiated, which in itself renders the work of the monographer very difficult; but his difficulties are increased owing to the fact that the family attains its best development in Mexico and Central America and herbarium material from these regions is as yet comparatively meager.

Mr. Henry Allan Gleason, graduate student in botany in Columbia University, is among those who are engaged in research work this year in the herbarium, library, and laboratories of the garden. Mr. Gleason received the degree of B.S. from the University of Illinois in 1901 and that of M.A. from the same institution in 1904. In the University of Illinois, also, he occupied the position of curator of the herbarium from 1900 to 1904, serving in addition as assistant in the teaching work from 1901 to 1902 and as instructor in botany for the year 1903–'04. During the college-year 1904–'05, he held a fellowship in botany in the Ohio State University, the previous summer having been spent as a special assistant at the Missouri Botanical Garden. Mr. Gleason has devoted several summers to floristic and ecological studies in southern Illinois and has brought out a number of interesting facts in regard to the distribution of the higher plants in that region. A series of three articles under the title of "Notes on Some Southern Illinois Plants" has been published by him in *Torreya* and a series of five under the heading of "Notes from the Ohio State Herbarium" has appeared in recent numbers of the *Ohio Naturalist.* Mr. Gleason's major work during the present year consists of taxonomic studies of a group of seed-plants that is well represented in the Middle West, though he is giving some attention also to the marine algae and the Pteridophyta.

The total precipitation in the garden during January, 1906, amounted to 2.78 inches. Maximum temperatures of 59.5° on the 4th, 45° on the 12th, 59° on the 21st, 56° on the 22d, and 48° on the 30th were recorded; also minima of 24° on the 3d, 7° on the 10th, 29° on the 18th, and 20° on the 26th.

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PLANTS AND SEEDS.

1 plant for conservatories. (Given by Miss M. A. Knight.)

10 plants for conservatories. (Given by Mrs. B. B. Tuttle.)

35 plants from Mexico for conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

3 plants for conservatories. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

1 plant for herbaceous collections. (Collected by Dr. H. H. Rusby.)

5 bulbs from Philippine Islands. (Given by J. M. Thorburn & Co.)

25 plants of *Castanea dentata.* (Purchased.)

2 plants for nurseries. (By exchange with New York Zoölogical Society.)

1 fern for nurseries. (Given by Miss Church.)

5 violets. (By exchange with President Ezra Brainerd.)

4 plants for conservatories. (Given by Dr. R. M. Harper.)

1 plant for conservatories. (By exchange with Bureau of Plant Industry.)

3 cuttings for conservatories. (Given by Dr. G. H. Shull.)

5 plants for conservatories. (Given by Mr. F. H. Chapman.)

17 packets of seeds from the Philippine Islands. (Collected by Mr. R. S. Williams.)

1 packet of seeds from Montana. (Collected by Mr. R. S. Williams.)

1 packet of seeds. (Given by Mr. J. S. Holbrook.)

1 packet seeds of *Cassia Medsgeri.* (Given by Miss Blanche Sherbondy.)

23 packets of seeds from Costa Rica. (Given by Mr. C. Wercklé.)

1 packet of seeds. (By exchange with the Royal Gardens, Kew, England.)

2 packets of seeds. (Given by Dr. R. M. Harper.)

3 packets of seeds. (Given by Col. T. F. Wilcox)

3 packets of seeds. (By exchange with Bureau of Plant Industry.)

4 packets of seeds from Mexico. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

1 packet of seeds from Honolulu, S. I. (Given by Mrs. Gen. Sumers.)

1 packet of seeds from Fiala Expedition to North Pole. (Given by Dr. H. H. Rusby.)

1 packet of seeds from the Philippine Islands. (By exchange with Bureau of Forestry.)

1 packet of seeds. (Collected by Dr. J. A. Shafer.)

3 packets of seeds from the Philippine Islands. (By exchange with Bureau of Botany.)

1 packet of seeds. (Given by Mr. G. A. Skene.)

83 plants derived from seed from various sources.

MUSEUMS AND HERBARIUM, JANUARY, 1906.

50 specimens "Phycomyceten et Protomyceten," nos. 201–250. (Distributed by Dr. P. Sydow.)

1 specimen of beadwork made of different seeds from the West Indies. (Given by Dr. Mary J. McCleery.)

24 specimens of Mexican plants. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

8 specimens from Virginia. (By exchange with Mr. K. K. Mackenzie.)

1 specimen of *Ganoderma sessile* from Louisiana. (Given by Professor J. C. Arthur.)

2 specimens of fungi from the Black Hills, South Dakota. (Given by Dr. Hermann von Schrenk.)

75 specimens of mosses from Missouri. (Collected by Mr. B. F. Bush.)

28 specimens "Musci Acrocarpi Boreali-Americani." (Distributed by Professor J. M. Holzinger.)

21 specimens of mosses from the Northern Black Hills, South Dakota. (Given by Miss F. Grace Ernst.)

6 specimens of fungi from Guatemala. (Collected by Professor W. A. Kellerman.)

97 specimens from the Philippines. (By exchange with the Bureau of Government Laboratories, Manila.)

5 specimens of Iowa plants. (Given by Mr. R. I. Cratty.)

6 specimens of *Sparganium*. (Given by Mr. E. P. Bicknell.)

44 specimens from New England. (Given by Miss Frances P. Perry.)

31 specimens "North American Musci Pleurocarpi." (By exchange with Dr. A. J. Grout, for the Columbia Herbarium.)

38 specimens of ferns from tropical America. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

60 specimens from Utah. (By exchange with Professor A. O. Garrett.)

8 specimens of *Malus* from Maine. (Given by Mr. F. L. Temple.)

1 specimen of fungus from New Jersey. (Given by Mr. H. W. Ballou.)

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Vol. VII MARCH, 1906 No. 75

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

CONTENTS

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

JOURNAL

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A GUIDE TO THE CONSERVATORIES.

The range of horticultural houses, known as the conservatories, is located near the southern boundary of the Garden, but a short distance from the terminus of the Third Avenue Elevated Railroad. The range comprises fifteen houses or compartments, numbered consecutively, the sequence of numbers beginning with the large central dome, known as the palm-house, continuing westward, and then around the range, which encloses an oblong court, terminating with the house to the eastward of the palm-house and known as no. 15. The accompanying floor plan of the range will make this plain.

Ground was formally broken for this structure on January 3, 1899, and the first eight houses, nos. 1 to 5 and 13 to 15, were completed in June, 1900, and at once opened to the public. The remaining houses were finished and opened to visitors early in 1902.

The conservatories cover an area of about 45,000 square feet. The front elevation is a little over five hundred feet in length and the side elevations about two hundred and ten feet. The central house with the large dome, designated as no. 1, is circular in form; it is one hundred feet in diameter and from the ground to the apex of the upper dome is about ninety feet. The lateral extension on each side of this house is about one hundred and sixteen feet long, thirty feet wide and twenty-six feet to the ridge, each extension divided by a transverse partition into two equal parts. At the end of each of these extensions is a house, cross-shaped in form, with a maximum width of eighty-four feet and a height of forty-six feet to the ridge. From each of these corner houses runs an extension thirty feet wide and seventy-five feet long, which is terminated by a square house with cut corners fifty feet in diameter and thirty-five feet high. The range terminates at each end with an extension from this corner house about thirty-eight feet wide and one hundred and three feet long, divided transversely into two equal compartments or houses. The range encloses an oblong rectangular court about three hundred and eighty-six feet long and one hundred and eight feet wide, in which are placed, one on each side of the main walk, two large pools devoted to the display of water-lilies and other aquatic plants. These pools are about one hundred feet long and fifty feet wide.

The building, which is modernized Italian renaissance in design, stands upon a grass terrace five feet high, approached by six flights of steps, three of these on the north side, the central one of which is broader and terminates in the walk leading to the large dome; one at each end; and one on the south side, which is the main entrance, and the only one at which vehicles can approach the foot of the terrace. Entrance to the range can be had only at the north and south sides of the large dome or palm-house.

The range is heated by steam, supplied from the power-house, located near the railroad on the west side of the grounds. Water is supplied by two systems, one for hot and the other for cold, each water-faucet having a connection with both systems, so that it is possible to supply water at whatever temperature is required.

The collections assembled here were acquired in the main by gift or exchange in the early stages of installation, while lately large additions have been made through exploring expeditions sent out by the Garden. There are now about ten thousand plants contained in the fifteen houses, representing, with those which cultural conditions require us to keep at the propagating houses at certain periods, about two hundred families, thirteen hundred genera and over seven thousand species.

It is intended that each plant shall have a show label. Many thousands of these labels have already been placed in position, and this work is being actively and continuously carried on.

Floor Plan of the Conservatories.

This label gives a common name for the plant, its botanical name, the country where it is native, and the family to which it belongs. This feature gives to the collections a great educational value, and offers a ready means not only for a comparative study of plant relationships but also of their geographic distribution.

The general arrangement of the collections is outlined below — the details will be considered when we come to treat of each house separately. The first consideration, of course, must be a cultural one, and for this reason certain houses or groups of houses are kept at different degrees of temperature and humidity, and in the proper house are brought together the plants requiring such conditions. In each house, however, the plants are grouped by families, and also by genera, wherever practicable. For cultural purposes the houses are divided as follows :

Houses 1 to 4, 7, 8, 10, 11 and 15, are devoted to tropical plants ; of these, nos. 1 to 3 (no. 2 also contains *Nepenthes*, the pitcher plants, belonging to the dicotyledonous division), the greater part of no. 4, and no. 15 contain the endogenous or monocotyledonous plants, or those with one seed-leaf; a part of no. 4, and nos. 7 and 8 the exogenous or dicotyledonous plants, or those with two seed-leaves ; and nos. 10 and 11 the ferns and their allies, no. 11 containing the large tree ferns and other specimens of a size too great to be accommodated on the benches in no. 10.

Houses 12 to 14 contain the temperate collections. In nos. 12 and 14 the plants are arranged according to the sequence adopted by Engler and Prantl in their Natürlichen Pflanzenfamilien, which is of great aid to students in the comparative study of plant families. It is aimed to represent here as many families and genera as the conditions and space at command will permit. The sequence begins in house no. 12 and terminates in no. 14; the details will be considered when we treat of those houses. In no. 13 are placed plants too large to be accommodated on the benches in houses nos. 12 and 14.

Houses 5 and 6 contain the collections of plants from xerophytic or desert regions, including the cacti and century plants or agaves ; while no. 9 is devoted to the aquatics, which require conditions exactly opposite.

Let us now consider the contents of the individual houses, and, that they may be referred to readily, take them up in the order of their numbering. To facilitate the handling of crowds, and to prevent confusion in the inspection of the collections, it has been found necessary to adopt the rule of keeping to the right. Visitors are requested to observe this rule.

House No. 1.

In this house will be found the greater part of the palms, the Palmaceae ; the sago-palm family, the Cycadaceae, more nearly related to the ferns, however, than to the palms ; the cyclanthus family, the Cyclanthaceae ; and a portion of the grass family, the Poaceae, often known as the Gramineae.

The great preponderance of the palms gives to this house the name of the palm-house. A consideration of some of its features will be found in an illustrated article in this Journal for January, 1903, entitled, "The Palm Collection."

The palm family, Palmaceae, numbers about 1,100 species, widely distributed in tropical countries, with a few extensions into temperate regions. They are most fully represented in America, less numerously in Asia and Australia, and are rare in Africa. They are of great economic importance to the inhabitants of the countries in which they grow, and many of their products, either crude or manufactured into articles, are of world-wide use.

Near the south entrance, on the right hand side of the walk, will be found a specimen of the cabbage palmetto of our own southern States, *Sabal Palmetto.* This represents the form with the old leaf-sheaths still persisting, which give to it an appearance quite different from the older state of the tree, shown by a specimen a little further along to the left, in which these have fallen away, exposing the naked straight trunk. This palm is extremely plentiful in some parts of Florida, especially along the line of the East Coast Railway, south of Jacksonville, where groves made up of many thousands of them occur. It is also found in the Bahamas. Nearly opposite to this is a tall plant of the Panama silvertop palm, *Coccothrinax argentea,* which, as indicated by its common name, comes from the Isthmus of Panama. The under surface of the leaves is silvery, and this character, which is found generally in the species of this genus, gives to the leaves a peculiar silvery appearance when swaying in the breezes of their native homes. Another plant in the immediate neighborhood is *Phoenicophorium sechellarum*, known only from the Seychelles Islands. An account in detail of this specimen, with an illustration, will be found in the JOURNAL for September, 1902. The large leaves, which are merely toothed on the margin, are quite in contrast with the more divided leaves of its neighbors. While this plant has flowered in other conservatories, it is believed that it perfected fruit here under cultivation for the first time, and from seeds thus derived several specimens have been raised. In a young state, and until the plants attain a considerable height, the leaves of this palm are clothed with a dense growth of needle-like spines. But a short distance from this is a West Indian palm, *Acrocomia media*, secured during one of the Garden expeditions to Porto Rico. It is known as the tufted palm. The trunk is armed with numerous black flattened spines.

Almost opposite to the *Phoenicophorium* is a large specimen of a Mexican palm, *Acanthorhiza aculeata*, curious in the development of spines on its trunk which are quite different from those in the *Acrocomia*. Near the entrance to house no. 15 is *Thrinax microcarpa*, the small-fruited thatch-palm, from the southern part of Florida. This is rare in cultivation under glass. Near this, on one of the rafters, is a climbing palm from Java, the rough calamus, *Calamus asperrimus*. There are about two hundred species of these climbing palms, all inhabitants of the Old World, where they support themselves on the surrounding vegetation by means of the long spiny tips to the leaves. Standing well above the other palms to the left of the walk and near the entrance to house no. 15 is a large specimen of the East Indian wine-palm, *Caryota urens*. This is one of the group, the members of which begin to flower at the apex of the stem and die when done flowering. It is this palm which furnishes much of the palm-wine or toddy of India. To obtain this a man climbs the palm and cuts off the flower-cluster before it expands, hanging a receptacle to the cut end to catch the juice, which flows freely, sometimes for a month. When fresh it is a pleasant drink, but it soon ferments and becomes intoxicating, and when distilled it is called arrack, the gin of India. An account of this specimen, with an illustration, appeared in the JOURNAL for November, 1902, under the title, "A New Palm for the Conservatories." Opposite to the wine-palm is *Pritchardia Martii*, a rather rare palm from the Pacific Islands. This specimen is frequently in flower and fruit. Forming a part of the same group is *Pseudophoenix Sargentii*, for a long time known only from Elliott's and Long Keys, Florida. From the former key it is now all but exterminated, its removal to other points for decorative purposes and the clearing of the land for pineapple culture having effected this result. It has since been discovered to be quite common on several of the Bahamas, and perhaps this is its real home, the plants on the Florida keys being but distant sentinels. It is known in the Inaguas as the mountain cabbage palm. This palm, which is rare in cultivation in the north, at least in specimens as large as the one under consideration here, flowered at the Garden for the first time in 1903, an account of which appeared in the JOURNAL for August of that year. Near the *Pseudophoenix* is another Florida palm, *Thrinax floridana*, known only from the southern part of the peninsula. As it grew in the grounds of the large hotel at Miama, whence the two plants in the collection here were secured, its appearance was most attractive, the large masses of ivory-white fruit giving it a very striking aspect. For an account of the Florida palms in cultivation in the Garden collection, see the JOURNAL for October of 1904.

Near by is the cabbage palm of the West Indies, *Roystonea oleracea*, which forms so striking a feature in the landscape of these islands. Opposite to the north entrance is a group of the date palms, the genus *Phoenix*, which in some twelve or fifteen species is found in the tropical and subtropical regions of Asia and Africa. The one of great commercial importance is, of course, the common date palm, *Phoenix dactylifera*, from which the well-known date is obtained. One or two specimens as yet small and with no development of the trunk will be found here. In the countries where it grows the trunk sometimes attains a height of one hundred feet. The flowers, which are of two kinds, staminate and pistillate, borne on different trees, occur in big bunches, the stems bearing the clusters arising from the axils of the leaves. In cultivating this plant in India, as a rule only one or two staminate plants are grown in each grove. The pistillate trees are artificially fertilized, when the flowers are in the right condition for this purpose, by cutting off a bunch of flowers from the staminate tree and inserting small portions of it in each cluster of the pistillate flowers. The pollen is said to retain its fertilizing power for one or two months, so the staminate flowers are carefully preserved and used when required. Each tree is capable of yielding but a certain number of fruits, and rarely more than twelve bunches are allowed to remain on a tree, all the weaker and less promising ones being cut out. The date palm has been cultivated for many centuries.

Near the entrance to house no. 2 will be found the group of cocoanut palms. The genus *Cocos*, to which these belong, contains about thirty species, all natives of tropical and subtropical South America, with one exception, this being *Cocos nucifera*, the origin of which is lost in obscurity. It is extensively cultivated in all tropical countries for its fruit, the common cocoanut. Many thousands of the trees are found in our own state of Florida. It is very common in the West Indies, where it sometimes grows at an elevation of 2,500 feet, although preferring the vicinity of the seashore, where it attains its best proportions and produces its best fruit. It grows sometimes one hundred feet tall. Quite in contrast with this is the dainty little *Cocos Weddelliana*, from Brazil, with its delicate leaves and slender trunk. A specimen of this, not over three or four feet tall, forms a part of this group, and is frequently to be seen in flower.

Opposite to the cocoanut palm is a large plant of *Livistona chinensis*, the Chinese fan-palm. It is this species, in small plants, which is so extensively used in decorations; it is frequently known under the name of *Latania borbonica*. Near it is a smaller specimen of *Livistona australis*, sometimes known as *Corypha australis*, from Australia. Not far removed is another species of the genus, *L. Hoogendorpii*, from Java, in an unusually fine specimen. The petioles of the leaves are strongly armed with stout spines. Small plants of *Livistona rotundifolia*, also from Java, very popular for the past few years as a house plant, will be found in the immediate vicinity.

Opposite to the plant of *Livistona Hoogendorpii* are two plants of *Licuala grandis*, from New Britain. This is not so easily grown as the livistonas, requiring more heat. Two palms from Lord Howe's Island will be found in this part of the house—they are *Howea Belmoreana*, the curly palm, and *Howea Forsteriana*, the flat or thatch-leaf palm, both most popular as house plants, and deservedly so, for they possess the qualifications of grace, beauty and hardiness so requisite in plants devoted to house culture. Many thousands of these are grown and sold in the neighborhood of New York every year. Upon the *Howea Forsteriana* a plant of the genus *Vanilla* is growing; it is from the fruits of *Vanilla planifolia*, one of the orchids native in tropical America, that the flavoring extract known as vanilla is obtained.

Two large plants of *Neowashingtonia robusta*, the desert palm, will be found near the south entrance. An account of these, in an article on "George Washington's Palms," will be found in the JOURNAL for February, 1904, accompanied by two illustrations, one of the tree as it grows in the California Desert, the other of one of the specimens in the Garden collection. Nearby is a specimen of the royal palm, *Roystonea regia*, found in southern Florida, the West Indies and in Central America. It is closely related to the cabbage palm of the West Indies, *R. oleracea*, to which allusion has already been made. Another of the popular house palms is *Chrysalidocarpus lutescens*, commonly known as *Areca lutescens*, a native of Madagascar. It is sometimes called the golden-fruited palm, on account of the color of its fruit. This is represented in the collection by several large specimens fifteen to twenty feet tall. Its great usefulness as a decorative plant lies in its graceful habit and the rich yellow of its petioles and leaf-midribs, which are especially marked in young plants, the form in which this is commonly used. Another of the palms having the leaves armed with needle-like spines is *Acanthophoenix crinita*, from the Mascarene Islands, a specimen of which will be found near the south entrance. The under surface of the leaves is a blue-white, adding to its beauty. Other specimens and species of palms will be found on the central bench in house no. 15.

The sago-palm family, Cycadaceae, will be found located opposite the door leading into house no. 15. There are a number of large specimens of *Cycas revoluta*, from Japan, commonly known as the sago-palm, the leaves of which are largely used in funeral decorations. Several large specimens represent *Cycas circinalis*, a species from the Moluccas. All of the specimens, with one exception, are pistillate. The staminate inflorescence is quite different in appearance from the pistillate. A much rarer plant is *Cycas media*, from Australia, represented by a single staminate specimen. *Dioon edule*, a native of Mexico, is present in two plants; its seeds are eaten by the Mexicans. Two species of *Encephalartos*, an African genus, are represented, *E. horridus*, to the right, from tropical Africa, and *E. villosus*, to the left, from southern Africa. Close to the edge of the walk on the left are several specimens of two species of *Zamia*, *Z. pumila* and *Z. floridana*, both native to Florida. The roots of the latter, under the name of coontie, are dug to a considerable extent in southern Florida and manufactured into starch, in which they are quite rich. Other specimens of this family will be found on the central bench in house no. 15.

Near the north entrance will be found the cyclanthus family, the Cyclanthaceae. The genera *Cyclanthus* and *Carludovica* are both represented, the latter in several species. The best known of these is *Carludovica palmata*, the Panama-hat plant, of which there are two large specimens in the collection. It is said that the famous Panama hats are made from the young leaves of this plant.

Near the south entrance is the group of the grass family, the Poaceae or Gramineae, represented mainly by the bamboos. The largest and most conspicuous is a plant of *Bambusa vulgaris*, a native of India, but widely introduced into tropical America. It is very common in the West Indies and is of untold value to the natives there, being used for a great variety of purposes. It is extensively employed for making the framework of their houses, and when split into longitudinal sections does service also as an exterior covering for the framework, which is either left naked or plastered over with mud. It is also cut up into sections at the joints and used for vessels of various kinds. A section of it several feet long, from which the cross-partitions at the joints have been removed, excepting that at the lowermost joint, is employed in Haïti as a water-carrier. Water-pipes and many other articles too numerous to mention here are made from it. The rate of growth of the new canes is almost incredible. From actual measurements made on this particular plant it has been found that one of the canes grew sixty-five feet in ninety-five days, or at the rate of about eight inches per day. Other specimens of the grass family will be found in the aquatic house, no. 9.

House No. 2.

In this house will be found the following families: the East Indian pitcher-plant family, Nepenthaceae, hanging from the rafters on both sides, the only exogenous plants in the house; the pineapple family, Bromeliaceae, on both side benches, with a few hanging from the rafters; and the aroid family, Araceae, confined to the central bench, and to the small bench at the end.

The pitchers of the East Indian pitcher plants, *Nepenthes*, belonging to the Nepenthaceae, are said to secrete from gland-cells a fluid which digests the insects which fall into the liquid contained in them. These plants are largely climbers, growing upon trees, and are often erroneously referred to by the general public as orchids, with which they have nothing whatever to do, being members of the large division of exogenous plants, while the orchids belong to the other large division, the endogenous. The pitchers are the petioles of the leaves modified; what is called the blade or broad flat part of an ordinary leaf is represented in these plants by the lid-like organ over the pitcher, which, however, is not movable, as is sometimes asserted by visitors to the collection. The pitchers are sometimes erroneously referred to as the flowers, but these are borne in racemes or panicles at the upper part of the stems. There are about thirty-five species of the genus *Nepenthes*, with numerous horticultural hybrids in addition. These plants grow in tropical Asia and Australia, Madagascar, the Seychelles Islands, the Philippine Islands, and especially in the Malayan Archipelago.

The pineapple family, Bromeliaceae, is strictly American in distribution, mostly confined to the tropics. There are between 1,100 and 1,200 species known. Much water collects in the bases of the leaves of many of the species, and the water thus collected is said to furnish breeding places for mosquitoes in tropical forests. The pineapple, *Ananas Ananas*, is the most widely known plant of this family. It is cultivated in all tropical countries, and even in cold climates under glass. In southern Florida many hundreds of acres are devoted to the pineapple industry. Several forms of this plant are represented in the collection on the north side bench, about half way down the house, among them some variegated forms which are quite decorative. On the corner of the same bench near the palm-house will be found two or three specimens of the hedge bromeliad, *Bromelia Pinguin*, very largely used in the West Indies for hedges. An inspection of its viciously armed leaves will show how well it is adapted to this purpose. The leaves attain a length of four to six feet, and a thickly planted hedge effectually keeps out both man and beast. The genus *Tillandsia*, on the south bench in the corner near the palm-house, is a large one, and is represented by several species in Florida. The Florida or Spanish moss, *Tillandsia usneoides*, native to Florida and tropical America, will be found hanging from two suspended baskets. This occurs in great profusion in some of the Florida swamps, hanging down in long streaming masses, and giving the surroundings a most weird appearance. The members of the pineapple family are nearly all epiphytes, and sometimes cover the branches of the trees with an unbroken mass to the exclusion of all other forms of vegetation.

The aroid family, the Araceae, is a vast one, occurring in the tropics everywhere, both in the Old World and the New, with a few extensions into temperate regions. There are perhaps over twelve hundred species of this family known. The modest little jack-in-the-pulpit of our own woods is one of the best known;

the common sweet flag, *Acorus Calamus*, and the skunk's cabbage, *Spathyema foetida*, are other well-known examples occurring in our own country. Many of these plants have corms, as is the case in the jack-in-the-pulpit, and in the commonly cultivated fancy caladiums, *Caladium bicolor*, of which specimens will be found in this house during the growing season of these plants. Plants with corms, whether tropical or temperate, usually have a long resting period, and at such times are destitute of both flowers and leaves.

The habit of growth of these plants is quite varied. In some it is tufted, while in others there is a long creeping stem, with roots at intervals which enable them to climb up the trunks of trees in the tropics, sometimes to a great height. The genera *Philodendron* and *Anthurium*, the latter known as tail-flowers from their long tail-like spadix, furnish examples of this. An examination will show the great resemblance in inflorescence in all the members of this family. There is the broad leaf-like part, very variable as to both form and color, called the spathe, which is represented by the "pulpit" in our own jack-in-the-pulpit; and the usually long cylindrical portion, which also varies much in color and form, called the spadix. These parts collectively are often spoken of as the flower, but this is erroneous. The true flowers are quite small and partially or completely cover the surface of the spadix, their outlines being often indicated by more or less formal markings. Other members of this family form a group in house no. 4.

House No. 3.

Here will be found: the amaryllis family, Amaryllidaceae, on the central bench, and a portion of the north side bench; on the central bench will also be found the tacca family, Taccaceae, the spiderwort family, Commelinaceae, and the arrow-root family, Marantaceae; on the north side bench, in addition to the amaryllis family, are the ginger family, Zingiberaceae, and the banana family, Musaceae; on the south side bench are located the lily family, Liliaceae, the iris family, Iridaceae, the screw-pine family, Pandanaceae, and the bloodwort family, Haemodoraceae.

The amaryllis family, Amaryllidaceae, is represented by a number of species of the spider lilies, *Hymenocallis*, such as *H. expansa*, *H. speciosa*, and *H. caribea*. All the species of this genus are confined to America. The genus *Crinum*, a cosmopolitan one, has representatives in the following large and showy species : *C. augustum*, with masses of large claret-colored flowers, a native of Mauritius, but widely cultivated in the West Indies ; *C. asiaticum*, a native of tropical Asia, as its specific name implies, with white flowers ; and *C. americanum*, common in the swamps of our southern states, ranging from Georgia and Florida to Louisiana and Texas, and known as the swamp lily. The genus *Furcraea* is represented by several species, the most interesting of which, on account of its commercial value, is *F. foetida*. It is widely distributed in the tropics of both the Old World and the New. In Porto Rico it is known as maguey, but is not the same as the plant of that name found in Mexico. It is sometimes known as *Furcraea gigantea*. A fiber is derived from its leaves. Another interesting plant of the same genus is *F. cubensis*, with much broader toothed leaves. This is widely spread through the West Indies. Several plants of both these species will be found on the north side bench.

The curious tacca family, Taccaceae, is represented in two genera, each by a single species ; *Tacca cristata* and *Schizocapsa plantaginea*, the former a native of the East Indies, the latter of China. The long slender drooping organs arising from the flower cluster are said to be bracts.

The spiderwort family, Commelinaceae, has an interesting representative in a dracaena-like plant which was offered to the American public some years ago by a nurseryman, under the name of *Tradescantia dracaenafolia*. Upon investigation it proved to be an old Mexican plant, described many years ago by Lindley as *Spironema fragrans*. It is not particularly showy, but the individual flowers are a pure white and quite dainty and exhale a delicious fragrance. A showy plant is *Dichorisandra thyrsiflora*, a native of Brazil, which bears large terminal masses of deep blue flowers at certain times of the year. The pouch plant, *Rhoeo discolor*, a native of Mexico but widely distributed in tropical

America, receives its common name from the queer pouch-like sheathes from which the flowers arise.

In the ginger family, Zingiberaceae, there are specimens of several species of the genus *Costus*. *Costus igneus*, a popular member of the genus from Brazil, is ornamental in its large deep orange-colored flowers. *Kaempferia rotunda*, of tropical Asia, sends up, early in the year, on very short stalks a succession of fragrant lavender flowers, which are followed later by large erect ornamental leaves, so that it has two desirable decorative features.

The arrow-root family, Marantaceae, is largely shown in the genera *Maranta* and *Calathea*. *Maranta arundinacea*, from the roots of which the arrow-root of commerce is obtained, is a native of South America, but is widely distributed elsewhere; it is represented by several specimens in the collection. The genus *Calathea*, comprising over one hundred species in tropical America, furnishes many excellent foliage plants. Among these may be mentioned: *C. zebrina*, the zebra plant, *C. picta* and *C. virginalis*, all from Brazil; *C. Legrelleana*, from Colombia and Ecuador; *C. Veitchiana*, from Peru; and *C. ornata*, from British Guiana, which in a young state has the leaves prettily marked with red and white stripes parallelling the veins, a character entirely disappearing in the mature plants. Another ornamental plant of this family is *Stromanthe sanguinea*, from Brazil, the bright red bracts of the inflorescence making it highly desirable.

The genus *Heliconia* represents the banana family, Musaceae, with two ornamental forms: *H. aureo-striata*, said to be a native of the Solomon Islands, and perhaps not a true *Heliconia;* and *H. illustris rubricaulis*, reported to come from the Pacific Islands.

The lily family, Liliaceae, has many showy plants, among them the following: *Dracaena Godseffiana*, with its spotted leaves and shrubby habit, from the Congo; *Dracaena Goldieana*, from west tropical Africa, in which the leaves are barred; *Dracaena Aubryana*, from tropical Africa; *Dracaena americana*, from Central America; and *Dracaena Draco*, the famous dragon-tree, of the Canary Islands. An account of this last species and of *D. americana*, with an illustration of the latter, will be found in the JOURNAL

Banana group in house No. 4. The plant to the right shows an inflorescence just unfold-
g. The one in the center exhibits this developed into a bunch of fruit, with the long naked
l and knob of unfolded bracts characteristic of the true bananas.

for February of this year. Other members of this family are the popular *Cordyline terminalis*, from tropical Asia, and the bowstring hemps, belonging to the genus *Sansevieria.*

In the iris family, Iridaceae, the genus *Marica*, mostly from tropical America, is represented by *M. northiana.* The flowers of this plant are dainty and pretty, but unfortunately they are so delicate that they persist but a few hours after opening.

The screw-pine family, Pandanaceae, is represented by a few small plants here. In house no. 4 will be found a group of large specimens, and the family will be considered in detail there. Species represented here and not elsewhere are: *Pandanus pacificus*, peculiar in the long tails to its leaves; and *P. Sanderi*, of recent introduction, much resembling the old favorite *Pandanus Veitchii*, having the markings golden instead of white as in that species.

Other specimens representing the families in this house will be found elsewhere, as follows: large tropical plants in house no. 4; desert or xerophytic species in houses 5 and 6; temperate species in houses 12 and 13.

House No. 4.

In this house are brought together the specimens of tropical families represented in other houses, but too large to be accommodated on the benches. They are grouped in families, so it is possible to find here larger representatives of families which may have attracted attention elsewhere.

Of particular interest in this house is the large group of the banana family, Musaceae, which occupies a large part of the center opposite the entrance from house no. 3, and the corner immediately opposite. Of the genus *Musa*, to which the bananas and plantains belong, there are many representatives. The inflorescence of these plants comes from the apex of the stem, and when it first emerges appears to be composed of large leaf-like objects, called bracts, which are usually colored. As each one of these bracts falls a little cluster of flowers is revealed, and it is each one of these clusters, matured into the ripe fruit known as the banana, which forms the "hand" of the dealers. *Musa* *sapientum* is the name of the common banana of our markets, and of this there are many cultivated varieties. In the true *M. sapientum*, of which there are specimens in the collection, the fruit is large and yellow, and the stem and leaves green; while in the variety *champa* the stem and midrib of the leaves is red and the fruit more of an orange color when ripe. The Chinese dwarf banana, *Musa Cavendishii*, from China, is a much smaller species, rarely exceeding five or six feet in height, and with much smaller fruit. *Musa zebrina*, with its slender stems and leaves marked with dark red, is decidedly ornamental. In most of the bananas the inflorescence is pendulous, while in others it is upright; of the latter kind are *Musa coccinea*, from southern China, with red bracts, and *Musa ornata*, from the East Indies, with purple ones. Bananas are largely cultivated in all tropical countries. In Florida the fruit is raised to a considerable extent. Most of the fruit that comes to our market, however, is from northern South America, Central America and Jamaica. Another banana, also of commercial importance, is *Musa textilis*, from the Philippines; from the base of the petioles of the leaves is derived a fiber which is the well-known Manila hemp.

Closely related to the genus *Musa* is *Heliconia*. A large plant of *H. latispatha* forms, when in flower, a conspicuous object in this group, its long bright red bracts making it very showy.

The genus *Strelitzia*, confined to southern Africa, is present in two species, *S. Nicolai* and *S. Reginae*. The latter is quite common in cultivation and is known as the queen's-bird-of-paradise-flower, its gaudy flowers doubtless suggesting this name. The other species, *S. Nicolai*, is much more imposing, attaining a trunk of considerable height. The flowers of the latter are white and blue, and usually appear between January and March. An account of the first flowering of this plant here may be found in the JOURNAL for April, 1903, under the title, "Interesting Plants in Bloom."

The famous traveler's tree, *Ravenala Madagascariensis*, from Madagascar, is also a member of the banana family, and several specimens of it will be found in the collection. At maturity the stem of this plant attains a diameter of about one foot and a height of thirty feet. The bases of the petioles of the leaves are dilated and firmly imbricated over each other. The inner substance of the petioles is divided into small chambers or cells filled with a clear watery sap which makes a refreshing drink; it is from this circumstance that it has received the name of the traveler's-tree. In its native land the stems are used for the floors of houses; they are cut in half lengthwise and placed with the convex side up, in which position the rounded surface soon flattens out and becomes very hard, making an excellent floor.

A group of plants belonging to the arrow-root family, Marantaceae, will be found in the corner with the banana family. This contains large plants of several species, among them *Calathea ornata* and *C. zebrina*, and *Stromanthe sanguinea*. In the same corner are some large plants of the pineapple family, Bromeliaceae; among them a fine plant of *Pitcairnia corallina*, a native of Colombia, which bears long racemes of coral-red flowers which hang out over the tub.

On the column to the right, in the banana group, is a plant of *Allamanda Hendersoni*, Henderson's allamanda, from Brazil. This blooms very freely, and when in full bloom is most attractive, being laden with large yellow flowers. It belongs to the dogbane family, Apocynaceae. On the next column is a plant belonging to the potato family, Solanaceae. This is Wendland's solanum, *Solanum Wendlandii*, from Costa Rica. It bears showy bunches of large blue flowers, resembling at a distance those of the wistaria. Plants of the coffee tree, *Coffea arabica*, will be found near by. This belongs to the madderwort family, Rubiaceae. The white flowers are followed by the red berries which contain two seeds each, these being the coffee beans of commerce. In the opposite corner is a group of the genus *Ficus*, forming part of the mulberry family, Moraceae. To this belongs *Ficus elastica*, of tropical Asia, a large tree of which will be found near the center of this house. An interesting member is *Ficus Roxburghiana*, from India, which bears its flowers and fruit in large bunches near the base of the tree.

Just beyond the *Ficus* group are some small specimens of the chocolate tree, *Theobroma Cacao*, a native of tropical America, and a member of the Sterculiaceae. This is extensively cultivated in many tropical countries. The flowers and fruit are borne on the trunk and at the base of the branches. The mature fruit is six to eight inches long, pear-shaped, and contains five rows of seeds, each row comprising ten to fifteen seeds, making a pod yield from fifty to seventy-five seeds. These are the chocolate beans of commerce, from which are derived chocolate and cocoa.

Opposite to the chocolate trees is the group of the aroid family, Araceae, referred to when describing house no. 2. The most noteworthy object here is the large plant of Veitch's tail-flower, *Anthurium Veitchii*, from Colombia. This is believed to be the largest plant in cultivation. The larger leaves measure about four and a half feet long and one foot wide. An account of this plant, with an illustration as it appeared at that time, will be found in the JOURNAL for December, 1902, under the title, "A Remarkable Plant of a South American Tail-flower." A comparison of this illustration with the plant as it now stands will show how much it has grown in the past few years.

There are other interesting plants in this aroid group. Among them are several specimens of the genus *Philodendron*, climbing on supports and showing their habit of growth. A large plant of the commonly cultivated *Monstera deliciosa*, piña anona, a native of Mexico, will be found on one support. The fruit of this when ripe has very much the odor of the pineapple and is edible.

Across the walk from the aroid group is a plant of *Medinilla magnifica*, at home in the Philippines. The pendulous inflorescence is pink, making the plant very showy when in full bloom. Near this is a small tree which bears its pink flowers in dense pendulous heads; this is *Dombeya Wallichii*, from Madagascar, a member of the chocolate-tree family, Sterculiaceae.

In the same corner will be found the main collection of the ginger family, Zingiberaceae. The most interesting plant here, from an economic standpoint, is that which yields the ginger of commerce, *Zingiber Zingiber*. The ginger is obtained from the roots. Other and more decorative plants are: the striped alpinia, *Alpinia*

House No. 4. Groups of screw-pines and aroids on the right, with the ginger family in the :ground to the left.

vittata, from the South Sea Islands; the shell-flower of the East Indies, *Alpinia nutans*, with its nodding clusters of handsome flowers and shell-like bracts; and *Hedychium coronarium*, the East Indian garland flower, and *Hedychium Gardnerianum*, both from the East Indies, the former with pure white flowers with sometimes a faint marking of yellow and a delicious fragrance, and the latter with flowers entirely yellow.

Immediately across the walk is the main collection of the screw-pine family, Pandanaceae, all of them natives of the Old World. There are about two hundred and twenty-five known species, of which number over one hundred and fifty belong to *Pandanus*, the only genus represented in the collection. The name screw-pine is derived from the resemblance of these leaves to those of the pine and to the spiral manner of their arrangement on the stem. The leaves of the screw-pine are of economic importance to the natives, who make from them mats, hats, baskets, etc. The tough aerial roots consist of a spongy fiber; these are cut into lengths which are beaten out at one end and made into very effective brushes. The common ornamental plants, *Pandanus Veitchii* and *P. utilis*, are present in several specimens each. The leaves of many of the species are densely armed with vicious spines on the margins and on the midrib, thoroughly protecting them from destruction by animals.

Immediately in the rear of the screw-pines is the tropical papaw, *Carica Papaya*. The fruit of this plant is edible, and is cultivated in many tropical regions. The plant contains an acrid milky juice which, if added to water in which meat is boiling, is said to render the meat very tender. The same effect is said to be produced if meat is wrapped in the leaves of the plant. In the corner opposite to the ginger family will be found a group comprising representatives of several families. One specimen is a small tree of the alligator pear, *Persea Persea*, extensively cultivated in many tropical countries. This, frequently known as the avocado pear, is esteemed as a salad, or often eaten with salt and pepper as the first course at breakfast. It belongs to the laurel family, Lauraceae, to which also belongs our common sassafras tree. The lily family is represented by a number of large specimens, among them the following: *Dracaena fragrans*, from tropical Africa, and its forms with variegated leaves; the drooping form of the dragon tree, *Dracaena Draco Boerhaavei;* the bowstring hemp, *Sansevieria Guineensis* and *S. cylindrica; Dracaena Sanderiana*, from western tropical Africa; and *Beaucarnea recurvata*, from Mexico, with the much enlarged base to its trunk. On the column in the immediate vicinity will be found a plant of the night-blooming jessamine, *Cestrum Parqui*, from tropical America, belonging to the potato family, Solanaceae. This does not bloom until nightfall, but then opens its flowers in great profusion, filling the whole house with its dense perfume.

House No. 5.

This house is devoted to desert or xerophytic plants, *i. e.*, plants which grow in regions where the rainfall is small and followed by long dry periods, so that it is necessary for a plant to store up its water supply. All the plants in this house have either fleshy leaves or stems, and are provided with an epidermis which prevents the free transpiration of the stored-up water supply.

Entering from house no. 4, on the right-hand side bench will be found in the main South African desert plants. The carrion-flowers, belonging to the genus *Stapelia*, of the milkweed family, Asclepiadaceae, are present in many species. Leaves are not present, but only stems which bear odd forbidding flowers exhaling a most unpleasant odor; one of these, *Stapelia gigantea*, bears a flower ten to twelve inches in diameter. Back of these are several plants of *Bowiea volubilis*, a climbing member of the Convallariaceae, or lily-of-the-valley family. A large collection of the genus *Aloe*, which belongs to the lily family, takes up a considerable portion of this bench; it is from some of these plants that the medicine, bitter aloes, is derived. Other genera closely related to *Aloe* are: *Gasteria, Haworthia* and *Apicra*.

The central bench is entirely devoted to the cactus family, Cactaceae, almost entirely American, inhabiting for the most part arid regions. The cacti are especially numerous in Mexico and that portion of the United States adjacent thereto, and in northern South America. With very few exceptions the members of this

House No. 5, looking north. The cactus family on the central bench, with the stonecrop family on the right side bench.

family are entirely destitute of leaves, the stems, which are most diverse in form, performing the functions usually carried on by leaves in other plants. The genus *Pereskia*, specimens of which will be found in houses 6 and 7, have well-developed leaves; in the genus *Opuntia*, some species of which are known as prickly pears, on the young joints of the stem will be found small awl-shaped bodies — the only leaves which these plants bear — or in some few species of the round-stemmed members of the genus, as, for example, *Opuntia teres* and its relatives, leaves which are quite large and remain on the stems for some time. The flat bodies usually referred to as leaves in the prickly pears are not such, but only flattened joints of the stem. The great diversity in the form of the stem will be appreciated by inspecting the entire collection in this house. In *Opuntia* the stems are either flat or round; in *Cereus*, to which belong many of the night-blooming forms, they are round and ribbed in some species, angled in others, erect in many, and in a large number furnished with long roots, which enable them to climb on trees and rocks; in *Cactus* they are usually mound-shaped, pyramidal or globular, and bear elongated projections in spirally arranged rows all over their surfaces. The flowers of many of them are exquisite in coloring, are of great size, and are borne on various parts of the plant body; or, in the case of the genus *Melocactus*, on a modified portion at the apex. This last condition is illustrated in the collection by the Turk's-head cactus, *Melocactus Melocactus*, common in the West Indies. A plant of economic interest among the cacti is *Nopalea coccinellifera*, the plant upon which the cochineal insect breeds, several specimens of which are on the upper portion of the central bench. The dye cochineal obtained from these insects is the basis of the color known as carmine. An odd plant is *Cephalocereus senilis*, from South America, commonly known as the old man cactus, for obvious reasons; several specimens of this are in the collection. Other members of this family, some of them of large size, will be found in houses 6 and 7.

On the east bench will be found the stonecrop family, Crassulaceae, in many genera. Prominent among these are: *Cotyledon* and *Crassula*, from southern Africa; *Echeveria*, *Pachyphy-*

tum and *Oliverella*, mainly from Mexico; *Sedum*, from both the Old World and the New; and *Sempervivum*, the houseleeks, know from the Old World only. Other genera of this family will be found on the north bench in house no. 7.

A queer plant from southern Africa, belonging to the yam family, Dioscoreaceae, is on this bench at the end near house no. 4. This is *Testudinaria elephantipes*, or elephant's-foot, so named in allusion to the stem which, in large plants, has an appearance not unlike the foot of an elephant.

House No. 6.

This is also devoted to desert or xerophytic plants. On the two corner benches to the right, as you enter from house no. 5, is a collection of century plants, *Agave*, mainly native in Mexico or adjacent territory, with some in northern South America, the West Indies and elsewhere. Large plants of the same will be found in the central part of the house. Among these are fine plants of the following species: *Agave filifera*, the thread-like margins of the leaves giving it the name of the thread-bearing agave; Queen Victoria's agave, *Agave Victoriae-Reginae; Agave amoena; Agave ferox*, with its vicious-looking hooked and irregular spines; and *Agave americana*, with its many variegated forms. Of especial economic interest is *Agave rigida*, from which the sisal hemp of commerce is obtained. It is said to be a native of Yucatan, and is usually known in Spanish-speaking countries as henequen. Its cultivation has been introduced into many tropical countries, but it is produced commercially for its fiber mainly in Yucatan, the Bahamas, Turk's Islands, Cuba and Hawaii.

There is a popular belief to the effect that the American century plant, *Agave americana*, flowers only when it is one hundred years old, and from this has arisen the name of century plant. This is erroneous, for, although it appears to have no stated flowering age, it certainly flowers at a much earlier age than one hundred years.

The Mexican drink called pulque is made from the juice of some plant of this genus, said by some to be *Agave americana*, the maguey. When the plant is about to bloom the buds and upper leaves are cut out, and the sap, which is rich in sugar, gathers in the cavity thus formed. It is stated that a plant will yield two gallons per day for several months. The juice is fermented in rawhide receptacles. At first it has a pleasant taste, but later acquires a putrid odor from the animal matter of the hides. Pulque-brandy, or aguardiente or mescal, is produced by a distillation of the pulque.

On the corner bench near the south door is a curious desert plant, rare in cultivation. It is *Ibervillea Sonorae*, a member of the gourd family, Cucurbitaceae, growing in Mexico, and known there as "huariqui." During the dry season these large plant bodies lie around on the surface of the ground, looking dead and uninteresting. As soon as the rains come, however, green stems several feet long make their appearance. These bear flowers and fruit, dying away in a short time, when the plant assumes its resting stage again to repeat the process at the next favorable opportunity.

A group of the lily family will be found in the central portion of the house. This includes several species of the Spanish-bayonets, *Yucca*, which is strictly American, some large plants of *Aloe arborescens*, a native of southern Africa, and a considerable number of plants of the genus *Dasylirion*, representing several species which are natives of Mexico and the southwestern United States. The most imposing figure in the house, however, is the giant cereus, *Cereus giganteus*, sometimes called the cactus king, from Arizona and Sonora, known by the Mexicans and Indians of that region as suwarro. See the JOURNAL for August, 1905, for an illustrated account of this plant. The plants here were secured in 1902 by an expedition sent to the desert regions. They represent the largest specimens in cultivation in the east. The flowers are white and appear early in the spring near the apex of the stem. Of still greater rarity, even in a wild state, is Pringle's cereus, *Cereus Pringlei*, a large plant of which, together with several smaller ones, stands near the giant cereus. Near by is the collection of large specimens of the genus *Echinocactus*, or hedgehog-cactus. The Indians often secure their drinking water from these plants in the following manner: the top of the plant is cut off and the internal white substance pounded with a stick to a pulp to a depth of several inches; the pulpy mass is then squeezed and a considerable quantity of palatable water accumulates in the cavity.

On the corner bench near the entrance to house no. 7 is a collection of fig-marigolds, belonging to the genus *Mesembryanthemum*, natives of southern Africa. These blossom freely during the spring and summer, and many of them would be well adapted for planting in dry sterile soil for decoration during our summer months. They are unfortunately not hardy in this latitude, and must be propagated anew each year, but this is so simple a matter that it should not deter one from growing them. They yield a profusion of bright-colored flowers. In the center of the house will be found two or three plants of *Crassula portulacea*, also from southern Africa. This miniature tree is a resident of the arid regions there, and well repays for its cultivation in the profusion of white or pink flowers which it bears early in the year. Opposite to these is a small group, mainly of cacti, including some of the monstrous forms of *Cereus peruvianus*, a South American species, and a plant of *Pereskia aculeata*, one of the cacti already alluded to as having conspicuous leaves. It has a number of common names, among them lemon vine, blad apple, and Barbados gooseberry.

On the remaining corner bench some of the desert members of the pineapple family, Bromeliaceae, find a place. While most of those belonging to this family are found in humid regions, a considerable proportion occur under really desert conditions. The genera *Dyckia* and *Hechtia* and some species belonging to *Pitcairnia* are of this kind. In *Pitcairnia heterophylla* the large leaves fall off during the winter, leaving the plant in an apparently dead condition, with an armature of modified leaves which are viciously armed on the margins with stiff spines. During the summer new leaves make their appearance, to again fall off as winter approaches. On the same bench with these will be found a collection of the genus *Euphorbia*, from Africa, mainly from its southern part. The great resemblance in form which these plants bear to certain forms of the cactus family is striking and remarkable. This is especially noticeable in *Euphorbia cereiformis*, of which specimens will be found in the collection. They belong, however, to an entirely different family, the Euphorbiaceae, commonly known as the spurge family.

House No. 7.

In this house will be found, among others, representatives of the following families : the wood-sorrel family, Oxalidaceae ; the pea family, Papilionaceae ; the mimosa family, Mimosaceae ; the senna family, Caesalpinaceae ; the custard-apple family, Anonaceae ; the cactus family, Cactaceae ; the gamboge family, Clusiaceae ; the spurge family, Euphorbiaceae ; the stone-crop family, Crassulaceae ; the cocaine family, Erythroxylaceae ; the marcgravia family, Marcgraviaceae ; the myrobalan family, Combretaceae ; the mezereon family, Thymeleaceae ; the ginseng family, Araliaceae ; the mahogany family, Meliaceae ; and the chocolate-tree family, Sterculiaceae. Species to which reference is made below are to be found in the collection in this house.

Among the members of the pea family, Papilionaceae, is the interesting telegraph plant, as it is called, *Meibomia gyrans*, a native of tropical Asia. Its leaves are trifoliolate, the middle leaflet being large ; the two lateral leaflets are much smaller, a half inch long or less, and are often to be found slowly moving up and down, this feature giving to the plant its common name of the telegraph plant.

In the senna family, Caesalpinaceae, are a number of interesting plants. One of these, of great commercial importance, is the logwood, *Haematoxylon campechianum*, found now throughout tropical America. The tree grows to a height of twenty to thirty feet, and is exported in large quantities to this country on account of its deep-red wood, from which a dye is obtained. Another tree from which a dye is secured is *Caesalpinia Sappan*, known as sappan wood, a native of the East Indies. It grows to be thirty to forty feet tall. Another plant, belonging to this family, of economic importance, is *Copaiva officinalis*, one of the plants from which copaiba is obtained. The tree is an inhabitant of northern South America, where it attains a height sometimes of eighty feet. The balsam is obtained by making holes into the heartwood, when the balsam rushes out and is collected. Copal, or gum anime, is obtained from several trees of this family; one of these is *Hymenaea Courbaril*, of tropical America, and another, *Trachylobium Hornemannianum*, of tropical Africa. Belonging to the senna family is the tamarind tree, *Tamarindus indica*, a native of Asia and tropical Africa, but now widely distributed in tropical and warm temperate regions for its edible fruit. This consists of flat pods four to six inches long which contain a sweet pulp; placed in water they make a very pleasant beverage.

In the mimosa family, Mimosaceae, is *Mimosa pudica*, the humble or sensitive plant, from Brazil. The leaves and leaflets of this are extremely sensitive and close at the least touch. Another interesting plant of this family is *Acacia cornigera*, a native of Jamaica. This has large hollow spines, and it is said that in its native home these form the congregating places of vicious ants, which are enticed there by a sweet fluid secreted by the plant. Browsing animals which come to eat the foliage are immediately assailed and driven away by these ants.

Among the members of the mahogany family, Meliaceae, is one of great commercial importance, *Swietenia Mahagoni*, the common mahogany, used so much in cabinet work. This is widely distributed throughout tropical America, and in its native wilds is said to attain a great size, logs five to six feet in diameter having been shipped.

In the cocaine family, Erythroxylaceae, we have the interesting plant from which the drug cocaine is obtained. This is *Erythroxylon Coca*. The plants in the collection are the variety *neogranatense*; they may frequently be seen in both flower and fruit. It is native to the Andes of South America. Coca, the dried leaf, has long been used as a masticatory by the Indians of that region. It is a stimulant, having somewhat the effects of tea and coffee. The alkaloid cocaine is obtained from the leaves and is used as a local anesthetic.

In the custard-apple family, Anonaceae, is the cherimoyer, *Anona Cherimolia*, a native of tropical America. The tree attains a height of twenty to twenty-five feet, and has an oblong fruit of a light green color with white pulp and a few seeds. It is edible and highly esteemed by some people. The sour sop or custard apple is another tree of economic importance. Its botanical name is *Anona muricata.* It is also a native of tropical America and attains a height of fifteen to twenty feet. The fruit is usually two to three inches in diameter, and contains a somewhat acid juice.

In the gamboge family is the genus *Garcinia,* native to the East Indies and Malaya. From various species of this genus is derived the gamboge of commerce, which is used in medicine and the arts. In the collection will be found several species of *Garcinia.* The calaba tree, *Calophyllum Calaba,* a native of the West Indies, grows fifty to sixty feet tall. The fruit is drupe-like, containing a single seed, from which is obtained an oil which may be burned in lamps. In the mammee apple, *Mammea americana,* we have another member of the gamboge family. The tree grows to be sixty to seventy feet tall and is a native of tropical America. The fruit, which is highly prized by some, is about the size of a small melon or cocoanut. From its seeds is obtained an oil used by the Indians as a hair-oil.

In the spurge family, Euphorbiaceae, on the north side bench, are a number of specimens of the succulent euphorbias. *Euphorbia lactea,* from the East Indies, has three-angled stems with the angles armed with short stout spines. This is widely distributed in the West Indies and is often used there as a hedge plant, growing sometimes twelve to fifteen feet tall. It forms an effective barrier, for the natives exceedingly fear its juice, which flows at the least abrasion of the surface, on account of its reputed poisonous qualities, and the belief that if it gets into the eye blindness will result. The hedge formed of this species is very dense and absolutely impenetrable. A large plant will be found in the center of house no. 6, near the giant cereus. *Euphorbia Nivulia* and *Euphorbia neriifolia,* both from the East Indies, are quite in contrast with many others of this group in having, at certain times of the year, large fleshy leaves. *Euphorbia Tirucalli,* also from the East Indies, is quite striking in its round stems, which much resemble those of some of the forms of the genus *Rhipsalis* among the cactus family in the immediate neighborhood. Large specimens of two of these species, *E. Nivulia* and *E. Tirucalli*, will be found with the *E. lactea* in house no. 6. Another genus of this family is *Pedilanthus*, confined to tropical America, of which there are several species represented. The members of this genus have been given the common name of slipper-spurs.

The stonecrop family, Crassulaceae, besides the large collection in house no. 5, has a few representatives here, species which require warmer treatment than can be accorded them in the house referred to. The sprouting-leaf plant, *Bryophyllum calycinum*, is widely distributed in tropical America, its original home probably being in Mexico. It receives the name of sprouting-leaf from the ease with which it can be propagated from the leaves. A leaf laid down on moist sand will send up numerous plants from the indentures along its margins, each of which, if properly cared for, will grow into a large plant. The genus *Kalanchoë*, also of this family, is Old World in its distribution, and has some showy members among it. *Kalanchoë flammea*, from tropical Africa, with its flame-colored flowers, is quite frequently seen in cultivation. Another species, *K. marmorata*, from Abyssinia, is quite different in appearance, with large white tubular flowers three to four inches long, and gray-green leaves mottled with brown, the whole overcast with a whitish bloom.

Opposite to this is another group of the spurge family, Euphorbiaceae, including those which have more the appearance of ordinary plants. One of these was quite popular some years ago under the name of the chenille plant, or Philippine Medusa. It is an old plant of the East Indies, described many years ago as *Acalypha hispida*, and rechristened in 1896 as *Acalypha Sanderi*. Its long and pendulous inflorescence certainly bears a strong resemblance to the old-time chenille and makes very appropriate its common name. *Jatropha* will be found in *J. Curcas*, a native of tropical America, but widely cultivated in tropical regions generally for its seeds, which are known as physic-nuts or Barbados nuts. These seeds, together with those of *Jatropha multifida*, yield jatropha-oil. The snow-bush, *Phyllanthus nivosus*, of the

South Sea Islands, is frequently seen in cultivation and is often used for bedding purposes in summer. The sandbox tree, *Hura crepitans*, is found throughout tropical America. It grows to a considerable height in its native home and forms a dense shade. The juice is said to have caused fatal injuries to the eyes. The fruit is of peculiar construction, looking something like a wheel two to three inches in diameter. It is frequently kept as a curiosity, but on becoming very dry the component parts burst asunder with a loud report, scattering the parts and seeds to a considerable distance, and causing considerable consternation to those who may be in the vicinity. The large group of the genus *Codiaeum*, a native of the Malayan region, commonly known in cultivation as variegated crotons, contains many peculiar variable colored forms, all of which are said to be derived from two or three species. They are much used for decoration where rich and varied color-effects are desirable; or in small plants for jardinieres.

The members of the cactus family in this house are those which require warmer treatment than can be given them in houses 5 and 6. The genera mainly represented are the following: *Rhipsalis*, of which a striking example is the mistletoe cactus, *R. Cassytha*, widely distributed in the West Indies, where it gracefully adorns the trunks of trees or hangs down in masses upon the face of cliffs; *Epiphyllum*, in the well-known Christmas or crab cactus, *E. truncatum*, from Brazil; *Phyllocactus*, in many forms, including *P. anguliger*, from Mexico, with its stems toothed like a coarse saw, *P. crenatus*, from Honduras, *P. Hookeri*, from northern South America, and the commonly cultivated *P. latifrons*, one of the best night-blooming sorts, also from Mexico; and the genus *Pereskia*, already referred to as one of the cacti bearing large leaves.

The marcgravia family, Marcgraviaceae, seldom seen in cultivation, is present in two species, *Marcgravia umbellata* from tropical America generally, and *M. Sintenisii* from Porto Rico. These plants adhere closely to the bark of trees, in much the same manner as does the ordinary English ivy, the flowering branches hanging down from the main stem in a pendulous manner. They frequently ornament rocks and the sides of damp gorges or ravines in the tropics with their closely appressed foliage.

The myrobalan family, Combretaceae, is represented in an interesting species, *Terminalia Catappa*, a native of tropical Asia, but widely introduced into other tropical regions. It is common in the West Indies, where it is often called the almond tree. The name myrobalans is given to the fruits of this tree in India. The fruit is yellowish when ripe, and oblong and somewhat compressed in shape. The kernels are edible and have the flavor of almonds, hence the common name of the tree.

Near the genus *Codiaeum* are two or three small plants representing the mezereon family, Thymeleaceae. These are the lace-bark tree, *Lagetta lintearia*, a native of Jamaica. Its common name is derived from the peculiar character of its bark, which separates into many lace-like layers; this material was at one time much used in Jamaica for making veils, bonnets, ruffles, etc.

The ginseng family, Araliaceae, has many ornamental species, among them *Aralia Guilfoylei*, *A. Veitchii* and others.

The chocolate tree family, Sterculiaceae, is represented by *Cola acuminata*, from western tropical Africa, where it grows to a height of thirty to forty feet. Its fruit contains several nut-like seeds which are known as cola or goora nuts. They are held in high esteem by the negroes of that region, for they are supposed to quench thirst, allay hunger, and give strength; qualities which, if true, might well endear them to the negroes. A superstitious value also attaches to them, for the fetish-man there offers these nuts as food to the spirits to obtain favors for his votaries. The plant has been introduced into tropical America. It is said that these nuts will quickly counteract the effects of intoxication: this is due to the caffein present, which equals about twice the amount found in coffee.

House No. 8.

The chief families represented in this house are the following: the acanthus family, Acanthaceae; the torch-wood family, Burseraceae; the dogbane family, Apocynaceae; the milkweed family, Asclepiadaceae; the madder family, Rubiaceae; the potato family, Solanaceae; the gesneria family, Gesneriaceae; the figwort family, Scrophulariaceae; the begonia family, Begoniaceae; the pokeweed family, Phytolaccaceae; the nettle family, Urticaceae; the mulberry family, Moraceae ; the grape family, Vitaceae ; and the pepper family, Piperaceae.

The acanthus family, Acanthaceae, is located on the south side bench, and contains many showy plants, ranging in color of flowers from white through pinks, blues, purples and reds. Many of them are exceedingly decorative.

The madder family, Rubiaceae, is well represented in several species of *Ixora*; two or three of *Hoffmannia*, among them the stately foliage plant from Mexico, *H. Ghiesbreghtii*; several plants of *Coffea arabica*, from which our coffee is obtained ; and species of the genus *Rondeletia*.

The torch-wood family, Burseraceae, occurs in *Canarium commune*, a native of the East Indies, where it is known as the Java almond tree and the Chinese olive. It bears a fleshy fruit which yields an oil used for a condiment when fresh, or for burning in lamps. A gum exudes from the trunk which is known as Manila elemi.

The potato family, Solanaceae, has representatives in the genera *Browallia*, *Brunfelsia*, *Solanum*, and *Cestrum*, many of them showy and decorative.

In the gesneria family, the Gesneriaceae, the dainty little *Saintpaulia ionantha*, from eastern tropical Africa, with its bright star-like blossoms of a clear blue known as African or Usambara violets, is one of the prettiest of winter-flowering plants. The genus *Trichosporum*, usually known as *Aeschynanthus*, is present in several species, among them *T. Lobbianum*, from Java, *T. pulchellum*, from Malaya, and *T. marmoratum*, of unknown origin — all excellent basket plants.

The vervain family, Verbenaceae, in several species of *Lantana*, and the showy *Clerodendron fallax*, from Java, occupy a place near the end of the central bench. Across the walk from these is the dogbane family, Apocynaceae, in a number of species. Next to this is the milkweed family, Asclepiadaceae, represented by several plants. Belonging to this family, but placed near the partition between this house and no. 7, that it may have a support, is a large plant of *Hoya carnosa*, from Asia. This is well known as the wax-plant, on account of the waxy texture of its pink flowers.

In the figwort family, Scrophulariaceae, are *Russelia juncea*, the coral-plant, from Mexico, and *R. sarmentosa*, a native of tropical America, both excellent basket plants, with bright red flowers.

The entire north bench is allotted to the begonias in many showy and interesting forms. The extremes are represented in the large-leaved *Begonia nelumbiifolia*, from the West Indies, and the small-leaved *B. foliosa*, from Colombia. A queer one is *B. incana*, from Mexico, with the leaves covered with a woolly pubescence. One of the most interesting in the collection is *Begonia rotundifolia*, known only from Haïti, and for a century and a half lost to science. It was rediscovered in 1903 by an expedition sent to that island by the Garden. An account of this plant and its rediscovery will be found in the JOURNAL for September, 1905. Another pretty plant is *Begonia imperialis*, a Mexican species, with its velvety leaves with darker markings, and the variety *smaragdina* with the leaves a bright velvety green and without markings. Another type of begonia is that shown in *Begonia Rex*. This species is the principal parent in the production of many of the begonias with ornamental foliage, of which there is an almost endless number, distinguished by the markings of the leaves and their peculiarities in shape.

Several species of tne genus *Rivina* represent the pokeweed family, Phytolaccaceae, whose bright-colored berries make these plants quite attractive.

The nettle family, to which belongs the common stinging nettle of our roadsides, has an Australian member which far outdoes our nettle in stinging qualities. It is known as *Urticastrum moroides*, the fruit, which somewhat resembles the mulberry in shape, suggesting its specific name. It attains the height of a shrub or small tree in its native country, where it is known as gyrupia. The artillery plant, *Adicea microphylla*, is a popular favorite. The pollen is forcibly discharged and in the act appears as little puffs of smoke, hence its common name. The ramie plant, *Boehmeria nivea*, is of interest. It is a native of China. Grasscloth is a name given to the woven fiber obtained from this plant. The stems are four to six feet high, and it is from these that the fiber is extracted.

The aquatic house, No. 9. The south side, looking east, with fringe of bamboos.

The most interesting plant in the mulberry family, Moraceae, is *Artocarpus incisa*, the bread-fruit tree, originally from the islands of the Pacific. It usually attains a height of twenty to thirty feet. Its so-called fruit is really a thick spongy receptacle, globose or oblong in shape and a foot or so long. In this are imbedded the true fruits, nut-like bodies, but these are seldom produced in cultivated trees. This forms one of the main articles of food of the natives of the Pacific Islands. The bark of the tree is tough and is beaten out to make a fine white cloth.

The bread-fruit tree is now widely distributed in tropical countries. It is common in the West Indies, where it was introduced by the British government in the latter part of the eighteenth century. The first attempt to secure plants of this tree in its native country was unsuccessful, owing to a mutiny which occurred on board the ship. The second expedition, however, accomplished its purpose, and in 1793 bread-fruit trees were flourishing in the West Indies. Other interesting plants of the mulberry family are *Ficus religiosa*, the peepul tree of India, one of the trees of Hindoo worship, and *Ficus quercifolia*, of Burma and Malaya, striking in its imitation of the leaves of some of our oaks. This resemblance to the oak is especially noticeable when the plant is fruiting, the fruit resembling young acorns in shape.

To the grape family, Vitaceae, belongs *Leea coccinea*, with its quite showy red flowers. It is a native of Burma.

The pepper family, Piperaceae, is represented by several species of the genus *Peperomia*, among them *Peperomia maculosa* from the island of Haïti, with its dark green leaves marked with lighter green, *P. clusiaefolia*, of tropical America, and *P. Davisii*, known at present only from St. Kitts, and secured by one of the Garden expeditions which visited that island. The genus *Piper*, to which the pepper plant belongs, has some showy members, represented by *Piper magnificum*, and *P. ornatum*, the latter from the Celebes Islands.

House No. 9.

This house is one of the most attractive to the general public. Its arrangement is unusual in having the point of view from a bridge over the water, thus enabling visitors to see the beauties of many of the aquatics, especially of the water-lilies, by looking directly down into the flower.

Fringing the pool on the right, as one enters from house no. 10, are members of the sedge family, Cyperaceae, and on the further end some of the grasses, Poaceae or Gramineae. The corresponding area to the left is devoted entirely to the grasses, including many ornamental bamboos. The sedge in the corner, with the tall stems terminating in tassel-like tops, is the Egyptian paper-plant, *Cyperus Papyrus*, said to be plentiful on marshy river-banks in Abyssinia, Palestine and Sicily, but now almost extinct in Egypt. It is supposed to be the bullrush used in constructing the ark of Moses. It is the plant from which the Egyptians, and through them the Romans and Greeks, secured part of their writing material. This was prepared by first cutting the central pith of the stems into longitudinal strips. A number of such strips were laid side by side and another layer placed across these at right angles. The two layers were then soaked in water and pressed together to make them adhere, after which they were dried, thus forming the papyrus of the ancients. The documents found in the Egyptian tombs are said to have been written on material of this kind.

The umbrella-plant, *Cyperus alternifolius*, from Madagascar, together with several other members of this genus, form decorative features near by. Among the grasses on this side, the most interesting, at least from an economic standpoint, is the sugar-cane, *Saccharum officinarum*, and its more showy form, the variety *violaceum*. Like many other plants which have been cultivated for so long a time, its origin is veiled in obscurity, but it is supposed to have come from tropical Asia. It is cultivated now in all tropical countries, and in the warmer parts of our own land it is a staple product. It seldom bears flowers in cultivation, being propagated by cuttings. To secure the sugar the lower portions of the stems, or canes as they are called, are subjected to pressure. By subsequent processes the sugar is separated from the expressed juice, the resulting product being known as raw sugar, the brown sugar in common use. By further processes white and granulated sugars are obtained from this. Rum, properly so called, is also obtained from the products of the cane by distillation.

The bamboos on the opposite side of the house form a graceful fringe to the pool, their arching stems bending over and forming an effective background for the aquatics.

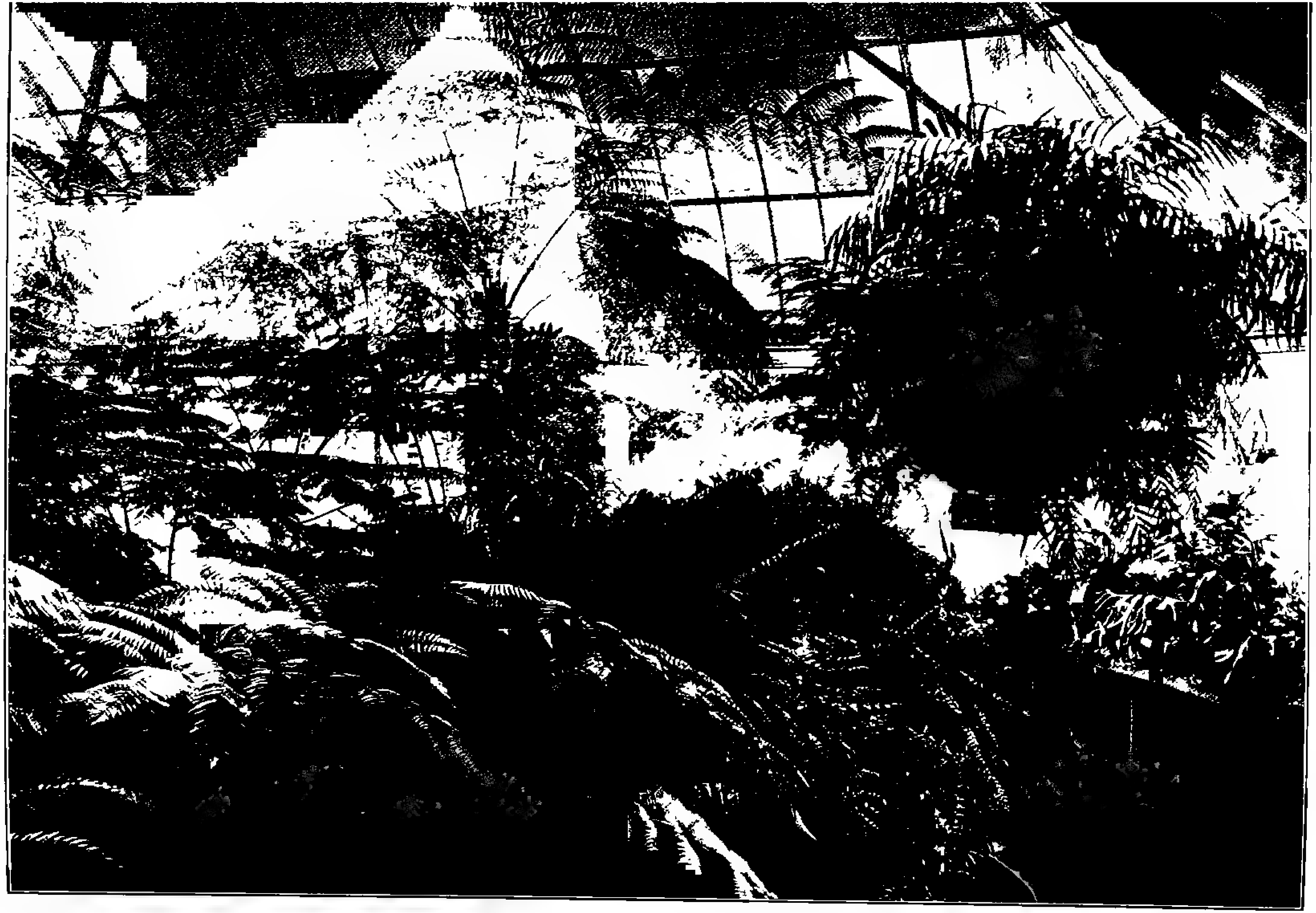
In the pool will be found many interesting plants. Among the water-lilies is one unusual in cultivation, *Castalia pulchella*, from tropical America. This specimen was secured in the Bahamas by one of the Garden expeditions which visited that region. *Castalia flava*, near by, from our own state of Florida, was lost to science for a long time, but rediscovered some years ago. *Castalia Marliacea chromatella*, is of hybrid production, and one of the most charming members of its genus. The water hyacinth, from tropical America, *Piaropus crassipes*, with the queer bulb-like bases of the leaves, is of interest, not only for its beauty when in flower, but from the fact that it at one time seriously interfered with navigation in the St. Johns River in Florida. It is an excellent plant to use in slowly running waters or in pools during the summer time. A small piece will soon grow into an attractive mass of bright green, which often develops showy clusters of purple flowers, somewhat resembling in shape bunches of hyacinths, hence its popular name. The parrot's-feather, *Myriophyllum proserpinacoides*, from South America, with its delicate feathery masses of green is a desirable decorative plant. It is said to be hardy here in the north in water three or four feet deep. The water-poppy, *Hydrocleys nymphoides*, sometimes known as *Limnocharis Humboldtii*, of tropical America, and the water-snow-flake, *Limnanthemum indicum*, of tropical regions generally, are quite appropriately described by their popular names. The water-lettuce, *Pistia Stratiotes*, belonging to the aroid family, and the floating fern, *Ceratopteris thalictroides*, of Florida and tropical regions, will be found growing in receptacles hanging from the edge of the bridge. The South American pickerel-weed, *Pontederia montevidensis*, much resembling the common plant of our own marshes and river banks, will be found on the south side of the pool. Near it is an unusual plant from tropical America, *Limnocharis emarginata*, sometimes known as *L. Plumieri*, from which it has derived the common name of Plumier's limnocharis. Growing in receptacles hanging from the edge of the bridge will also be found two or three species of the genus *Salvinia*, odd floating plants related to the ferns.

House No. 10.

This house is devoted entirely to ferns and their relatives from tropical countries. The species from temperate regions will be found in house no. 12, on the west side bench. The collection installed in this house is arranged in botanical sequence. Thus closely related families and genera are brought into juxta-position, offering exceptional facilities for a comparative study of these interesting plants.

The sequence begins on the north side bench near the entrance from house no. 11 with the Marattiaceae, continues along both sides of the walk around the house, and terminates near the entrance to house no. 11 with the Selaginellaceae.

The Marattiaceae are represented by two genera, *Marattia* and *Angiopteris*, which are peculiar in having thick scale-like bodies, sometimes regarded as stipules, at the base of the fronds, a most unusual feature among the ferns. Following the Marattiaceae come the true ferns, the Filicales, represented by the following families: the floating-fern family, Ceratopteridaceae; the curly grass family, Schizaeaceae, represented among others by the climbing ferns, *Lygodium*; the gleichenia family, Gleicheniaceae; the tree-fern family, Cyatheaceae, with such genera as *Dicksonia*, *Cybotium*, *Cyathea*, and others [house no. 11 should be visited to study large specimens]; the polypody family, Polypodiaceae, represented by many specimens, among them the stag-horn ferns, *Alcicornium*, the elephant-ear fern, *Hymenodium crinitum*, and the old man's beard, *Vittaria lineata*, common in Florida and tropical America. The remainder of the polypody family are across the walk on the central bench and are represented by such genera as *Polypodium*, *Goniophlebium*, *Phlebodium* (including a group of *Phlebodium aureum*, the golden polypody, known often as *Polypodium aureum*, common in Florida and tropical America), *Camplyoneuron*, *Cyclophorus* and *Drynaria*.



The tree-fern house, No. 11. In the immediate foreground is *Cibotium regale*, hanging from the roof is a basket of *Stenochlaena tenuifolia*, and on the side bench a group of stag-horn ferns.

The sequence is again continued on the north side bench with the cliff-brakes, *Pellaea*, the maiden-hair ferns, *Adiantum* (which occupy the space as far as the entrance to the aquatic house, no. 9), thence continued along the south side bench with the brake, *Pteris*, the golden and silver ferns, *Ceropteris*, the spleenwort ferns, with such genera as *Diplazium*, *Asplenium*, *Neottopteris*, the bird's-nest fern, *Blechnum*, and *Woodwardia*, the chain-ferns. The sequence is then taken up on the end of the central bench near the entrance to the aquatic house with *Dryopteris* and *Polystichum*, the shield-ferns, *Tectaria*, and *Olfersia*, terminating with the genus *Nephrolepis*, to which the Boston fern belongs, and *Davallia* and its allies, at the other end of the central bench. On the upper portion of this central bench will be found specimens of some of the foregoing genera which are too large for insertion in the sequence. The Salviniales are represented by the genera *Azolla* and *Salvinia* of the Salviniaceae, and by *Marsilea* of the Marsileaceae, occupying a position on the south side bench ; and are followed by the Lycopodiales, represented for the greater part by the genus *Selaginella*, which fills out the remainder of the side bench and is terminated on the small end bench against the partition separating this house from no 11.

House No. 11.

This house is devoted mainly to the tree-ferns and such large specimens of the other ferns as could not be accommodated in house no. 10.

On the corner bench to the right, as one enters from house no. 12, is the main collection of the stag-horn ferns, *Alcicornium*. In some species this resemblance to stag-horns is very marked, as in *Alcicornium bifurcatum*, the commonly cultivated form of this genus, from temperate Australia, *A. Hillii*, from Queensland, and *A. Willinckii*, from Java. Immediately opposite to this group is a large plant of the Boston fern, *Nephrolepis exaltata*, common throughout tropical America and also in Florida. To the left of the entrance to house no. 10 are some climbing ferns, represented by the genus *Lygodium*. A little further on to the left of the walk is *Cibotium Barometz*, from China and Tartary, the stout rootstocks of which formed the basis of a marvellous tale current in early times, to the effect that on a vast lofty plain to the eastward of the Volga occurred a wonderful plant, having the appearance of a lamb, its skin being covered with soft down. This animal, so the story ran, grew upon a stalk, and was so attached that it could turn in all directions and feed upon the surrounding vegetation, drying up and pining away when this was exhausted. The native name was said to be Barometz, and it was known to the travellers of those days as the Tartarian lamb, or as Agnus Scythicus, the Scythian lamb.

In the baskets overhead are a number of desirable ferns that may be readily grown in hanging baskets. Among these are specimens of the Boston fern, and of others equally desirable, such as *Davallia dissecta*, from Java, *Davallia fijiensis*, from the Fiji Islands, and *Davallia bullata*, commonly found in the Japanese fern-balls offered for sale at the florists. Another decorative fern is *Stenochlaena tenuifolia*, from southern Africa, useful not only for baskets, but for a column or wall, as it is a strong climber.

In the central part of the house are the graceful tree-ferns, which are distributed in tropical or warm temperate regions the world over. They are quite common in the West Indies, and many of these here exhibited have been secured by the various Garden expeditions to those parts. They are generally found in the mountainous regions of the tropics, commonly at an elevation of fifteen hundred feet or over, and are exceedingly picturesque in appearance, especially when their trunks are thickly covered with masses of delicate filmy ferns, mosses and hepatics. In the genus *Alsophila* will be found *A. australis*, a native of Australia, *A. aspera*, common throughout the West Indian region, and *A. armata*, of tropical America generally. In addition to *Cibotium Barometz*, to which allusion has already been made, will be found *Cibotium regale*, from Mexico, with graceful arching fronds several feet long. In the genus *Cyathea* are *C. arborea*, generally distributed throughout tropical America, *C. concinna*, known only from Jamaica, and *C. insignis*, from Jamaica and Cuba. *Cnemidaria grandifolia*, known from many parts of tropical America, is represented in several specimens.

House No. 12.

The plants in this house, together with those in house no. 14, are arranged after the sequence of Engler & Prantl, with a view to furnishing a collection for the comparative study of plant families and genera.

The ferns and their allies, in order to meet the requirements of their culture, are placed at the end of the west side bench near house no. 11. The pine family, Pinaceae, and the yew family, Taxaceae, occupy the end of the east side bench near house no. 13. Following these are the monocotyledons or endogenous plants in their order, terminating at the other end of the bench with the orchid family, the Orchidaceae. The sequence of the dicotyledonous or exogenous plants begins on the west side bench, continuing its length as far as the ferns, then crosses to the central bench opposite, returning and continuing around it, and terminates with the loasa family, Loasaceae, at the end near the tree-fern house. Cultural requirements necessitate placing in other houses the begonia family, Begoniaceae, and the cactus family, Cactaceae; the former will be found on the north bench in house no. 8, and the latter on the central bench in house no. 5, in various parts of house no. 6, and on the north and end benches in house no. 7.

The sequence is then taken up in house no. 14, beginning the Myrtiflorae with the mezereon family, Thymeleaceae, on the north side bench, at the entrance from house no. 13, continues along that bench, then crosses at the end to the central bench, returning and continuing around that, and then crosses to the south side bench and, returning on that, terminates with the sunflower family, Compositae, near the entrance to house no. 13.

There are so many plants of interest in this house that only a few of them can be referred to here. On the west side bench are the Australian grevilleas, among them *Grevillea alpina*, a rather compact shrub with an abundance of red flowers borne for several weeks in the early part of the year, and *Grevillea Thelemanniana*, with pink flowers borne at the ends of the slender drooping branches, the whole making a most pleasing effect. *Polygonum equisetiforme*, from the Mediterranean region, is curious in its imitation of the stems of some of the horsetails, *Equisetum*, hence its specific name. The so-called carnivorous plants, the American pitcher plants, *Sarracenia*, and the sundews, *Drosera*, are on exhibition on this bench, excepting for a few months during the winter when they are in a state of rest and are located at the propagating houses. The flowers of *Sarracenia* are very odd and appear from March to June or July. The pitchers contain a fluid in which insects are drowned, the matter resulting from their decay being absorbed by the pitchers. These pitchers form a part of the leaves, and are a modification of the petiole, the blade of the leaf being represented by the small portion which terminates the pitcher and sometimes overhangs it as a hood. The sundews secrete a sticky substance from the glands which cover the surface of the leaves, and this fluid is also said to digest insects which adhere to the leaves.

On the west side of the central bench are the members of the pea family, Papilionaceae, represented by such plants as the gorse, *Ulex Europaeus*, the tam furze, *U. nanus*, and the Australian *Chorizema varium*, with its flowers made up of an odd combination of colors. In the mimosa family near by are a number of species of *Acacia*, some with true leaves, the midrib being furnished with many small leaflets, and others with the leaves modified into what are called phyllodia, the leaflets being entirely suppressed.

On the east side of the central bench, at the end near house no. 13, is a group of the rue family, Rutaceae. To this belong, among others, the oranges and lemons, of which a number of small specimens are present, larger ones being placed in house no. 13. A peculiar plant of this family is *Agathosma apiculata*, of southern Africa. Its leaves are full of glands which secrete an oil exhaling a disagreeable odor.

On the east bench near house no. 11 are the orchids which require a cool temperature, species which inhabit mountainous regions in the tropics, or are found in the warmer parts of the temperate zone. A group of the crested orchid, from the Himalayan region, occupies the corner. This is *Coelogyne cristata*, and it is one of the daintiest of a family rich in beautiful things. It flowers in February or March. On account of the shape of the pseudobulbs it is sometimes called by visitors to the conservatories the olive plant. An account of this orchid, together with an illustration of one of the plants forming this group, will be found in the JOURNAL for April, 1905. Next to this orchid is another one from the same region, *Paphiopedilum insigne*, one of the Venus' slippers. It usually flowers in January and continues in flower for several weeks. This is often known as *Cypripedium insigne*. Hanging over the path are several plants of *Cattleya citrina*, from Mexico, the upside-down orchid, so named from its habit of growing with its stems and flowers reversed, the large yellow flowers hanging down. A collection of the tooth-tongue orchids, *Odontoglossum*, and species of the genus *Masdevallia* follows. The latter are mainly from the Andes of South America, being especially numerous in Colombia and Bolivia, and are exceedingly difficult to cultivate here on account of the extreme heat of our summers. Some of these are very small and might be easily overlooked by any one but the experienced collector of such plants. Others, such as *M. Tovarensis*, are comparatively large and the flowers showy.

The iris family, Iridaceae, has a pretty dwarf representative in *Iris gracilipes*, from Japan, a miniature of our own blue flag of the swamps. Several showy species of *Dietes*, from southern Africa, *Aristea Ecklonii*, from the same country, and *Libertia formosa*, from Chili, belong in this family. The last-mentioned genus, *Libertia*, has an odd distribution, being found also in Australia and New Zealand.

The amaryllis family, Amaryllidaceae, is largely represented by bulbous plants, many of which have a resting period, so that the complexion of this collection is constantly changing, such plants when at rest being removed to other quarters. Of the genus *Hippeastrum* there are many showy forms ; these are often known under the general name of *Amaryllis*. Other genera with showy flowers are *Clivia*, *Crinum*, *Nerine* and *Atamosco*.

The vellozia family, Velloziaceae, is represented by one Brazilian species, *Vellozia leptophylla*. This family is closely related to the amaryllis family.

The lily family, Liliaceae, is largely represented. Several species of the genus *Ornithogalum* may be seen: *Ornithogalum arabicum*, from the Mediterranean region, and *O. caudatum*, from southern Africa, with its elongated inflorescence, are both desirable and showy. The Australian genus *Dianella* is present in *D. laevis* and *D. coerulea*. Another plant from southern Africa is *Veltheimia capensis*, often called *V. viridifolia*, with its vivid green leaves and terminal inflorescence of drooping flowers, resembling in appearance the red-hot poker of the gardens.

In the lily-of-the-valley family, Convallariaceae, we have, besides others, *Ruscus*, in two species, *R. aculeatus*, the butcher's broom, of southern Europe and the Orient, and *R. Hypoglossum*, of the Mediterranean region. These are not quite hardy in this latitude, so it is necessary to grow them indoors. Another plant related to these is *Danaë racemosa*, native from Greece to Persia, and known commonly as Alexandrian laurel. In these three plants the flat leaf-like bodies are not true leaves. If the young shoots are examined the true leaves will be found on them as scale-like organs, and from the axils of these arise the flattened leaf-like bodies, which are really branches and bear the name of phylloclades. In addition to their arising from the axils of leaves, their branch-like character is shown by the fact that they bear flowers and fruit. In the two species of *Ruscus* these are borne on the surface, either the upper or the lower, while in *Danaë* they are borne at the apex.

The aroid family, Araceae, has the little variegated Japanese sweet flag, *Acorus gramineus variegatus*, to represent it. This is a miniature of the common sweet flag of our swamps, *Acorus Calamus*.

In the pine family, Pinaceae, there are a number of interesting plants, among them *Callitris Whytei*, from Nyassaland. In the yew family, Taxaceae, perhaps the most interesting plant is *Tumion taxifolium*, sometimes known as *Torreya taxifolia*. This is related to the common yew of the gardens, *Taxus baccata*, and represents a class of trees now nearly extinct. This particular species is found in a small area, perhaps two or three miles in length, along the Apalachicola River in the extreme northwest corner of Florida. It is known from nowhere else in the world. In its wild state it is a symmetrical tree with rich dark green foliage, and fruit about the size of a plum. The leaves when bruised exhale a disagreeable odor, on which account it has received from the natives the name of "stinking cedar."

HOUSE NO. 13.

This house bears the same relation to the temperate collections that house no. 4 does to the tropical, *i. e.*, it contains such plants as are too large for proper presentation on the benches in the other houses devoted to such collections. The plants here are grouped in families. The monocotyledonous or endogenous plants will be found on that side of the house next to house no. 14, the dicotyledonous or exogenous plants occupying the remainder.

On entering from house no. 14, immediately in front in the central portion of the house is a group comprising the pine family, Pinaceae, and the yew family, Taxaceae. The most conspicuous objects among the former are the members of the genus *Araucaria*, which takes the place in the southern hemisphere occupied by the pines in the north. Prominent among these are *Araucaria Brasiliana*, from Brazil, attaining a height of one hundred feet, *A. Bidwillii*, from Australia, closely related to the former and much resembling it, but having the branches more rigid and the leaves apparently in two ranks, and *A. excelsa*, from Norfolk Island and Australia, common in cultivation under the name of the Norfolk Island pine. Another member of the pine family is represented by a small specimen of the Deodar cedar, *Cedrus Deodara*; from the Himalayan region.

The yew family, Taxaceae, has a number of representatives in the genus *Podocarpus*, among them *P. Purdieanus*, *P. neriifolius* and *P. chinensis*. They bear drupe-like fruits.

In the corner to the right, opposite the pine family, is a small collection of the lily family, Liliaceae, including plants of *Phormium tenax*, the New Zealand flax, and its variegated variety *Veitchianum*. On the trellis back of this is a member of the rose family, *Rosa laevigata*, said to be a native of China and introduced into our southern states, where it is certainly very much at home. It begins to flower in February and is in flower for some time. Further on to the right are the Proteaceae, well represented in *Grevillea robusta*, commonly cultivated in the south under the name of the Australian oak, and several others of the same genus from Australia. Near these is the group of the Pittosporaceae, among which is *Pittosporum Tobira*, long in cultivation from China and Japan, with white flowers which exhale a delicious fragrance.

To the left and opposite is the myrtle family, Myrtaceae, embracing, among many others, a bottle-brush tree, *Callistemon citrinus*, from Australia, of which a large specimen ten to twelve feet high stands near the walk. Belonging to this family are the eucalypti. *Eucalyptus globulus*, the blue gum-tree of Australia, with its bluish leaves, is conspicuous. The genus *Eucalyptus* is a large one, and is native in Australia and Tasmania, where the trees form large forests, the individuals sometimes attaining a height of two hundred to four hundred feet and a trunk diameter of six to eight feet. They usually have long straight trunks, bearing the leaves and branches only at the top. Some have very hard and durable wood which is of economic importance, while others yield essential oils used in the manufacture of perfumery. A number of species have been grown in the warmer parts of this country, especially in California.

A plant some six or seven feet high of *Myrtus bullata*, from New Zealand, stands near the walk. Its queer leaves are natural, and not due to any diseased condition. *Eugenia Jambos*, the rose apple, is also a member of this family. It is a native of the East Indies. Its light-colored fruits are sometimes made into preserves.

Opposite the entrance to house no. 12 are several plants of *Eriobotrya Japonica*, a native of Japan, commonly known as the loquat or Japan medlar. It is a member of the apple family, Pomaceae, and becomes a good-sized tree. Its fruit is about the size of a small-sized plum and has a flavor somewhat like that of the apple.

The hydrangea family, Hydrangeaceae, is in this vicinity, and is represented by several species of *Hydrangea*. During the winter time these lose their leaves and are kept for that period in one of the cellars . A large plant of *Hydrangea hortensis* makes a gorgeous show here early in the summer. The orange family, Rutaceae, forms a large group a little further on, being composed mainly of orange and lemon trees.

The buckthorn family, Rhamnaceae, has a curious representative in *Colletia cruciata*, from Chili. The broad triangular bodies along the stems are branches, homologous with the branches of *Ruscus*, to which allusion was made in describing the plants in house no. 12. At the blooming period little white flowers will be found growing on these organs. The leaves are very small and are to be looked for on the young growths. So different are the young growths from the mature portions of the plant that one might readily be forgiven for mistaking them for parts of different plants, if they were not found growing on the same individual.

The corner opposite to the orange group is devoted to a number of families, among them the soapberry family, Sapindaceae, the laurel family, Lauraceae, which includes a large specimen of *Cinnamomum Camphora*, the tree from which the commercial camphor is obtained, the plum family, Drupaceae, the holly family, Ilicaceae, the dogwood family, Cornaceae, represented by several large specimens of *Aucuba japonica*, and, on the trellises in the rear, the morning-glory family, Convolvulaceae, and the passion-flower family, Passifloraceae.

On the column to the left is a plant of *Passiflora edulis*, of tropical America. The fruit is edible, of a light blue color, and somewhat resembles an egg in shape. It is said to have an agreeable and cooling taste. Near this column is a collection of the genus *Thea*, which belongs to the tea family, Theaceae. The commonest species in cultivation is *Thea japonica*, the camellia of gardens, in several double-flowered forms, ranging from white to red. The most important economic member is *Thea sinensis*, from which tea is obtained. This plant is extensively cultivated in many warm and tropical countries. Tea, as a beverage, has been used by the Chinese from time immemorial. Its first introduction into Europe is said to have been by the Dutch in 1610.

In the year 1666 it was worth about fourteen dollars per pound in England, and was imported from Holland. In 1669 it was first imported directly into England. Black and green teas are obtained from the same plant, the difference in color being due to the method of preparation.

The mimosa family, Mimosaceae, has a large representation in the genus *Acacia*. Most of those here are from Australia. *Acacia dealbata*, *A. Baileyana*, *A. decurrens*, and *A. mollissima* are species having true leaves; while *A. longifolia*, *A. neriifolia*, and *A. cyanophylla* represent those forms in which the leaves are reduced to phyllodia.

Further along the walk is the pea family, Papilionaceae, to the right, and to the left a few small families, among them the magnolia family, Magnoliaceae, with several specimens of *Magnolia foetida*, sometimes called *M. grandiflora*, known in the south as laurel or bull bay.

Near by are several fig-trees, *Ficus Carica*, from which the edible figs of commerce are obtained. This belongs to the same genus as does the common rubber tree which is so much cultivated for decorative purposes. The leaves drop off in winter and so for a short time these plants are placed elsewhere. The fig is supposed to be a native of western Asia and to have been introduced into the region about the Mediterranean. The so-called fruit of the fig is not really a fruit, but a hollow receptacle, the inside of which is covered with the true flowers and seeds. The small end of the receptacle, which is conic or obovoid, is attached to the branch.

Among the mallow family, Malvaceae, is the Chinese rose, *Hibiscus rosa-sinensis*, but not a true rose at all. In warm countries, where it can be grown in the open, it is a magnificent object, with its rich green glossy leaves and bright red flowers. The flowers when bruised become black, and they are then said to be used in coloring the eyebrows, or in blacking the shoes; it is from this that it gets its common name of the blacking plant.

Following come the oleanders, *Nerium Oleander*, which belong to the dogbane family, Apocynaceae. The oleander is a native of the Orient, but has become extensively naturalized in the

Mediterranean region. It grows luxuriantly in Florida, and a plant of it in full bloom is a charming sight. A poisonous principle exists in the flowers and leaves, and especially in the bark.

The olive family, Oleaceae, has a few representatives a little beyond the oleanders. The sweet-scented *Osmanthus fragrans*, found wild all the way from Japan to the Himalayan region, is one ; another, and the most important from an economic standpoint, is the olive tree, *Olea europaea sativa*, originally from the Mediterranean region and the Orient, but now largely introduced into cultivation in warm countries. A small specimen of this forms a part of the group. It is from this tree that the olive of our tables is derived, and from the fruit that the olive oil is obtained. In the middle of the eighteenth century this plant was first introduced into California, it is said, at San Diego. It is largely cultivated at present in southern California.

On the column in the immediate vicinity is a fine plant of *Bougainvillaea glabra Sanderiana*, a native of Brazil. What are usually called the flowers of this plant are in reality large bracts forming a sort of cup or involucre surrounding the true flowers, which are three in number, one for each colored bract. The color of the bracts is somewhat crude, but when in full bloom it makes a gorgeous show, clothing the column in a garment of purple.

The collection of the potato family, Solanaceae, follows. Especially interesting among the plants here is the tree tomato, *Cyphomandra betacea*, from Peru, but largely cultivated in other parts of tropical America. There are two specimens eight to ten feet in height. The fruit is pear-shaped and of an orange color. Its uses are about the same as those of the ordinary tomato. Another plant of this family, with large white flowers, is *Datura arborea*, from South America, a close relative of the common Jimson or Jamestown weed, or thorn apple, *Datura Stramonium*, of our roadsides and waste places. On one of the columns near the center of the house will be found another plant of this family, *Solandra longiflora*, of the West Indies.

In the corner, opposite to the dogbane family, are some of the vervain family, Verbenaceae, *Duranta repens*, commonly distributed in tropical America, and *Lippia triphylla*, of tropical America, the lemon verbena.

Following these are members of the heath family, Ericaceae, in several species of *Rhododendron*, *Azalea* and the true heaths, *Erica*.

In the corner near the entrance to house no. 14 is located the amaryllis family, Amaryllidaceae. The most conspicuous object here is a large plant of the Australian *Doryanthes excelsa*. Near it stands a large specimen of one of the best of foliage plants for large decorations, the old and well-known *Curculigo recurvata*, from tropical Asia and Australia. Two charming bulbous plants from southern Africa, *Crinum capense* and *C. Moorei* are represented in several specimens each ; the flowers of the latter in their delicate pink shades being especially attractive.

On the trellises against the wall in this part of the house will be found two or three species of the family Bignoniaceae. On one of the central columns is one of the best of plants for decorative purposes in such places. This is *Bignonia venusta*, from Brazil, of the trumpet-creeper family, Bignoniaceae. It flowers early in the year and continues for some weeks, its brilliant flowers hanging down in festoons from the column and the neighboring rafters.

On one of the trellises back of the group of the amaryllis family is a plant of *Gelsemium sempervirens*, the yellow jessamine of the south, a member of the logania family, Loganiaceae. It sends out its pretty yellow flowers usually in February, and they persist for some time.

House No. 14.

The general arrangement of this house was described when treating of house no. 12. Among the mint family, Labiatae, located on the south side of the central bench, are several interesting plants. The lavender plant, *Lavandula vera*, a shrub native to southern Europe, is well known as the source from which the oil of lavender is obtained. The oil is distilled from the flowers, and when dissolved in spirits becomes lavender water. The rosemary, *Rosmarinus officinalis*, enjoys a reputation of long standing, for it was held in high esteem by the ancient Greeks and Romans, being regarded by them as the emblem of fidelity. It is a native of southern Europe and western Asia, and is largely cultivated for its perfume, which is called herb-of-memory. A liquor is made from it, and it is used in the manufacture of eau-de-cologne.

A little further along is the milkweed family, Asclepiadaceae, represented by several plants worthy of notice in the genus *Ceropegia*, from Africa. The parachute flower, *Ceropegia Sandersoni*, from Natal, has large green flowers which resemble a parachute, hence its common name; another of the same genus is *C. Woodii*, from further south in southern Africa.

On the south side bench, near the entrance to house no. 13, is the sunflower family, Compositae. There are a number of showy things among these, their flowers appearing at different times, some early in the year and others continuing the procession up to late fall. *Eupatorium micranthum*, from Mexico, with its white flower-heads exhaling a delicious heliotrope-like fragrance, is very attractive. *Thyrsanthema semiflosculare*, often known as *Chaptalia tomentosa*, tells us every year that spring has begun in its home, which is in our own southern states, by sending up in Feburary and March its unpretentious flowers. The same tale is told to us by the golden flowers of *Chrysogonum virginianum* which is from the same country. This latter is hardy and may be found in the herbaceous grounds also, but it blooms there, of course, much later.

On the northern portion of the central bench will be found first the dogwood family, Cornaceae, represented by two genera, *Aucuba japonica*, from Japan, and *Corokia Cotoneaster*, quite different in appearance, from New Zealand.

The carrot family, Umbelliferae, is present in several species of *Eryngium*. In the ginseng family, Araliaceae, is the rice-paper tree, *Tetrapanax papyriferum*, in small plants. This is a native of China, where it attains a height of ten to twelve feet and a trunk diameter of three to four inches. It is from the white pith of the interior portion that the rice paper is made.

On the north side bench will be found the loosestrife family, Lythraceae. The genus *Parsonsia*, often called *Cuphea*, is present in several species. The cigar-plant, *Parsonsia ignea,* from Mexico, is commonly cultivated, and is interesting in its odd flowers which resemble a cigar in shape.

The great part of this bench is given over to the myrtle family, Myrtaceae, which is continued across the walk on the further end of the central bench. The common myrtle of southern Europe and the Orient, *Myrtus communis,* is among these. In its native country it sometimes becomes a tree twenty feet high. Its wood is hard and is much esteemed for turning. From it is also obtained an oil used in perfumery. The leaves are used sometimes for sachet powders. The Cattleya guava, *Psidium Cattleianum,* from Brazil, may be seen in small plants. Several species of the genus *Eucalyptus* and of *Callistemon* are in the collection.

House No. 15.

This house is mainly devoted to orchids, the side benches and the rafters above being devoted to this family, while the central bench is given up to a collection of palms and cycads.

The mistake is frequently made of considering all plants orchids which come under the general popular classifiction of "air plants." This is a great mistake, for many plants which are just as much epiphytic as are the orchids, have nothing whatever to do with that family. Many of the aroid family and nearly all of the pineapple family are epiphytes, but they are by no means orchids. Odd or strange-looking flowers are often classed among the orchids also, when they may be in no manner related to them. It is difficult to describe in a few words what constitutes an orchid, but to the botanist it is known at once by the peculiar structure of the flower, this peculiarity consisting in the uniting of the stamens and pistils into one organ, called the column.

The family is a widely distributed one, occurring in all tropical regions, but finding its greatest development in the Old World in India and the Malayan region, while in the New World it finds its greatest numbers in Brazil and other parts of northern South America. In temperate regions relatively few species are found, while in cold countries orchids are entirely absent. Most of the tropical forms are epiphytic, that is, they grow upon trees and

The orchid house, No. 15, south side, looking west. Orchids to the left and hanging fr the roof, with palms on the right.

usually have bulb-like or thickened stems and fleshy leaves for the conservation of their water supply, as, from their habitat, this supply must be precarious. In temperate regions nearly all of the species are terrestrial and have thin leaves, the soil about their roots serving to protect them from the cold of the winters in such latitudes, and also giving them a more constant water supply than their relatives, which have taken to the trees, can command: they do not therefore need psuedo-bulbs, or thickened stems and leaves. Coming from all parts of the world as they do, their blooming period varies greatly. Members of this family from many lands will be found in these collections, and to see the flowers of them all would require repeated visits to the conservatories at different times of the year. The genus *Dendrobium*, a large one of the Old World, usually comes into bloom in February or March. *Cattleya*, strictly American in its distribution, and largely from northern South America, varies greatly in its time of blooming, depending on different species, so that at almost any time during the year some member of this showy genus will be found in flower.

The palms of the central bench are most of them too small to develop character as yet. One of these, however, is of especial interest; this is the double cocoanut, *Lodoicea maldivica*, of which a figure and short account appeared in the JOURNAL for January of this year. This is also known as the coco de mer and coco des Maldives. It is a native of the Seychelles Islands, and is known only from these islands. It is one of the rarest of palms in cultivation, only a few growing in the gardens of the Old World, and but four or five in this country. The upper portion of the seed may be seen emerging from the surface of the soil in the specimen on view, which will be found on the end of the central bench near house no. 1. Its double character, from which it derives the name of double cocoanut, can be plainly seen. The tree in its native wilds attains a height of ninety feet, bearing aloft a magnificent crown of green leaves which make it an important feature of the landscape.

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

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NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

Vol. VII APRIL, 1906 No. 76

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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Published for the Garden

At 41 North Queen Street, Lancaster, Pa.
by The New Era Printing Company

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JOURNAL

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The New York Botanical Garden

VOL. VII. April, 1906. No. 76.

THE SPRING LECTURES.

The lectures of the spring course will be delivered in the lecture hall of the museum building on Saturday afternoons at 4:30, beginning April 21 and closing June 23, as shown in the following schedule. They will be illustrated by lantern slides and otherwise.

April 21. "On the Correlation of Characters in Plants," by Professor Hugo de Vries.

April 28. "A Day at Hammarby, the Home of Linnaeus," by Dr. W. A. Murrill.

May 5. "A Historical Review of the Study of Fossil Plants," by Dr. Arthur Hollick.

May 12. "A Glimpse at the Development of Botany in America," by Professor L. M. Underwood.

May 19. "The Effects of Radium on Plants," by Dr. C. Stuart Gager.

May 26. "Some Botanical Features of Porto Rico," by Dr. Marshall A. Howe.

June 2. "Orchids; Their Botanical Features and Relation to Horticulture," by Mr. G. V. Nash.

June 9. "The Wild Vegetable Foods of the United States," by Dr. H. H. Rusby.

June 16. "The Origin and Adaptations of Desert Floras," by Dr. D. T. MacDougal.

June 23. "The Botanical Exploration of the West Indies," by Dr. N. L. Britton.

Before the lectures, opportunity will be given for inspection of conservatories, museums, library, herbarium, herbaceous garden, hemlock forest, and other parts of the grounds. The Garden is reached by the Harlem Division of the New York Central Railway to Bronx Park Station, or by the Third Avenue Elevated Railway to Bronx Park. Lectures will close in time for auditors to take the 5:29 train to Grand Central Station.

THE HISTORY OF BOTANY IN THE PHILIPPINE ISLANDS.

The first plant to reach Europe from the Philippines seems to have been brought by an English sailor named Thomas Cavendish, who visited the islands in 1587 in the course of the third circumnavigation of the globe. It was described and figured by Clusius in his Rariorum Plantarum Historia in 1601 as *Anisum Philippinarum insularum*, and was, indeed, the star anise of the East. This reference seems to have been deliberately rejected by Linnaeus, and rightly too, for three hundred years later Fernandez-Villar knew it only as sold by the Chinese.

The first series of collections from the archipelago, consisting of plants and animals, accompanied by many descriptions and drawings, met a similar fate. It was made by a Jesuit priest named George Joseph Kamel, and sent to James Petiver and John Ray of London, by whom the notes were communicated to the Royal Society and published in the Transactions. Ray, moreover, devoted to it an appendix to the third volume of his Historia Plantarum (1704), consisting of 96 folio pages, with references to nearly 1,400 species, many, however, merely called by a native name. It formed more than one consignment, the first being recorded by Petiver on August 31, 1699, as among the plants received in the preceding twelve months. Another lot is said by Ray to have arrived in 1701, and there were probably others. Petiver figured several things from this source in his Gazophylacium, and it is from this that Linnaeus made his very few citations: for the latter calmly dismisses the entire work of Kamel and Ray by the remark "descriptiones imperfectae.

Florum nulla notitia." To atone for this, perhaps, he called one of the most beautiful genera by the name *Camellia.* It is usually stated that Kamel introduced this plant into Europe from Japan in 1739; but he died in 1706, and there is every reason to believe that he never was in Japan. His claims upon our interest rest upon a more solid foundation, since for his age he must have been a wonderful man, though under the rules his work goes for nothing. Many of his plants are still preserved in the British Museum, and 260 of his unpublished drawings are at Louvain in Belgium.

Many of the leading scientific explorers included the Philippines in their travels, spending as a rule about a month at or near Manila, though Sonnerat, the first to arrive, far exceeded this limit. Sighting Luzon in September, 1771, he spent five months and a half in this island, Panay, Mindanao and Jolo. His chief interest was in birds, but he describes and figures many plants, and seems to have taken to Europe not only dried specimens, but either living ones or seeds, some of which were grown in France and described by Lamarck.

Commerson is said to have visited the group about the same time: but the Bougainville expedition was unable to reach the Philippines, and if he was there later his collections were of little importance.

The Spanish Malaspina expedition in 1792 brought with it three naturalists, one of whom, Pineda, was a zoologist rather than a botanist. He explored the country north of Manila, but died within three months, and his plants, if he collected any, have not been described. Née and Haenke, the other two, are more important, though neither wrote anything concerning his collections. But Cavanilles for the former, and Presl and others for the latter, have supplied the want, so that this was the first expedition from which much has come permanently into Philippine botany. Haenke's trip was eventful. At the outset he missed the ship at Cadiz by one day, and taking the next one, three weeks later, for the La Plata River, was there shipwrecked, lost almost everything, became ill, and thus was again late at Montevideo. Scarcely recovered, he followed the party to

Buenos Aires, only to fail a third time, but undismayed crossed the Andes and at last found the party in Chile.

Cavanilles also says that Cuellar had spent the five years preceding 1791, collecting, describing, and drawing Philippine plants, but no other mention of him, beyond the mere name, seems to exist.

Chamisso collected in the neighborhood of Manila in December, 1817, and January, 1818, and obtained some interesting species. Perrottet was in Mindanao, Luzon, and others of the islands from November, 1819, to January, 1820.

But it was the fourth decade of the century which was most memorable. Meyen in 1831, Calléry in 1835, and Gaudichaud in 1837, especially the first, got valuable collections. Of greater interest to us is the work of the United States Exploring Expedition, which did not not however spend much time in the Philippines, but visited Luzon, Mindanao, and the Jolo archipelago. Asa Gray described their material, but only part of his manuscript was ever published. The Dumont d'Urville expedition, in 1839, was less fortunate, being driven away by pirates from the east coast of Mindanao, after a few hours on shore. They subsequently made a short visit to the southwest of the same island.

Greatest by far of all Philippine collectors was Hugh Cuming, who from 1835 to 1840 visited nearly every important island in the group, and Malacca, Sumatra, Singapore, and St. Helena as well. He was an all-round naturalist with a first preference for shells, yet he took back to England 130,000 specimens of dried plants, representing over 2,450 numbers, of which about 2,200 were Philippine and form the basis of numerous descriptions. Unfortunately the remainder have often been so cited and much confusion has resulted. This has taken place similarly with other collectors, but the complication has not been in any other case nearly as serious.

Cuming further introduced several species of living orchids into Europe, and thus first called attention to the beauties of this element of the flora. For the next thirty years the islands were diligently explored by orchid-hunters, who sent home many species of plants, mostly confined to this one family. An exception is the fine Melastomaceous shrub, *Medinella magnifica*, frequently seen in bloom in our conservatory, discovered by Thomas Lobb, who, unlike most other collectors of living plants, preserved a small number of dried specimens.

In the meantime the subject had entered upon a new phase. Besides Kamel many members of the various religious orders had written treatises, some nominally botanical, all really medicinal. Few of these were ever printed, and some of them are lost. The authors whose names are on record are Frs. Blas, Valencia, Alsina, Clain, Sta. Maria, Cacho, Viso, Gomez, Belby, Saldada, Ferrero, Delgado, and Mercado. The works of the last two are much the most important, yet they remained in manuscript 150 and 200 years respectively, and have only been printed in the last quarter century.

But the appearance, in 1837, of Blanco's Flora de Filipinas, was of the utmost consequence. Manuel Blanco was born at Navianos, Spain, in 1778, educated at Valladolid, and coming to the Philippines in 1805, held several curacies near Manila, and ultimately became provincial delegate, in which capacity he traveled extensively in Luzon, Panay and Cebu. Impressed from the first by the beauty and variety of the vegetation, he began its study with very few books and no other aid of any description. The result was the famous Flora, an octavo of 965 pages in which over 1,000 species are described, a few called by native names only, but most of them in binomial form, some identified with extra-Philippine plants, others considered to be new. Errors naturally abound, but when the circumstances and the difficulty of the task are taken into account, it must be confessed that it is a wonderful piece of work. A second edition, issued shortly after his death in 1845, was taken almost entirely from his notes, and contained many additions. Many names of the first edition were also changed, rarely with any intimation of the fact, and as these involve not merely specific and generic but even family differences, confusion has often resulted.

Blanco seems further to have stirred many others into activity, and plants were sent him by various persons throughout the archipelago. Some also wrote short articles upon the subject, of which the chief was by Llaños, intended to contain corrections and additions to Blanco's Flora; but far inferior to the original.

During the years from 1877 to 1883 there appeared the successive parts of the third, grand, or Augustinian, edition of the Flora de Filipinas, so-called because all the writers belonged to that order. It is perhaps the most sumptuous botanical publication of recent years, composed of four large folio volumes of text, and two others containing 480 plates, all elegantly printed upon heavy paper. It contained Blanco's second edition and Llaños' papers, with hardly any change except the addition of a Latin version, Mercado's medicinal treatise, and, above all, the Novissima Appendix, compiled by Frs. Celestino Fernandez-Villar and Andrés Naves. The latter took the monocotyledons, but fortunately was unable to complete them, and Villar wrote up the grasses and part of the sedges, besides all dicotyledons. They accumulated a fine library and were able to find nearly all the references to Philippine botany published elsewhere. But in another way these books proved their undoing, for they acted on the fixed principle that they would find in them identifications of almost every plant they collected. They had very few specimens from other countries for comparison, consequently their specific errors were very numerous, and as they rarely give more than the name, synonymy, and location of their plants, in a high percentage of the cases we shall never know what they had. But Villar was almost always right so far as the genus was concerned, his interpretation of specific limits was most conservative, and anyone who wishes an approximately correct account of the Philippine flora can at present get it only from this source. For more concise and accurate summaries and, above all, for discussion of the relations shown with other countries, nothing so far compares with papers written by R. A. Rolfe of Kew.

The literary and mechanical supervision of the Flora was entrusted to two brothers, Domingo and Sebastian Vidal, but the former died when only a small part had appeared. The latter, besides this, did work of a different kind, and he alone of his countrymen has left behind that which assists rather than hampers the students of the subject. For however fascinating and even romantic the efforts of Blanco, Villar, Kamel, and others may seem, yet, with all their enthusiasm and perseverance, their work is only an obstacle, for it adds to a task already sufficiently extensive a great many problems, which must be grappled with, often in vain.

Vidal formed an excellent herbarium of over 4,000 numbers and in so doing visited several of the highest mountains of northern Luzon, hitherto untouched, obtaining in this way many species which cast an entirely new aspect upon the flora. He further took his material to Kew, where the greatest collection of the plants of Cuming and other eastern explorers was to be found, made careful comparisons, and thus avoided the errors of his compatriots and laid a firm foundation for future work. He published six books, two of which are devoted to a review of Cuming's numbers and the first half of his own.

With the last years of Spanish rule came renewed activity in collecting. Between 1889 and 1896 Loher, a pharmacist of Manila, secured over 5,200 numbers, the greatest variety yet obtained by one person. Yet, although distributed at once, little has been published about them, the ferns excepted. Dr. Warburg, of Berlin, got about 3,000 numbers in 1888, and descriptions of some of these have appeared, especially on the flowerless plants and certain of the higher groups. Professor Steere, while studying the birds in 1874–5, made a valuable collection of ferns. In the same years the Challenger expedition spent several weeks around the islands, but little has been published except upon the cryptogams then obtained. F. W. Burbidge, of Dublin, was in Jolo for a month in 1878, chiefly in search of orchids, and in 1896 J. Whitehead gathered a small but unusually interesting assortment from the hills of Luzon and Mindoro. Two other travelers who have left valuable published records of their observations are Jagor, who visited Luzon and the Visayas in 1859, and Marché, who made two trips to Luzon and Paragua, one in 1879–1881, the other in 1883–5.

Such was the condition of affairs that faced botanists about the time of the American occupation. Worse was to come. Vidal's herbarium was burned in 1897, Villar's in 1899, and the library of the Manila Botanical Garden vanished in the interval. The loss of the herbaria was most serious, as they contained all the type material that existed belonging to resident botanists. Many of the plants had been wrongly identified with allied species from India, the Malay Islands, Australia, South America, or even West Africa and eastern North America, and many well-meant efforts to straighten out some of the tangles have failed, both through the deficiencies or absence of description by the Spaniards and the want of Philippine material by the European monographer.

This work has been resolutely undertaken by the Bureau of Government Laboratories, now incorporated in the Bureau of Science, under Mr. E. D. Merrill, and by that of Forestry under Captain Ahern, aided by numerous assistants, of whom Elmer, Whitford, Copeland, Barnes and Borden have so far been the chief, their collections to the present totaling at least 13,000 numbers. Mr. Merrill has given special attention to the identification of Blanco's plants, has worked up several important families, describing many species, and thus accomplished very much towards placing the matter on a more satisfactory footing. Duplicates of their earlier collections were sent to Berlin, and descriptions of those of them and others already there, which belong to some important families, have been published by Miss Perkins with the collaboration of several German botanists. Professor Underwood has published a valuable summary of the ferns, and Dr. Copeland has written papers upon the same group and the fungi. The energetic work thus done has already had most pleasing results, and Mr. Merrill in particular is to be congratulated upon the transformation effected in so short a time.

Probably the largest collections yet made by a non-resident, as well as the best preserved, were sent home to this Garden by Mr. R. S. Williams, in the course of the last two years, from the islands of Luzon, Mindanao, and Jolo, and owing to the care lavished upon them all reached this city in beautiful condition. The numbers reach 3,126, representing probably 2,800 species, many of them undescribed, belonging in several instances to genera not yet recorded as Philippine. They comprise flowering plants, ferns, mosses, and lichens, besides fungi and seaweeds not included in the above total. The greatest interest attaches to those from Benguet in Luzon, and Mt. Apo in Mindanao, both high levels, the recent discoveries from which have changed our ideas of this flora, through the large semi-temperate element found there.

The Philippines have long been noted for the unusually large proportion of plants which grow nowhere else, though the Augustinians signally failed to recognize this. Outside of Luzon exploration is still in its infancy, and even there many promising localities are still unvisited, and much time must yet elapse before any summary more than approximate can be given. Elevation seems to be the most important factor in regulating geographical distribution. The strand flora is nearly the same everywhere, as is usual in the tropics ; that of levels below about 3,000 feet is tropical, with a strong general resemblance to that of the Malayan islands ; while on the mountains the vegetation is most similar to that of western and southern China and Formosa. Connecting links with Bornean plants are strangely few, these mostly from Mindanao, but this is at least partly due to our almost total ignorance of Paragua, the animals of which are more like those of Borneo than the Philippines. A few important affinities with Australia have long been known, though two of the most interesting are uncertain, while recently a few have been found with Celebes.

The summaries of Fernandez-Villar and Rolfe are as follows :

	Villar			Rolfe		
	fam.	gen.	sp.	fam.	gen.	sp.
Gymnosperms,	3	7	19	3	6	18
Monocotyledons,	26	325	1,425	26	273	1,340
Dicotyledons,	123	835	2,552	119	723	2,108
	152	1,167	3,996	148	1,002	3,466

These figures are very much of an estimate ; they represent the knowledge of over twenty years ago, since which time at least five hundred new species have been described, and others found already known from other countries. The number of families now credibly recorded is 180, on the Engler and Prantl basis.

In three of these, which take in the full range of altitudinal variation, the number of species has been raised from 67 in Rolfe's list to at least 134. Professor Underwood in 1903 provisionally estimated the ferns then known at 633. The figures for monocotyledons above were largely based on Naves' statements, and they will be increased, if at all, less than the others, so that the alleged exceptional proportion of this division of the flora will likely be found misleading.

There are now in the Garden herbarium between 10,000 and 11,000 sheets of Philippine flowering plants and ferns. Among these are 200 collected by Cuming, 60 by Loher, and 40 by the U. S. Exploring Expedition. Nearly all of value in the rest was either obtained by Mr. Williams or sent by the Bureaus of Government Laboratories and Forestry at Manila.

C. B. Robinson.

A FLOATING ORCHID (HABENARIA REPENS).

Many species of *Habenaria* are found in damp locations, and a number actually grow in water, but so far as known to the writer this is the first record of one growing in a floating position.

In the delta of the Orinoco there occur many lakes or pools, connected with the river by channels in which the water flows only when changes of level occur in the main stream. During the rainy reason the water flows into them from the river, and they acquire a much greater depth than in the dry season, when, in fact, many of them dry up altogether. These pools offer rich harvests to the collector of aquatics. In some of them the plants are all rooted in the mud, while in others, where there is little current or other violent disturbance attendant upon the change in level, much floating vegetation is found. One of these still pools existed at the back of a hill facing the river, upon which was built the one house that now constitutes Sacupana, where Mr. Squires and myself spent part of the collecting season of 1896. The shores of this pool were often visited by us, but no favorable opportunity occurred for exploring its surface until one day in May, shortly before our departure. On this afternoon we

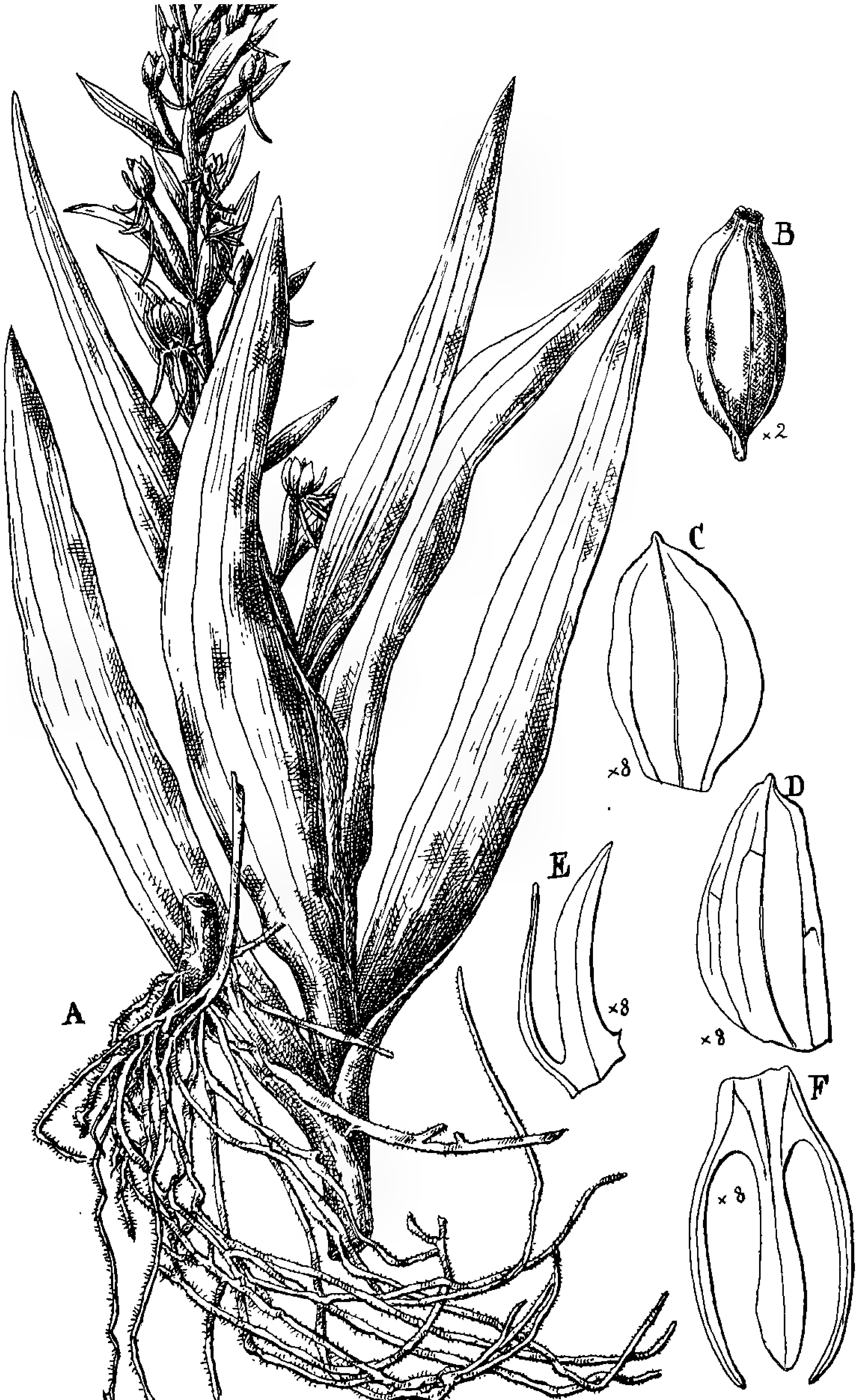

FIG. 3. A floating orchid, *Habenaria repens* Nuttall. *A*. Plant, natural size. *B*. Fruit, x 2. *C*. Dorsal sepal, x 8. *D*. Lateral sepal, x 8. *E*. Petal, x 8. *F*. Lip, x 8.

took a small cedar canoe and explored the narrow tortuous bayou that connects the pool and the river running along the eastern base of the hill. The river had already risen some four or five feet from its lowest level. Few plants were found in the bayou until we had reached a point nearly a mile from the river, where we found the channel completely filled, and our progress stopped, by a heavy sedge, which appeared to grow from the shallow water at each side of the bayou, here about twenty to thirty feet in width, meeting at the center and filling the water for about three or four feet below its surface. The plant was not in flower, and no collections were made. I cannot be positive at this time even that it was a sedge. Its stems were as thick as small cornstalks, and its leaves long and broad. It was with the greatest difficulty pressed down with the paddle so as to allow the boat to be forced over it.

A short distance beyond this obstruction, the bayou turned sharply to the west and broadened out into a pool between a quarter and a half mile in length, and with an average width of perhaps a hundred yards. Probably half of it consisted of open water, which swarmed with fish and reptiles. Of the former, we captured a number of very strange sorts, but most of them were piranhaus or Carib fishes, of several species. Several very large alligators were seen, and some otters were playing about a wooded bank. Of the surface which was not clear, the greater portion was thinly covered with slender and sparsely leafy grass-stems, which rose to a height of about six feet above the surface. This plant presented much the appearance of our *Zizania*, and grew thickly enough to obscure the view at a distance of eighty or one hundred feet. The remainder of the pool was covered with floating aquatics and floating leaves, but none of them in bloom at the time. In the midst of a floating mass of this kind, perhaps fifty yards in breadth, many yards from the shore and exposed to the bright sunshine, were many plants of a *Habenaria* that has been determined by Mr. Rolfe as *H. repens* Nuttall. They grew singly for the most part. Occasionally several would stand sufficiently near together to have their roots intermingled, but I did not notice any apparent connection. The plants grew in every case where slender-stemmed aquatics, such as *Potamogeton* or *Myriophyllum*, grew so thickly as to furnish a support. A rhizome about an inch long and an eighth of an inch thick was imbedded among these plants, rising obliquely from them, and at the top of this the stem grew erect, in no case much more than six inches above the surface. The yellowish-white roots, well clothed with short and thick root-hairs, did not dip down into the water but spread out almost horizontally through the mass of vegetation, a considerable body of which was lifted up when the *Habenaria* plants were raised. With a little gentle shaking they were readily drawn out. The inflorescence was of a light-green color, the leaves of a rather light, but brilliant, green, and sub-erect.

The plant would have been more carefully examined, had it not been found just as we were about to make a hasty return. It did not occur to us to investigate its germination, which we might have done, as many plants were in fruit. It seems reasonable to suppose that the seeds germinate while in the pods.

It is not improbable that the plant is common in such localities, but we had no other opportunity of finding it. It certainly did not grow along the shore, nor in the mud, for such localities, there and elsewhere, were often searched. So far as this locality is concerned, therefore, the plant grows only as a natant.

H. H. RUSBY.

THE TYPE OF ZAMITES MONTANENSIS FONT.

Mr. R. S. Williams recently donated to the Garden a collection of some fifty specimens of Lower Cretaceous fossil plants, personally collected at Great Falls, Montana, about sixteen years ago. Dr. J. S. Newberry and Professor Wm. M. Fontaine subsequently described the flora of the locality, so their papers were consulted when engaged in the work of identifying and labeling the specimens. Among them was found an unusually perfect specimen of *Zamites montanensis* Font., enclosed in a concretion and showing both impression and cast as counterparts. To my surprise, I saw that this was evidently Fontaine's type specimen of the species, described and figured in Proc. U. S. Nat. Mus., 15: 494, *pl. 84, f. 4*, 1892! Mr. Williams was at first unable to explain how the specimen came to be in his collection, until the following abstract from Professor Fontaine's description was called to his attention: "Mr. R. S. Williams, of Great Falls, loaned Mr. Knowlton a beautiful imprint of a cycad which seems to be new. A drawing of it was made and is given in Pl. LXXXIV, Fig. 4, of this paper. I have not seen the original, but the drawing gives the character so distinctly that a description can be given from it."

ARTHUR HOLLICK.

NOTES, NEWS AND COMMENTS.

A collecting expedition to Porto Rico, organized under the auspices of the Garden and headed by Dr. Britton, left New York on February 24 and returned on April 1. Dr. Britton and Dr. Howe, accompanied by Prof. William Morton Wheeler of the American Museum of Natural History, spent ten days in the early part of March on the island of Culebra, where the facilities of the U. S. Naval Station were courteously placed at the disposition of the party. In the collections made at this point the Cactaceae and marine algae were especially well represented. Mrs. Britton, Miss Delia W. Marble and Mr. John F. Cowell in the meantime explored the mountains and foothills in the neighborhood of Mayagüez in the western part of Porto Rico, afterward joining the rest of the party at Arecibo for a trip across the island over the Adjuntas road. A stop of a week was made at Utuado, where two of the higher mountains of the island were climbed. From Ponce, on the south shore, the return to San Juan was made over the military road. The dried specimens of plants secured by the expedition are represented by about 1,700 numbers and in addition a large amount of living material was brought back. It is expected that a more extended account of the expedition will appear in a later number of the JOURNAL.

The Garden laboratory at Cinchona, Jamaica, will be occupied during the spring by Prof. Duncan S. Johnson, of Johns Hopkins University, and a party of his students, who go there to prosecute cell-studies on native plants of the Jamaica mountains, in continuation of the important investigations in cytology long prosecuted by him. As already reported in the JOURNAL, Dr. Forrest Shreve, also a student of Professor Johnson, is at present at Cinchona investigating the mistletoe and other parasitic plants of the forests, and pursuing studies on filmy ferns and on the relationships of tropical plants to soil and moisture. The demand for the use of this laboratory is increasing, and we are fortunate in being able to supply facilities for the use of the numerous students who desire to investigate one feature or another of the tropical flora.

During the winter, much progress has been made in the construction of the driveway and path entrances to the Garden at the Mosholu Parkway and at the Woodlawn Road bridges over the New York Central and Hudson River Railroad. The earth filling at the Mosholu Parkway is now essentially completed and the driveway at that point can be paved as soon as the filling has had time to settle down. Temporary ash sidewalks have been made and work is going forward in connecting the paths with them. At the Woodlawn Road approach there has been considerable delay by the contractors in completing the masonry work of the retaining wall, but this is at last finished and the additional earth filling needed to carry the driveway in at that point is being put in place. The portion of the border screen along the New York Central and Hudson River Railroad on the west side of the Garden opposite the upper lake, which has never been completed on account of necessary grading and road-building operations there, is being completed this spring by a heavy belt of evergreen trees, designed to mask the railroad from the driveway and paths. It is necessary to plant here upon a rather steep bank, as the driveway is some feet below the level of the rails, and several years' growth will be necessary before a complete masking will be effected. Work is also going forward toward the completion of the main east and west driveway which crosses the valley of the Bronx River on the long 5-arched rubble-stone bridge completed last year, and it is believed that this connection can be completed and the road thrown open for use by midsummer. The stone for the telford foundation of this road was all excavated from the quarry behind the museum building during the winter, and hauled into place.

At the conservatories, in house no. 13, will be found an odd plant, now in full bloom. Near the oleanders, on the north side of the house, the large showy leaves of this plant form a conspicuous object. The plant referred to is *Gunnera manicata*, originally introduced into cultivation from Campos de Lages in southern Brazil. It belongs to the family Gunneraceae, to which belong also some of our common aquatic plants here in the north, such as the mermaid-weeds, and the water milfoils. The large bracts, which are cut into long lobes and often richly colored, form a sort of sheath about the bases of the petioles, and it is from this character that the plant derives its specific name. The species is said to attain a size fully twice that of the plant now in flower, which was raised from seed secured from the botanic garden at Leiden, Holland. The leaves in this specimen are fully three feet in diameter, and have the petioles and the principal nerves on the lower surface densely furnished with spines, the upper surface of the blade being very rough. The curious inflorescence has much the shape of a large cone, with a length of eighteen to twenty inches and a diameter of about six inches, the apex being abruptly narrowed into a sharp point.

The total precipitation at the Garden for the month of February was 1.89 inches. Maximum temperatures of 45° on the 1st, 43° on the 5th, 48° on the 14th, and 57° on the 20th were recorded; also minimum temperatures of 6° on the 3d, 4° on the 6th and 7th, 9.5° on the 15th, 25° on the 23d and 24th, and 13.5° on the 28th.

The total precipitation in the Garden during March, 1906, was 4.15 inches. Of this amount 2.71 inches fell during the rain of March 4 and 5. The precipitation on the 13th and 14th was snow (5.50 in.), also on the 19th (5.50 in.), making a total of 11 inches snowfall during the month. Maximum temperatures of 48° on the 3d, 54° on the 9th, 42° on the 16, 37° on the 21st, and 54° on the 29th were recorded; also minima of

5° on the 1st, 16° on the 6th, 10° on the 18th, 9° on the 24th, and 26° on the 29th.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII MAY, 1906 No. 77

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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Published for the Garden

At 41 North Queen Street, Lancaster, Pa.
by The New Era Printing Company

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JOURNAL

OF

The New York Botanical Garden

'ol. VII. May, 1906. No. 77.

RECENT BOTANICAL EXPLORATIONS IN PORTO RICO.

'o the Scientific Directors.

Gentlemen: The Board of Managers having on January 9, 906, authorized the continuation of botanical exploration in 'orto Rico, and having granted me leave of absence from the ;arden for the purpose of directing it, I organized an expedition /hich left New York February 24 and returned April 1. The bjects were to increase our collections of Porto Rican species, nd to obtain a better knowledge of them by observing the plants rowing in their natural habitats, and also to visit certain parts f the colony hitherto unexplored by botanists.

We were fortunate in securing the coöperation of Mr. John F. :owell, Director of the Buffalo Botanical Garden, who gave pecial attention to collecting orchids, bromeliads, cactuses and ther living plants; Dr. Marshall A. Howe, of our curatorial taff, continued his collecting of West Indian marine algae and ther cryptogamic plants; Mrs. Britton, assisted by Miss Delia V. Marble, paid especial attention to the mosses, lichens, fungi, nd ferns, and also aided in the preparation of the general col- :ctions; and we were all favored by the company of Professor V. M. Wheeler, curator of invertebrate zoölogy in the American Iuseum of Natural History, who made a critical study of the nts, in continuation of his previous important investigations of ıe relationships and habits of these fascinating little animals, ıany of the sixty species obtained by him living in hollow stems of plants, and others cultivating fungi for food; he also obtained specimens of many other new or little known land invertebrates, and generously aided greatly in the work of preparing the botanical collections, which became so bulky toward the end of the trip as to require the unremitting attention of the entire party. Professor Wheeler and Dr. Howe were the photographers of the expedition, and secured many negatives of scientific value.

Soon after the annexation of Porto Rico, it was determined to explore it botanically on behalf of the Garden, and the work was commenced in 1899 by means of a sum of money contributed for the purpose by Mr. Cornelius Vanderbilt, then President of the Board of Managers; Mr. and Mrs. A. A. Heller were sent there as collectors in that year, and worked for several months, returning there the next year; in 1901 Professor Underwood, accompanied by Mr. R. F. Griggs, made a visit to the island for an investigation of the ferns in coöperation with Mr. O. F. Cook and Mr. F. S. Collins of the United States Department of Agriculture; in 1902, Mr. Percy Wilson, now my administrative assistant, accompanied Dr. Alexander W. Evans, of Yale University, in an exploration of the forests of the Luquillo Mountains, Dr. Evans making a special study and collection of the hepaticae, in continuation of work previously carried on by him in the same field; and in 1903, Dr. Howe spent the summer in collecting and observing the seaweeds, his part in the present expedition being principally supplementary to his previous work, and enabling him to study the marine plants at a different time of year; in 1903, Professor F. S. Earle, then one of our assistant curators, and now Director of the Cuban Agricultural Experiment Station, made a visit to Porto Rico for the United States Department of Agriculture, and secured a considerable number of fungi which were added to the Garden collection.

These previous expeditions had brought to light so much of novelty, and the study of the collections obtained had added so greatly to our knowledge of the West Indian flora, that the further exploration of the island seemed very desirable.

It is already clear that the collections just made are of high scientific importance, and the large number of living plants secured will add many species of interest to our conservatories.

The Island of Culebra, situated just east of Porto Rico and between it and the Danish Island, St. Thomas, was made a point of special examination, nothing being hitherto known of its flora. Our study of this island, which is under the jurisdiction of the Porto Rican Insular Government and is the site of a United States naval station, was made easy by the kind interest of the Hon. Charles J. Bonaparte, Secretary of the Navy, upon the request of President Roosevelt, in response to a letter from Mr. D. O. Mills, President of the Board of Managers of the Garden. Mr. Bonaparte asked Captain B. T. Walling, Commandant of the naval station, to faciliate the work of our expedition, and he most obligingly gave us all the assistance needed, including the use of steam launches, small boats, and horses, and the services of men when required. Captain T. F. Lyons, commanding the Marines at Culebra, also contributed much to our comfort. Professor Wheeler, Dr. Howe, and I spent two days pleasantly and profitably with Captain Walling and his staff, and we secured collections which illustrate both the land and sea flora of Culebra quite well; a visit at another time of year would doubtless add some species to the collection. Culebra is a hilly island with an area of about twelve square miles, apparently wholly composed of eruptive rocks, and containing only small areas of deep soil; there are a number of sand beaches backed by sand dunes. The highest hill reaches an elevation of about 690 feet. There are a number of smaller islands and keys adjacent, and Culebrita, where the important lighthouse for the Virgin Passage is located, is the most eastern of these; we spent part of one day on this island. The naval station is located on the shore of the beautiful land-locked harbor, an oval body of deep water, doubtless the crater of an ancient volcano, accessible from the ocean by a very narrow passage and enclosed on all but the southern seaward side, by hills of lava. The station ship "Alliance" provides quarters for the commandant and his staff, and here we were hospitably entertained. The island is fortified with masked batteries, so ingeniously masked, indeed, that we did not discover a gun during our whole exploration, but the supply of ammunition and the activity of the gunners gave plenty of evidence that cannon were at hand when wanted.

The altitude of the hills is not sufficient to cause the condensation of much moisture from the trade winds, and therefore Culebra is a dry island with no permanent streams or ponds. Its forest is low and not very dense, with guayanilla (*Bucida buceras*) and lignum vitae as the largest and most valuable elements; much of the woodland has been cleared and the principal industry

FIG. 4. Tall branching cactus (*Pilocereus*), Culebra.

of the island is cattle raising, although some sugar cane, tobacco and cotton are grown ; the cotton plants seen by us were healthy and apparently without insect pests. The melon of southern Europe grows very well, and with suitable refrigerating transportation to the north, might be made an exportable product, both here and on adjacent islands, as melons can be produced all the year around ; it is desirable that the culture of both figs and dates should be given experimentation in a scientific manner on Porto Rico and adjacent islands, for if successful, these products would add greatly to the resources of the colony, and it is believed that there is a strong probability of success.

Cactuses abound on Culebra, and their study and collection was a feature of our investigation. Ten species grow there, more

FIG. 5. Silver thatch palm (*Coccothrinax*), Mosquito Bay, Culebra.

than on any other island of the same size known to me, and the number of individuals is enormous. The columnar branching *Pilocereus* is often twenty-five feet high; the melon cactus becomes two feet long and over a foot thick; the three-sided climbing night-blooming *Cereus* formed impenetrable entangled masses on shrubs and trees, but we were not fortunate enough to find it in flower; the beautiful snowy little *Mamillaria*, with nearly white flowers, and tufts of bright white wool among its brown spines, is abundant here as on St. Thomas; the cochineal cactus (*Nopalea*) has showy red flowers; at least five kinds of prickly pear (*Opuntia*) occur, two of them forming tree-like plants up to fifteen or twenty feet in height, one of these tree cacti being most remarkable in being absolutely spineless. One species of palm is locally abundant, a silver thatch palm (*Coccothrinax*) with a tall slender trunk bearing a tuft of palmate leaves, silvery white on the underside, and large drooping branches of small black fruits. A gigantic century plant (*Agave*), native among the cactuses, contributes to the desert-like aspect of the vegetation in some parts of the island.

While one section of the expedition was exploring Culebra, the most eastern Porto Rican territory, the other visited Mayaguez, on the western end of the island, and made extensive collections in that vicinity, aided greatly by the courtesy of Mr. D. W. May, director of the Agricultural Experiment Station, and by Mr. H. C. Hendrickson, horticulturist of the Station. The higher elevations of this district, including the Mesa Mountain, and the Cerro Gordo range, were visited, and the vegetation up to the altitude of 2,500 feet carefully studied; several of the deep ravines were explored, and a good collection of the characteristic plants was made for the herbarium, and the most interesting species were sent home in a living condition for growing in the conservatories.

The work of the Agricultural Experiment Station proved interesting enough to require a rather extended examination; the Station is evidently handicapped for lack of funds, but the collections of bananas, yautias, pineapples, etc., show that very exact and important work is being done. It is unfortunate that the irector has not more help at his command, as there is great eed of instruction among the native farmers and fruit growers.

Proceeding south from Mayaguez, by rail, to Ponce, the charcter of the flora changes rapidly, small conical peaks of bare

FIG. 6. Tree prickly pear (*Opuntia*), near Tallaboa, Porto Rico.

limestone beginning to appear ; the conditions gradually becoming more arid until the south coast, with its characteristic dry-climate flora, is reached. The almost omnipresent royal palm (*Roystonea*) becomes mixed with the palmetto (*Sabal*), and these conspicuous objects at length give way to groups of cactuses, low thorny shrubs, and to the West Indian birch (*Bursera*). Tall tree-like prickly pears (*Opuntia*) are the most conspicuous cactuses, often forming groves. The few short rivers across this dry country seem to be utilized to their full capacity for the irrigation of the cane fields which occupy the more level portion of the valleys and the coastal plain.

The two detachments of our expedition joined forces at Arecibo on the north side of the island, March 13, the Culebra party coming from San Juan by rail, the Mayaguez party coming across the island from Ponce by carriage, and making considerable collections along the way. We all proceeded the next day to our third objective point, Utuado, a point situated among the mountains of west-central Porto Rico, and this point was made a base of operations for a week. The drive from Arecibo to Utuado is

FIG. 7. Group of royal palms (*Roystonea*), with cane field in foreground, near Utuado, Porto Rico.

one of the most beautiful and interesting in the West Indies, a capitally constructed stone roadway running up the valley of the river, usually at considerable altitude above it, and winding among the hills, bringing an ever-changing and characteristic landscape into view; the northern coastal plain of the island, here given over to sugar cane, is succeeded by the thick limestone, nearly horizontally bedded and eroded into craggy hills, the central mass of eruptive rocks of the island being reached a few miles north of Utuado, and here the character of the flora, as well as of the

Fig. 8. Primaeval forest, summit of Mount Mandios, near Jayuya, Porto Rico.

landscape, changes abruptly. Collections were made in many ravines and on many hillsides in the vicinity of Utuado, where we were given much assistance and pleasant guidance by Don Jose Lorenzo Casalduc, a resident of that town, but the special features were the summits of two high mountains, Mt. Morales, about ten kilometers distant, which was twice ascended, and Mt.

Mandios, above the village of Jayuya, considerably more distant, our return to Utuado from that point being only affected at eleven o'clock at night, but the sure-footed little horses brought us all in safely through the wonderful tropical night, richly ladened with the plants of the wet primæval forest.

The primæval mountain forests of Porto Rico are now restricted to a few summits in this west-central part of the island and to the forest reserve of over one hundred square miles in the high Sierra de Luquillo in the eastern part, established by a proclamation of President Roosevelt in 1904; they are dense jungles composed of very many different kinds of trees and shrubs, the mountain palm (*Acrista monticola*) being the most prominent features in those visited by us; climbing ariods (*Philodendron*) reached to their summits; graceful tree ferns add enchantment to the vistas; small ferns, mosses and lichens in great variety carpet the ground

FIG. 9. Mountain palm (*Acrista monticola*), Mount Morales, near Utuado, Porto Rico.

nd clothe the rocks and tree trunks, and in the more open places .umerous species of herbaceous plants occur, the whole forming mass of vegetation of wondrous beauty and interest, many of he plants growing here occurring nowhere else in the world. [he trumpet-tree (*Cecropia peltata*), with its large and deeply

FIG. 10. Trumpet tree (*Cecropia peltata*), Mount Morales, Porto Rico.

divided leaves, white underneath, is one of the most conspicuous :rees in the ravines. One is brought to regret that this fasci-ıating floral wealth is nowhere readily accessible to visitors, for few care to reach it, either by walking or on horseback, but we may hope that at least the lower levels of the Luquillo reserve may some day be penetrated by a carriage road, so that all may have the opportunity of seeing this extremely instructive and elegant tropical forest.

On leaving Utuado, our next stop was at Ponce, reached by carriages over the continuation of the Arecibo-Utuado road, completed since the annexation of the island, and a great boon to the colony ; the constant extension of the fine carriage roads is doing much for the people and the completion of the well-designed and elaborate plan of the Insular Government will provide many miles of additional driveway within the next few years. From Ponce, a trip was made westward, it being desired to study the extremely dry limestone hills west of that city toward Tallaboa, which are characterized by the interesting little fan-palm, *Thrinax Ponceana ;* specimens of this was secured, as well as of several species of cacti, which abound in this arid region, and also of numerous kinds of shrubs ; the flora of this district has many elements in common with that of some of the Bahama Islands. Dr. Howe made a considerable collection of interesting seaweeds at Tallaboa, and we all wished that more time was available for the exploration of this part of the island.

Parts of two days were next spent in the vicinity of Coamo Springs, noteworthy for its hot baths ; here we were also within the dry area of the island, the high mountains to the north and east condensing the moisture of the tradewinds so that little rain falls on the southern side of the island. Our most noteworthy botanical observation in this vicinity was the discovery in full bloom of a hitherto unknown tree of the Polygala family, with enormous masses of small purple flowers, and at the time almost devoid of leaves ; standing on a steep rocky bank, with a green background, it was one of the most elegant floral features ever seen by us, and its rarity is indicated by the fact that only one individual was found ; the foliage of this tree was obtained by Herr Sintenis, a German collector, near Utuado in 1887, but its flowers had not been previously seen by botanists and consequently the plant has never been described or named. The beauiful cycad (*Zamia*) is abundant here, its short trunks yielding tarch, as do its relatives of Florida and the Bahamas.

Our time now running close to its limit, and the collections ıaving become bulky, a rapid return was made by carriages to

FIG. 11. Tree ferns between Cayey and Caguas, Porto Rico.

San Juan, and in crossing the mountains through the Aibonito Pass, the first rainy day of the trip was experienced, the climate during all of March having approached perfection. At the higher altitudes the hillsides are clothed with ferns, both small and large, in great variety.

The last day was given to a trip to Vega Baja, west of San Juan, especially for the study of the remarkable llume palm (*Aeria attenuata*), which grows abundantly on the limestone hills in that region, a very slender species, reaching at least forty feet in height, with a trunk little if any more than eight inches thick, crowned

FIG. 12. Fern-covered bank (*Dicranopteris*), near Cayey, Porto Rico.

with a seemingly insignificant tuft of only five or six short pinnate leaves ; its yellow oblong fruits are borne in drooping clusters just under the leaves ; the tufts of foliage are elevated well above the surrounding hardwood tree, giving the rocky ridges a very peculiar sky line; abundant material of this palm was secured both in the living state and for museum purposes, as well as specimens of a gigantic bromeliad which grew on the rocks about it, and many specimens of other interesting species.

The specimens secured by the expedition, including living plants, seeds, and museum and herbarium specimens, aggregate 1,456 collection numbers of land plants, averaging three or four specimens to a number, and 231 collection numbers of algae, over 6,000 specimens in all; the duplicates will mostly be distributed to the U. S. National Museum, and to the Buffalo Botanic Garden. Our thanks are gratefully tendered to Hon. Beekman Winthrop, Governor of Porto Rico, and to Admiral Dunlap, U. S. N., Commandant of the Naval Station at San Juan, for favors received, and for their kindly interest in our work.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

NOTES, NEWS AND COMMENTS.

Dr. P. A. Rydberg, of the Garden staff, has been devoting three weeks to studies in the United States National Herbarium at Washington.

Mr. William R. Maxon, of the United States National Herbarium, sailed from New York on March 31, to spend two months in making botanical collections in Costa Rica in behalf of the Garden.

Dr. Duncan S. Johnson, associate professor of botany in Johns Hopkins University, sailed for Jamacia on April 5 with the intention of devoting two months to studies at the tropical laboratory of the Garden at Cinchona.

Dr. William Trelease, director of the Missouri Botanical Garden, spent two days with us during the latter part of April, examining our collections of certain groups of plants in which he is especially interested and arranging for the exchange of living specimens.

Dr. D. T. MacDougal, director of the department of botanical research of the Carnegie Institution of Washington, who has been spending the winter at the Desert Botanical Laboratory at Tucson, Arizona, came east early in April to attend the Franklin bicentenary in Philadelphia. During June, July, and August he will be occupied with his mutant-cultures at the Garden.

Professor Hugo de Vries, of Amsterdam, arrived in New York on April 10. He gave an address in Philadelphia, April 18, on "Elementary Species in Agriculture" in connection with the celebration of the two hundredth anniversary of the birth of Benjamin Franklin, and on April 21 lectured at the Garden on "The Correlation of Characters in Plants." He will visit various institutions where experiments in plant mutation are being carried on and in June and July will deliver a course of botanical lectures at the summer session of the University of California.

The Torrey Botanical Club has announced a special meeting for Wednesday, May 23, at 3:30 P. M. in the lecture hall of the museum building. This meeting is in commemoration of the tenth anniversary of the commencement of work in the development of the Garden. Dr. Henry H. Rusby will deliver an address on "The History of Botany in New York City," which will be followed by a reception in the museum halls, library and laboratories.

The golden bells, or forsythias, have been unusually fine this spring, the large group near the fountain and that at the entrance to the elevated railroad being especially conspicuous in their rich yellow color. The two species, *Forsythia Fortunei* and *F. viridissima*, represent the two extremes of the flowering period of this desirable shrub, *F. viridissima* being the later bloomer. A hybrid between the two, named *F. intermedia*, has an intermediate flowering period.

In the conservatories, perhaps the most interesting plant at present is Queen Victoria's agave, *Agave Victoriæ-Reginæ*, from Mexico. Several specimens of this species will be found in the central part of house no. 6, but the plant of special interest just now is the one that is sending up its large flowering stem — a stem out of all proportion to the rest of the plant; this is the first time the species has bloomed with us. Of especial interest among the orchids in house no. 15 is the broad-leaved platyclinis, *Platyclinis latifolia*, from the Philippine Islands. In general appearance it is very unlike the nearby showy dendrobiums, with their large masses of richly colored flowers. In house no. 13 is a large plant of *Bougainvillæa glabra Sanderiana* in full bloom, covering one of the columns from the ground to the roof. The large, colored bracts subtending the real flowers are borne in great profusion, and, though crude in shade, add a wealth of color to that part of the house. In the aquatic house, no. 9, is an odd plant known popularly as the water lettuce, and to botanists as *Pistia stratiotes*. It will be found in small receptacles hanging from the edge of the bridge. The flowers are very small, and are borne after the manner of those of our common jack-in-the-pulpit, it being a member of the same family. It forms large masses on the surface of the waters in tropical countries.

The total precipitation for April was 6.50 + inches. Maximum temperatures were recorded of 71.5° on the 4th; 77° on the 21st; and 75.5° on the 27th: also minimum temperatures of 19° on the first; 36.5° on the 17th; and 35.5° on the 24th.

ACCESSIONS.

PLANTS AND SEEDS.

2 plants for the conservatories. (Given by Mr. Lighte.)

30 plants for the borders. (Purchased.)

8 plants from Oregon. (Given by Dr. H. H. Rusby.)

4 plants for the herbaceous grounds. (Collected by Dr. C. C. Curtis and Mr. W. W. Eggleston.)

10 plants for the conservatories from Arizona. (Given by Dr. D. T. MacDougal.)

93 plants from Porto Rico. (Collected by Dr. N. L. Britton and Mr. J. F. Cowell.)

24 plants from Porto Rico. (Collected by Mr. J. F. Cowell.)

3 plants. (By exchange with Bureau of Plant Industry.)

22 plants for borders. (By exchange with the New York Zoölogical Society.)

2 plants from Italy for the conservatories. (Given by Mrs. H. L. Britton.)

213 plants derived from seeds from various sources.

14 packets of seeds from Porto Rioc (Collected by Dr. N. L. Britton and Mr. J. F. Cowell.)

2 packets of seeds from the Philippine Islands. (Given by Mr. E. P. Copeland.)

22 packets of seeds from California. (Given by Mr. S. B. Parish.)

5 packets of seeds. (By exchange with the Bureau of Plant Industry.)

MUSEUMS AND HERBARIUM, MARCH AND APRIL, 1906.

100 specimens "Fungi Columbiani," Century XXII., nos. 2101–2200. (Distributed by Mr. E. Bartholomew.)

3 herbarium specimens from Oregon and South Dakota. (Given by Prof. J. F. Kemp.)

11 herbarium specimens from Long Island. (Given by Mr. E. P. Bicknell.)

21 herbarium specimens from British Columbia. (Given by Dr. C. H. Shaw.)

2 specimens of ferns from Syracuse, New York. (Given by Mr. R. C. Benedict.)

22 specimens of mosses from Guatemala. (By exchange with the U. S. National Museum.

50 museum specimens from Great Falls, Montana. (Given by Mr. R. S. Williams.)

209 ferns from Costa Rica. (By exchange with Dr. H. Christ.)

50 specimens "Musci Frond. Archipelagi Indici," Series VIII., nos. 351–400. (Distributed by Prof. Max Fleischer.)

8 herbarium specimens of mosses from Costa Rica. (Given by M. J. Cardot.)

1 herbarium specimen of *Dicranum Muhlenbeckii* from Vernon Centre, Connecticut. (Given by Miss Annie Lorenz.)

1 museum specimen of *Smilax glauca* from Staten Island. (Given by Dr. Arthur Hollick.)

8 specimens of coniferous fragments from the Cretaceous clays of Kreischerville, N. Y. (Given by Dr. E. C. Jeffrey.)

248 herbarium specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

5 herbarium specimens from Colorado. (By exchange with Mr. Geo. E. Osterhout.)

85 herbarium specimens from Utah. (By exchange with Prof. A. O. Garrett.)

22 herbarium specimens of Characeæ from the Kützing herbarium. (Given by Mme. A. Weber-van Bosse.)

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Bulletin of the New York Botanical Garden, containing the annual reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations carried out in the Garden. Free to all members of the Garden; to others, $3.00 per volume. Vol. I, Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Vol. II, Nos. 6–8, 518 pp., 30 plates, 1901–1903. Vol. III, No. 9, 174 pp., 15 plates, 1903; No. 10, 114 pp., 1903; No. 11, 174 pp., 15 plates with index and table of contents of volume. Vol. IV, No. 12, 113 pp.

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII JUNE, 1906 No. 78

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

JOURNAL

OF

The New York Botanical Garden

Vol. VII. June, 1906. No. 8.

A SERIOUS CHESTNUT DISEASE.

A serious disease of our native chestnut, which threatens the extinction of this valuable tree in and about New York City, was brought to my attention last summer by Mr. H. W. Merkel, of the New York Zoölogical Park, and has been under investigation here since that time.

The immense number of dead and dying chestnut trees in the Zoölogical Park first caused Mr. Merkel to suspect the presence of a destructive fungus. The ravages of this fungus among the young chestnut trees of the nursery were later observed by him and the trees sprayed with Bordeaux mixture, a treatment afterwards administered to the larger trees in the Zoölogical Park. The same disease has been found to exist among the chestnuts of New Jersey, Maryland and Virginia, and it is probable that the death of the chestnut in the lowlands of Alabama and Georgia, as noted by Mohr and Small, is largely due to this agency.

Inquiries from various sources regarding the disease and the hope that suggestions made now may be of service during the present season have led me to publish at this time a preliminary account of the disease, reserving a more technical and detailed description for a later paper.

Pure cultures from affected chestnut sprouts in the Botanical Garden were made last autumn, and transferred to agar, bean stems, and sterilized chestnut twigs; on all of which the fungus grew rapidly and fruited abundantly. Living chestnut twigs

FIG. 13. Three generations of the fungus, on sterilized bean stems.

FIG. 14. Cultures of the fungus on sterilized chestnut branches, some with the cortex wholly or partially removed.

placed under belljars with one end of the twig in water were then infected and the growth of the fungus watched, as preliminary to field infections. These latter were made on a number of young chestnut trees in the propagating houses of the Garden as soon as growth commenced in the spring, experiments with dormant trees being carefully avoided. As the preliminary experiments had led me to expect, the actively growing fungus, when transferred from bean stems to the branches of the young trees, attacked them with vigor and soon caused their death by girdling.

The progress of the disease in infections through natural causes was observed in young trees transferred from the nursery of the Zoölogical Park and numerous older infected trees throughout Bronx Park. In all of these the fungus was found exceedingly active at the beginning of the season of growth, before the opening buds were able to use the large quantity of nourishment at hand.

The fungus works beneath the cortex in the layers of inner bark and cambium. Its presence is first indicated by the death of the cortex and the change of its color to a pale brown, resembling that of a dead leaf. Later the fruiting pustules push up through the lenticels and give the bark a rough, warty appearance; and from these numerous yellowish-brown pustules millions of minute summer spores emerge from day to day in elongated reddish-brown masses, to be disseminated by the wind and other agencies, such as insects, birds, squirrels, etc. In late autumn the winter spores are formed, which are disseminated from the dead branches the following spring.

When grown in artificial cultures, the mycelium of the fungus is at first pure white, changing to yellow with age, and the fruiting pustules are a beautiful yellow. Winter spores sown November 27 on agar and transferred to bean stems showed young pustules on December 8 and mature spores in process of discharge by December 17. Cultures transferred to sterilized chestnut twigs developed with equal rapidity, while those remaining on agar were considerably slower. Mycelium inserted beneath the bark of living chestnut twigs on December 13 developed a prominent spore-mass by December 27. Inoculations

ᶠIG. 15. Cultures of the fungus in sterilized and living chestnut branches. The central shows a large mass of yellow mycelium grown on the moist, cut surface of a living branch. igure to the right shows fruiting pustules arising from mycelium introduced beneath the of a living branch. On the left is an enlarged view of numerous pustules grown on steri- chestnut.

of growing mycelium into living trees in the propagating houses caused the death of infected branches and produced abundant fruit in from four to six weeks. One or two of these young trees appeared to be able to resist infection altogether, and a few of the older trees in the Garden are apparently immune, at least when in vigorous health.

In its effect on the host, this fungus may be classed with the most destructive parasites; the parts attacked being so vital and

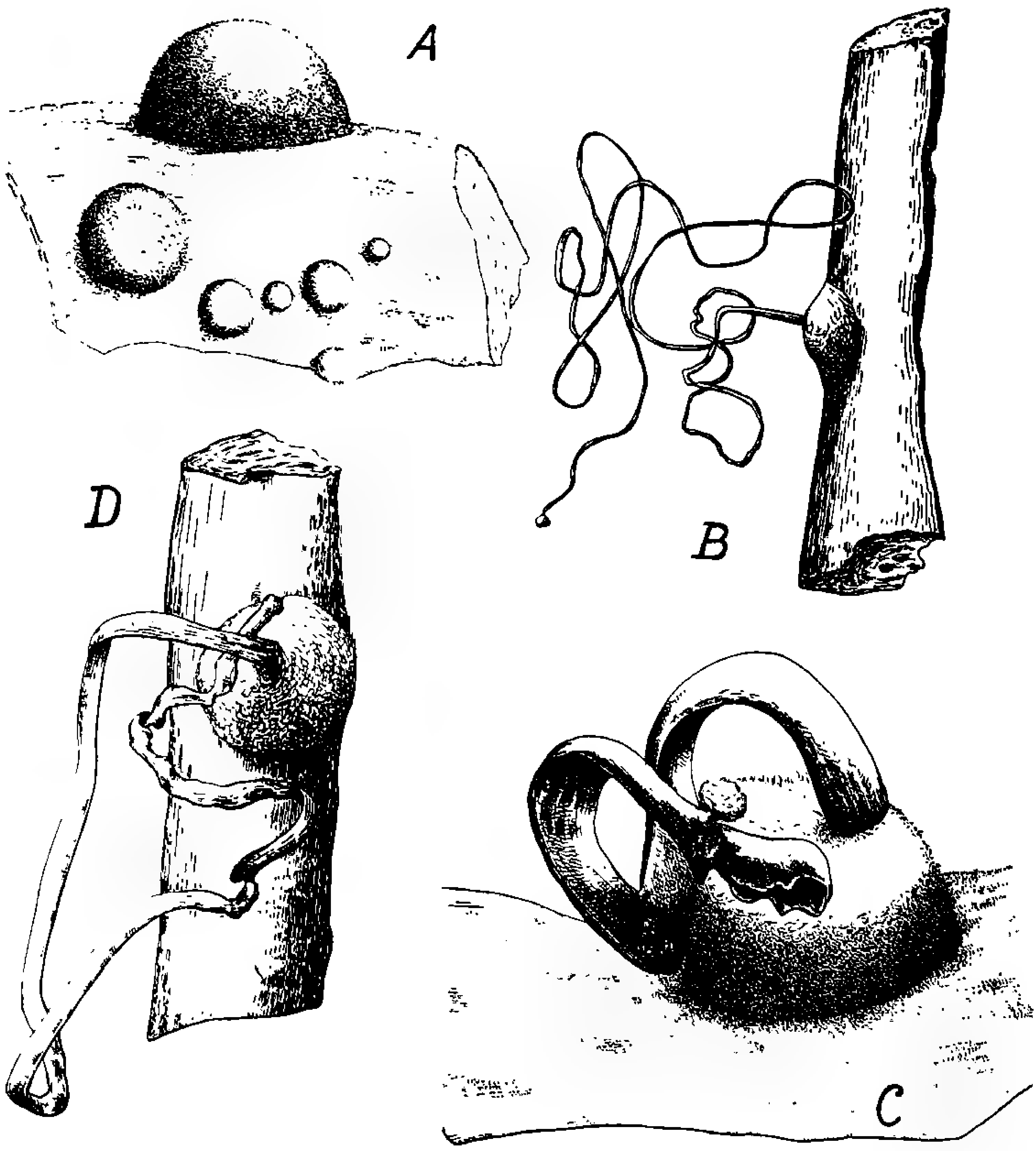

FIG. 16. Fruiting pustules and spore masses from chestnut cultures, × 16. *A*. Stages in the development of the pustules. *B*, *C*, *D*. Various forms of spore discharge in a moist atmosphere.

ɪ7. Young chestnut trees at the propagating houses inoculated with the fungus in various ays. A dead branch which has been killed by girdling is shown on the extreme left.

the attack so vigorous that young trees often succumb in one or two years, and older ones soon lose branches of such size that the vigor of the entire tree is materially impaired and its beauty and usefulness practically destroyed. It is not the primary effect of the fungus on the living tissues of the tree, widespread as this effect often is, that causes the greatest damage; but the secondary effect of this injury on the remaining portions of the trunk or branch affected; for it is the habit of the entering mycelium to proceed in a circle about the affected portion until it is completely girdled. This girdling habit is due to the stoppage of the circulation up and down the stem at the infected point and the growth of the mycelium toward the current of water and food supply, which is more and more deflected by the invading fungus until finally cut off altogether.

This is well shown in Fig. 19, which represents a portion of a young tree being girdled by the fungus, viewed from three different directions. The fungus entered in 1905 through an undressed pruning wound, and grew nearly half-way around the trunk during last season. The first week in May, 1906, when the weather was warm and moist and the inner bark full of food, the mycelium began to grow again, and by May 11 it had covered that part of the trunk indicated by the light area in the figure. On May 15 the two growing borders had united and the girdling was apparently complete; though death did not ensue for several days, on account of tissues lying next to the sapwood that still remained uninjured. At this time the leaves of the opening buds were scarcely an inch in length; too young to have made use of much of the nutriment stored in the stem.

When the tips of branches are affected, the progress of the disease is of necessity slow, since the affected area is small and the food supply scanty. On the other hand, the base of the young tree is a point of special danger, since the abundance of moisture and food it supplies facilitates the speedy growth of the fungus and thus endangers the life of the entire tree.

The way in which the fungus in question first enters a chestnut tree is at present largely a matter of conjecture. Twigs, sprouts, nursery trees, branches of various sizes, and trunks a foot or nore in diameter have been found infected, apparently irrespec-ive of their size or position. So far as field observations show, :he fungus might enter wherever a spore happened to find a rest-ng place. All of my experiments, however, have failed to intro-luce the fungus into a branch while the thin brown layer of :ortex remained intact ; though it readily entered when this was scraped off or punctured. As the fungus does not attack the eaves, I was not surprised when repeated attempts failed to ntroduce the disease into green twigs, where, although no cortex s present, the quality of the food and the character of the bark

.8. A nearer view is here given of the dead branch mentioned under Fig. 17. The fungus was roduced by scraping off the cortex and applying active mycelium grown on bean stems.

s evidently not suited to its development. The present suppo-sition is, therefore, that infection takes place only through wounds ; or, possibly, through the lenticels.

Wounds are, unfortunately, only too frequent, especially in the :ase of a tender, rapidly-growing tree like the chestnut, which has the additional misfortune of attracting lumbermen and nut-gatherers. If it escapes winter injuries to its trunk, the spring storms are sure to break the smaller branches and abrade the surfaces of the larger limbs; if it is not disfigured by the green fly and twig-borer during summer, it is sure to be mutilated by

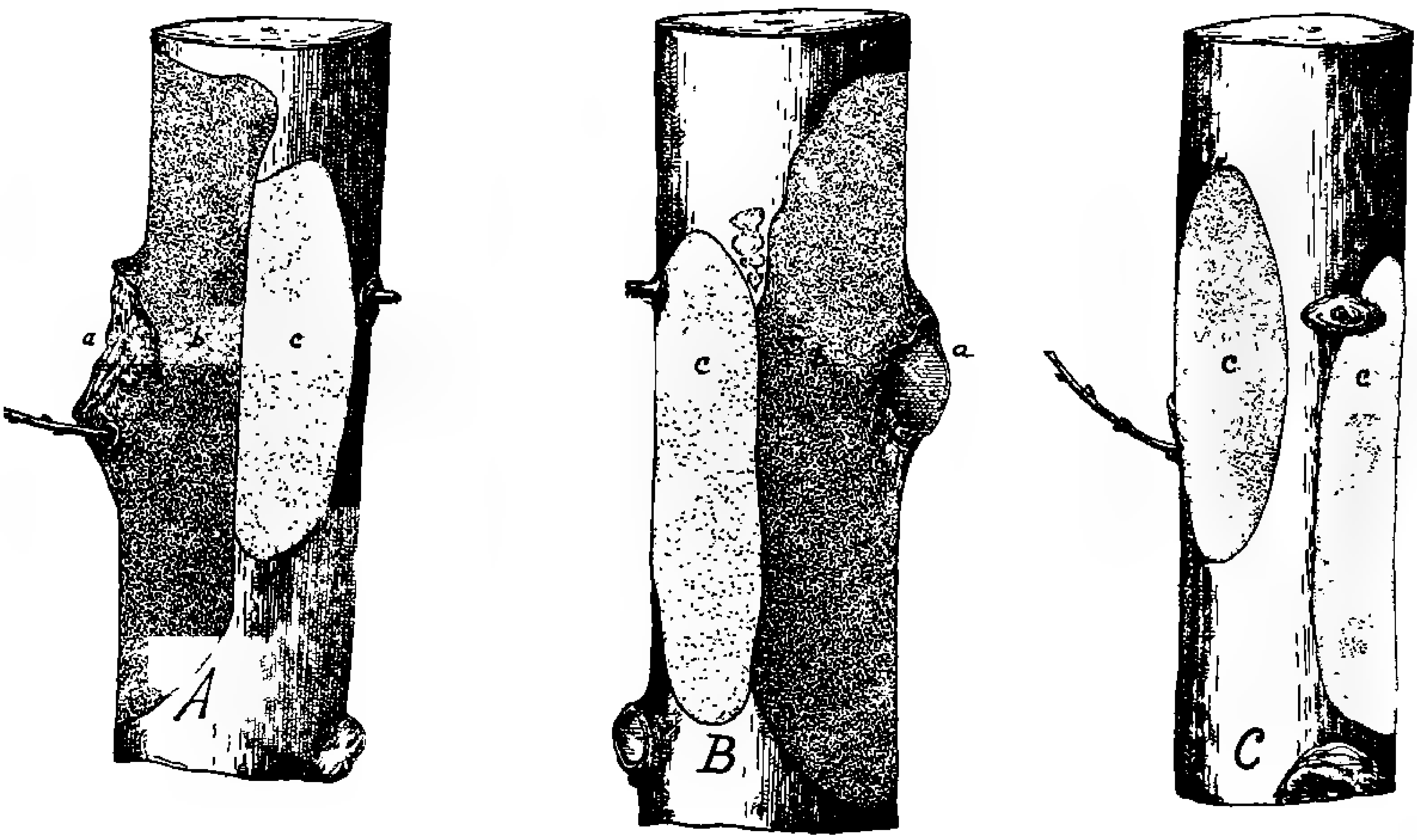

FIG. 19. The trunk of an infected nursery tree, shown natural size. *A*, *B* and *C* are views from different directions. The point of infection in each view is shown at *a*, the area killed by the fungus last year at *b*, and the development early in May of this year at *c*. Three days after this figure was drawn the girdling was complete.

savage hordes of small boys in autumn. Even the ubiquitous squirrel may spread the disease with tooth and claw while cutting off ripe burs and racing up and down the trunks; while every bird and insect that rests upon an infected spot is liable to carry the spores upon its feet or body to other trees. Mice, voles and rabbits often make wounds about the base of a tree and carry the spores in their fur. All during the growing season spores are being developed in countless numbers, and these are liable to fall into even the slightest abrasions of the bark and germinate.

The treatment of a disease of this nature must, of course, be almost entirely preventive. When once allowed to enter, it cannot be reached by poisons applied externally, nor can the spores, which issue continuously and abundantly through erupions in the bark, be rendered innocuous by any coating applied ıt intervals. On the other hand, no poisonous wash, even hough covering every part of the tree, can prevent the germiıation of the disseminated spores when they fall into a wound, ;ince the wound opens up fresh tissues unprotected by the ɔoison.

The spraying of young trees with copper sulfate solution, or ;trong Bordeaux mixture, in the spring before the buds open night be of advantage in killing the spores that have found lodgnent among the branches during the winter, but the real efficacy ɔf this treatment is so doubtful that it could not be recommended 'or large trees, where the practical difficulties and expense of ıpplying it are much increased. Nursery trees should be pruned ɔf all affected branches as soon as they are discovered, and the wounds carefully dressed with tar or paint or other suitable sub;tance. Vigilance and care should largely control the disease ımong young trees. With older trees all dead and infected wood should be cut out and burned and all wounds covered without delay. Particular attention should be paid to water, soil ınd other conditions of culture affecting the vitality of the tree; ;ince anything that impairs its health renders it less able to resist 'ungus attack.

It is possible that the conspicuous ravages of the disease about New York City are largely due to the severe and prolonged winter of 1903–'04, during which many trees of various kinds were killed or injured. The chestnut is peculiar, moreover, in ts power to sprout from the stump almost indefinitely, and most ɔf the trees now existing in this region are descendants of trees :ut for lumber many decades ago. This repeated coppicing canıot fail at length to impair the vigor of each new generation of ;prouts and render them peculiarly liable to speedy infection and ʼigorous attack.

W. A. MURRILL.

THE FIRST DECADE OF THE GARDEN.

On the afternoon of May 23, 1906, the Torrey Botanical Club held a special meeting at the museum building in honor of the tenth anniversary of the commencement of work in the development of the New York Botanical Garden, planting having been commenced in the spring of 1896. The program consisted of an illustrated lecture by the President of the Club, Dr. Henry H. Rusby, who is also a member of the Board of Managers of the Garden, on "The History of Botany in New York City."

The lecturer presented a historical sketch of the development of botany in the city of New York, giving special attention to the history of local botanical gardens, of the botanical department of Columbia University, and of the Torrey Botanical Club. The earliest local work related to the botanical gardens of Colden, Michaux, and Hosack, and to the publication of local catalogues and floras. The second period was that of text-books, manuals, and other educational works. Out of the associations resulting from local work, the Torrey Botanical Club developed so gradually that it was impossible to fix the date of its actual beginning. Portraits of its early members were exhibited, and brief biographical sketches presented. Out of the activity of the Club, and of the botanical department of Columbia University, grew the demand for a great botanical garden, which was satisfied by the establishment of the present New York Botanical Garden. The contemporary botanical forces at work in the city were briefly described, and their most important present needs outlined. The complete address will be published in *Torreya* for June, 1906.

After the lecture an informal reception was held in the library, followed by an inspection of the laboratories, library, herbaria, and the museum and greenhouse exhibits.

C. STUART GAGER.

A LARGE OAK STRUCK BY LIGHTNING.

During the first thunderstorm of the season, which occurred on April 21, the largest pin oak (*Quercus palustris*) within the Garden was struck and cannot recover from the damage which it suffered. The tree stands a few hundred feet southeast of the eastern end of the long stone bridge across the valley of the Bronx River, in the portion of the grounds set aside for the arboretum, and just south of the main driveway now approaching completion. In developing the general plan of the grounds this driveway was located in position and grade especially with reference to the preservation of this tree, and it is a great disappointment that we must lose it. The trunk is forked about 15 feet above the base, and the lightning shock has split this fork

FIG. 20. *Quercus palustris* struck by lightning.

deeply and loosened the bark from the ground to a height of about 25 feet; the energy of the discharge hurled large pieces of bark to a distance of 40 feet from the tree, and plowed up the ground on all sides of it along the larger roots. The general effect of the lightning stroke is shown in the photograph herewith reproduced.

During the development of the garden, a number of trees have been killed by lightning, which does not seem to be particular as to what kind it selects, as it has already included a tulip tree, a chestnut, a hemlock, an American elm, and now a pin oak, and none of those which have been struck have recovered from the destruction, which is not at all confined to bark and outer layers, but apparently affects the entire trunk.

N. L. BRITTON.

THE GARDEN AND THE PUBLIC SCHOOLS.

In the spring of 1905 the experiment was tried of utilizing the advantages of the garden in correlation with the nature study work of the public schools in New York City. A course of two lectures and demonstrations on the nature study of grade 4B, and a course of three lectures and demonstrations on the nature study of grade 5B were given by the Director-in-Chief and other members of the garden staff, as described in the garden JOURNAL for June, 1905.

The course was repeated in the fall of 1905, and the plan proved so successful that it was decided to continue the work this spring. The lectures were given in the lecture hall of the museum building under the auspices of the Board of Education. The lectures to grade 5B were given by Dr. W. A. Murrill, on "Woody Plants and Plants Without Wood — The Protection of Trees in Cities"; Dr. Henry H. Rusby, on "Industries Depending on Forests. Plant Products"; and by Dr. N. L. Britton, on "Classification of Plants."

The lectures to grade 4B were by Mr. George V. Nash, on "The Cultivation of Plants"; and by Dr. Marshall A. Howe, on "Seedless Plants."

The classes assembled from the various schools of the Bronx Borough in charge of their teachers, and the audiences numbered from 450 to 850. After the lectures the pupils were divided into convenient groups, each under the charge of a guide and demonstrator, and the topics treated of in the lectures were further illustrated and enforced by study of the museum collections, and of the living plants in the greenhouses, and out of doors, in the forest and plantations.

These lectures and demonstrations have served to give to pupils in a crowded city a close contact with nature, and a breadth of view and inspiration such as could never be obtained under the more restricted conditions of the class room alone.

C. STUART GAGER.

FIRST GRANT FROM THE STUDENTS' RESEARCH FUND.

Under an appropriation made by the Board of Managers at the annual meeting held last January, a grant of $150 has been made to Mr. Charles Budd Robinson from the accumulated income of the Students' Research Fund for the purpose of enabling him to complete his monograph of the North American species of the genus *Chara*, or brittleworts.

These interesting plants, which have been little studied in America, inhabit fresh water and brackish ponds and slow flowing streams, being entirely submerged, and thus quite unknown to most people. Many of them are very beautiful, however, and make interesting subjects for aquaria, though the offensive odor of some prevents this usage. Many of them absorb a great deal of lime from the waters in which they grow, and inasmuch as some ponds are very densely occupied by the plants, considerable thicknesses of carbonate of lime become deposited. Mr. Robinson's studies show that a much larger number of species inhabit North America than has previously been supposed, and several of those studied by him are new to science. The collection which has formed the basis of his work was accumulated by the late Dr. Timothy Field Allen, and presented by him to the garden in 1901 (see JOURNAL **2**: 52–54). Considerable additions have been made to this collection during the studies of Mr. Robinson and it is one of the most complete in the world.

Mr. Robinson has been a student at the garden for parts of three years, and during portions of his time with us has held one of the scholarships provided by the Board of Managers. He is a graduate of Dalhousie College, Nova Scotia, and continued his studies at Cambridge University, England. During his residence in New York he has been a registered candidate for the degree of Doctor of Philosophy at Columbia University, and this degree was awarded him at the commencement ceremonies on June 13, this monograph of *Chara* being accepted as his dissertation. It is published in the BULLETIN of the Garden, **4**: 244. 1906.

N. L. BRITTON.

NOTES, NEWS AND COMMENT.

Construction work is proceeding this spring at a number of points north and east of the museum building. The Mosholu Parkway approach is now nearly completed, the driveway and paths at that point only requiring surfacing with broken stone and screenings already ordered, and the use of a steam roller for a few days ; the main east and west park driveway leading from this approach around the valley of the lakes and across the long bridge over the valley of the Bronx is in the same advanced stage of completion, also needing only its final surfacing. The gap in the border screen along the railroad at the end of the valley of the lakes has been closed by regulating and grading, and the planting of a heavy belt of conifers and deciduous trees and shrubs, and considerable planting has been done at both sides of the Mosholu Parkway approach. At the approach to the Woodlawn Road entrance, the filling for the driveway is still in progress, and nearly completed, and stone for the telford foundation is being assembled there, though it will be best to give this fill considerable more time for settling before paving this road ; the path connection of this entrance to the south has been completed and much planting of shrubs effected along it, and also throughout the fruticetum. At the lake bridge, just east of the museum building, much additional filling and grading has been done, and the paths leading to this bridge both from north and south are under construction ; this work has necessitated the letting off of the water in both lakes for a time. The filling for the path approaches to the long bridge has been completed and these paths can be laid up within a few months.

Work is also going forward on the telford foundations of the driveway along the east side of the Bronx River to complete the road connection between the east end of the long bridge and the Newell Avenue entrance at the north end of the garden. In addition to these larger works, a great deal of topsoiling and planting has been done during the spring at a number of points.

All the earth and stone required in this grading and path and road building has been taken from the necessary excavations at the rear of the museum building.

The sixth annual meeting and exhibition of the Horticultural Society of New York was held at the garden on May 9, and the exhibition continued the next day. Dr. N. L. Britton delivered an illustrated lecture on "Horticulture in the West Indies." An important proposition came before the Council of the Society relative to organizing a conference on "Hardiness and Acclimatization," to be held in the autumn of 1907.*

Professor Howard J. Banker, of De Pauw University, is spending a portion of the summer vacation at the garden, working on the herbarium collection of the Hydnaceae, with special attention to the resupinate forms. Professor Banker was given the degree of Doctor of Philosophy by Columbia University at the commencement in June. His thesis, entitled, "A Contribution to the Revision of the North American Hydnaceae," is devoted to the pileate forms. The thesis is published as Memoir of the Torrey Botanical Club, vol. 12, no. 2. The Hydnaceae are an interesting family of fungi.

The total precipitation at the garden for May was 4.61 + inches. Maximum temperatures were recorded of 77° on the 5th, 89° on the 13th, 90° on the 18th, and 87° on the 24th. Also minimum temperatures of 40.5° on the 4th, 36.5° on the 10th, 42.5° on the 21st, 43° on the 22d, and 44.5° on the 30th.

* The sixth summer meeting and exhibition was held at the Garden on June 13 and 14. Mr. Geo. T. Powell lectured on "The Importance of Selection in Propagating Plants."

ACCESSIONS.

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MUSEUMS AND HERBARIUM, MAY, 1906.

162 specimens of marine algae from various localities. (By exchange with Mr. F. S. Collins.)

6 specimens of sedges from Florida. (By exchange with the Ames Botanical Laboratory.)

25 specimens from Bermuda. (By exchange with Mr. A. H. Moore.)

1 specimen of *Tillaea erecta* from Arizona. (Given by Prof. J. J. Thornber.)

269 specimens from Mexico. (By exchange with the U. S. National Museum.)

1 specimen of *Obolaria Virginica* from Arkansas. (Given by Mrs. M. L. Stevenson.)

3,167 specimens from the Philippine Islands. (By exchange with the Bureau of Government Laboratories.)

140 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

2 herbarium specimens of *Crataegus* from Ohio. (By exchange with Mr. E. Wilkinson.)

42 specimens of *Crataegus* from New York. (By exchange with Mr. W. W. Eggleston.)

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61 specimens of ferns from Guatemala. (By exchange with the U. S. National Museum.)

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26 specimens from Colorado. (By exchange with Mr. George E. Osterhout.)

7 specimens from British Columbia. (Given by Prof. Charles H. Shaw.)

2 specimens of *Quercus* from New York. (Given by Mr. Clayton Ryder.)

1 specimen of *Epipactis viridiflora* from Medina, New York. (Given by Mr. L H. Weld.)

14 specimens from the Southern States. (Given by Dr. R. M. Harper.)

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII JULY, 1906 No. 79

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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The New York Botanical Garden

Vol. VII. July, 1906. No. 9.

THE FLOWERING OF QUEEN VICTORIA'S AGAVE.

In the May number of the Journal a reference was made to the plant *Agave Victoriae-Reginae*, which at that time was sending up its flowering stalk. While the growth of this stalk was rapid, the maturing of the flowers has been a slow process, and it was not until June 19, about eight weeks after the stem was first seen emerging from the leaves, that the first flowers opened. The accompanying illustration, made from a photograph, will give some idea of its appearance, and indicate how the stem is out of all proportion to the body of the plant.

The numerous leaves, arranged in an almost globose body, are six to seven inches long and about two inches wide. They are a rich gray-green, thick and firm in structure and somewhat triangular in cross-section, and oblong in shape, the outer ones obtuse, only the inner ones acute; each is terminated by a stiff brown spine, which is usually curved or twisted and half an inch long or less, thus furnishing an armor which thoroughly protects the plant. The upper surface of the leaves is somewhat concave, the lower more or less angled, and both marked with a few white lines. The narrow margins, which are also white, often separate as thread-like appendages. The body of the plant is fifteen inches high. The flowering stem extends above this for ten feet, making a total height of eleven feet three inches, the upper four feet and a half of which was covered with flowers. The stem, which has a diameter of about one and three quarters

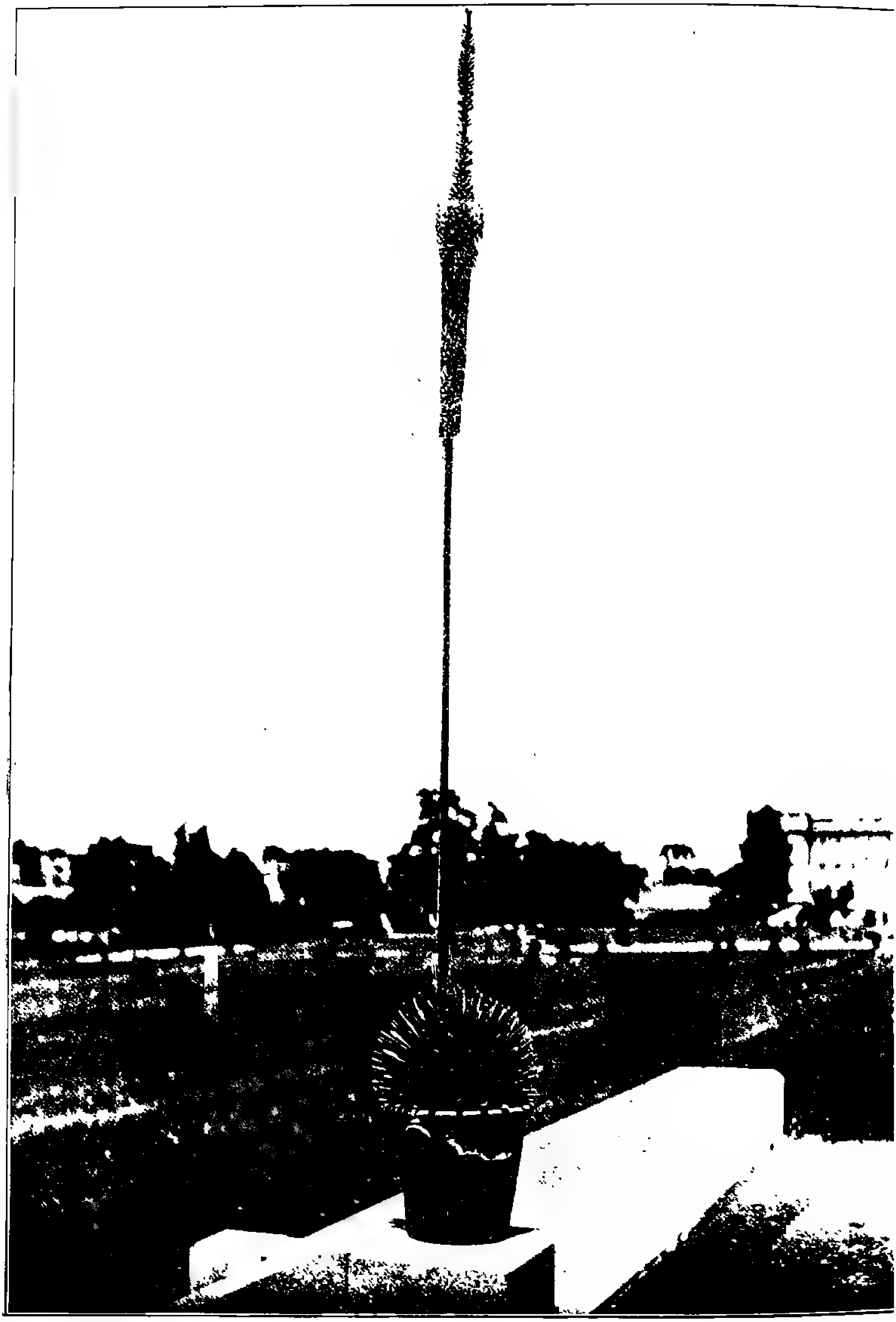

FIG. 21. *Agave Victoriae-Reginae* in bloom at the New York Botanical Garden.

inches at the base, has the lower portion covered with long slender scales, which decrease in length toward the flowers, all but the lowermost erect ones being reflexed.

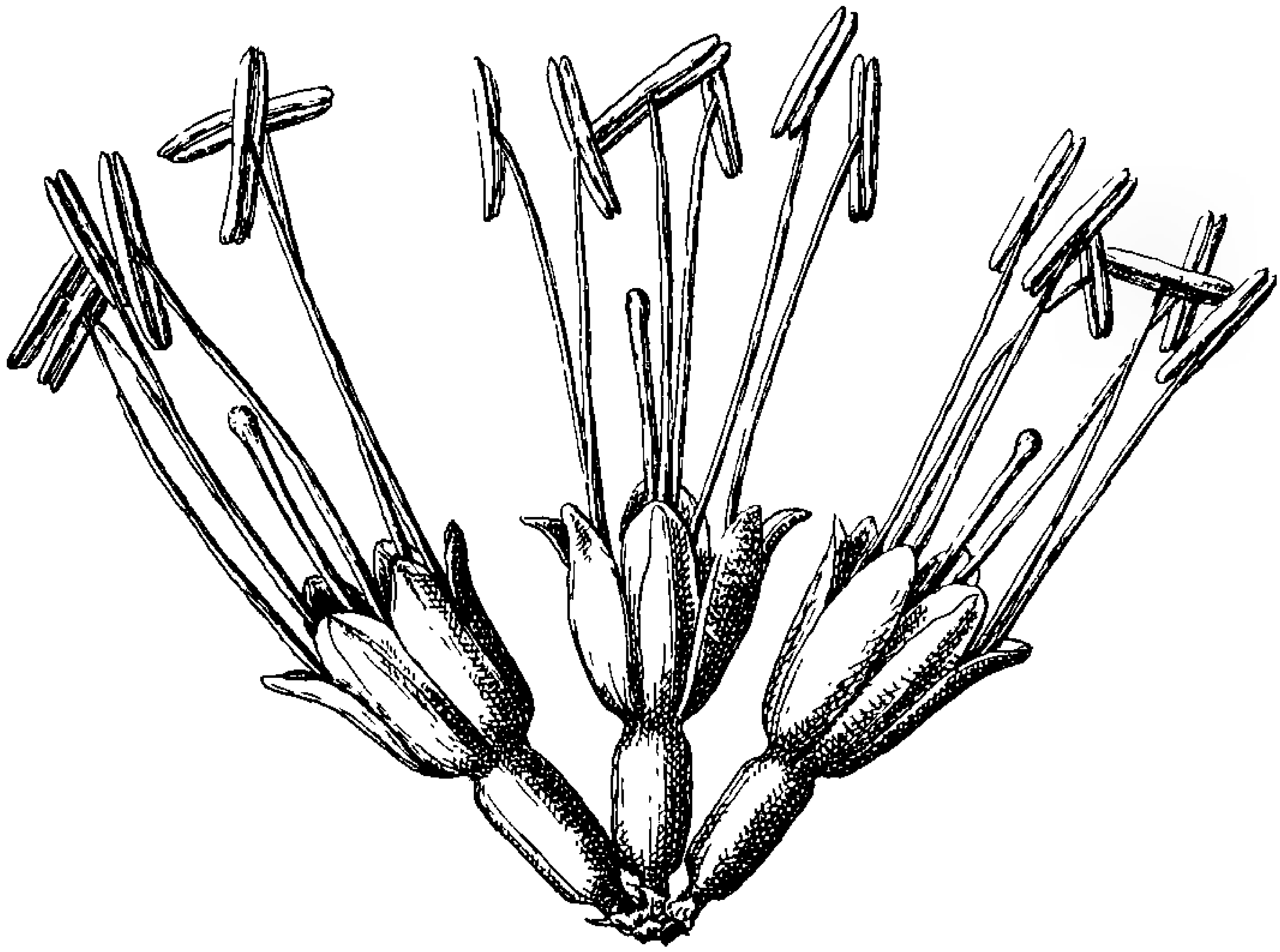

FIG. 22. Flowers of *Agave Victoriae-Reginae.*

The flowers are densely crowded on short stout pedicels in clusters of three (Fig. 22). The cylindric-oblong, pale green, ovary is about one half an inch long. The length of the perianth is about three quarters of an inch. Its segments are oblong, and about three sixteenths of an inch wide, rounded at the apex, minutely pubescent above on the outside, and furnished with a tuft of long hairs at the apex on the inside, pale green, margined with white, the green portion of the inner segments being sharply defined. The stamens are much exserted, the greenish filaments about one and three quarters inches long, the yellow anthers oblong-linear, five eighths of an inch long, rounded at both ends; the style pale green, one and a quarter to one and three quarters of an inch long.

This agave is apparently a shy bloomer, at least in cultivation under glass. The first, and perhaps the only other flowering of this plant under such conditions was at the Botanical Garden at Cambridge, Mass., and was made the subject of an article by Dr. George Engelmann in the Gardeners' Chronicle for December 30, 1882. This article was accompanied by an illustration of the plant in flower, made from a photograph sent to Dr. Engelmann by Dr. Asa Gray. This plant was secured by Dr. E. Palmer the veteran collector, in February, 1880, near Monterey, in Mexico, the locality from which this agave was originally secured some years earlier by M. Considerant. Dr. Engelmann states that the specimen had over two hundred leaves, and that it sent up a flowering stem over ten feet tall and with a basal diameter of about two inches, the upper six feet of which was densely covered with pale yellowish green flowers about one and a quarter inches long, borne in clusters of three.

The agave in question, perhaps one of the most popular and widely cultivated of this class of plants, had a rather interesting experience at the time of its christening, its zealous admirers in different countries conferring upon it two names. One of these names, and the one under which it is generally known, is *Agave Victoriae-Reginae*, given to it, with the express permission of Queen Victoria, by Mr. T. Moore, in the Gardeners' Chronicle for October 16, 1875. Mr. Moore describes the species, and among other things remarks that the entire stock of the plant was secured by Mr. J. T. Peacock, a lover of succulent plants, living near London. A few weeks previous to this, in the issue of that periodical for September 4, in an article upon an exhibition of plants at Cologne, mention was made of this as one of the novelties exhibited by M. L. de Smet, of Ghent, Belgium, and the further assertion was made that the plant was unnamed.

These remarks in the Gardeners' Chronicle inspired M. Carrière to set forth what he considered the facts in the case, in Revue Horticole, under dates of November 1 and 16, 1875. The substance of his remarks is comprised in the following paragraph :

"The plant was originally secured by M. V. Considerant, in 1872, in the cold regions in the vicinity of Monterey, on a mountain to the left of the road from that place to Saltillo. M

Considerant brought back but a single specimen, unique at that time, and this was exhibited at a general exposition of the Société centrale d'horticulture de France, in 1872, where it was awarded a silver medal of the first class. This plant unfortunately died from improper treatment during the winter succeeding its importation. In the fall of 1874 M. Considerant received twelve more of these plants, through a correspondent, seven of which were sold for 350 francs to M. de Smet, who in turn disposed of them to Mr. Peacock. At the time of purchase M. de Smet was informed, so M. Carrière remarks, that the species had been given the name of *Agave Consideranti*, and he knew that there were still five of the plants in the possession of M. Considerant. M. Carrière acknowledges, however, that up to the time of publication of the name *Agave Victoriae-Reginae* the name of *Agave Consideranti* had not been published, although it had been ready in manuscript for some time. He concludes, therefore, that M. de Smet either purposely suppressed the origin and name of this plant, or that Mr. Peacock rebaptized it."

The Gardeners' Chronicle, under dates of November 13 and 20, 1875, responds to the above, in part quoting remarks of Mr. Peacock in reference to the matter. The statement is made that the plant in question was exhibited by M. de Smet as a new and unnamed species, and that Mr. Peacock bought it without any reservations whatsoever, and at the time of purchase thought he was buying the entire known stock of the plant; that some time after the purchase M. de Smet did incidentally remark to him in a letter that he would like to have the name of the discoverer attached to the plant. The name assigned to the plant with the queen's permission was given in good faith, was duly and properly published, and there seemed to be no reason to recall the name, especially in view of the fact that the name proposed in the Revue Horticole was in no manner published at the time of the appearance of the name *Agave Victoriae-Reginae.*

George V. Nash.

STUDIES OF EXTINCT PLANTS OF THE ATLANTIC COAST.

Dr. Arthur Hollick was occupied during the early part of June in field work, investigating the Cretaceous fossil flora of New Jersey and Martha's Vineyard, in company with Professor Edward C. Jeffrey, of Harvard University. On June 4 and 5 the clay marls and clays in the vicinity of Cliffwood and Morgans, N. J., were visited, where they were joined by Mr. Edward W. Berry, of the Maryland and New Jersey Geological Surveys. Valuable palaeobotanical material, consisting of lignites and fossil leaf impressions, was collected, from horizons heretofore only superficially explored and not satisfactorily correlated geologically. It is hoped that the specimens collected may prove to be interesting from the biological standpoint and of value in determining the exact geological age of the horizons in which they were found.

After leaving New Jersey and until June 12, Dr. Hollick and Professor Jeffrey were located at Gay Head, Martha's Vineyard, investigating the deposits exposed there and making further collections of fossil plants. This locality is one of the most interesting and striking in eastern North America and has been studied and reported upon extensively by geologists, during the past sixty years or more, with varying opinions in regard to the geologic age of the deposits. These deposits consist of clays, sands, conglomerates and marls, representing almost every color of the rainbow, folded and tilted in a fantastic manner by the thrust of the continental ice sheet during the Glacial Epoch, and now exposed in the face of a bold escarpment, about one hundred feet in height.

It is of interest to note that until the fossil plants found in certain of the strata had been studied and identified as Cretaceous in age any definite or satisfactory data upon which to base conclusions were lacking. Mr. David White, Dr. Lester F. Ward and Dr. Hollick have all assisted in the work of identifying the fossil plants and the results of their labors on the material from this locality is regarded as one of the most significant demonstrations of the value of palaeobotany in determining the age of strata.

Dr. Hollick succeeded in collecting a large number of specimens which will make valuable additions to the museum, besides a large amount of lignitic material which it is hoped may yield interesting results when subjected to microscopic examination.

From June 13 to 16 Dr. Hollick was the guest of Professor Jeffrey at Harvard. During this visit some of the material jointly collected was subjected to preliminary examination and a trip was also made to Scituate, on the shore of Massachusetts Bay, where strata of undetermined age are exposed. Lignites collected at this locality may assist in solving the problem.

Dr. Hollick and Professor Jeffrey are preparing a joint contribution upon the botanical characters of the Cretaceous flora of the region, in connection with which the material recently collected will be of great assistance.

NOTES, NEWS AND COMMENT.

Professor W. J. Beal, of the Michigan Agricultural College, visited the Garden on June 27, inspecting the herbaceous and experimental gardens and selecting duplicate specimens for the garden under his direction, in exchange for desirable species to be sent here by him.

Dr. Forrest Shreve, professor in the Woman's College, Baltimore, spent a few days at the Garden in June and July consulting the library and herbarium. Dr. Shreve has recently returned from the Garden's tropical laboratory at Cinchona, Jaimaca, where he has made a study of the filmy ferns, of the transpiration of tropical plants and especially of the climatology and vegetation of the Blue Mountains.

Dr. H. H. Rusby, honorary curator of the economic collections, has recently received for the Garden a valuable collection of plant constituents, such as alkaloids, glucosides, amaroids, sugars, starches, plant acids, dye stuffs, fats, waxes and rare aromatic principles. The exhibit is the gift of E. Merck & Co., of Darmstadt and New York, and includes nearly 500 specimens of poisons, medicines and other substances. The more valuable specimens of the alkaloids are contained in "hour-glass" vials whereby minute quantities are exhibited to the best advantage. At retail prices, duty free, the exhibit is estimated to be worth several thousands of dollars.

The total precipitation for the month was 1.71 inches. Maximum temperatures were recorded of 84° on the 2d; 90° on the 10th; 88° on the 15th; 84° on the 22d, and 94° on the 30th; also minimum temperatures of 56° on the 8th; 49° on the 12th; 56.5° on the 21st, and 57° on the 25th.

A very interesting collection of the cactuses of the genus *Opuntia* (prickly pears) grown in the gardens of Sir John Hanbury at La Mortola, Italy, has recently been received by Dr. Britton in exchange for other plants sent to La Mortola. These gardens contain the most extensive collection of succulent plants brought together in the open air anywhere in the world, and the study of these collections by Mr. A. Berger, is adding much to our knowledge of many species; he has recently described a number of these prickly pears as species new to science, but in most cases the origin of the plants, thus made particularly interesting, has been lost, and we now have the opportunity of endeavoring to correlate them with wild species in cultivation here. It is suspected, however, that these plants cultivated in the Mediterranean region have changed from their natural characteristics, and that therefore such correlation may not be possible. A fine lot of the native species of the island of Jamaica has also recently been received from the Hon. William Fawcett, Director of Public Gardens and Plantations of that island, supplying several species not hitherto represented in our collections.

Many of the water lilies in the large pools in the court of the conservatories are now in full bloom. In the westerly pool are mainly tender sorts which it is necessary to protect in winter, or to grow fresh from seed each spring. Among these are young plants of the royal water lily of South America, represented by two species, the Amazon royal water lily, *Victoria amazonica*, and the Paraguay royal water lily, *Victoria Cruziana*. These have not flowered as yet. In this same pool, quite in contrast with these giants among the water lilies, is perhaps the smallest water lily known, *Castalia tetragona*, known sometimes as *C. pygmaea*, and very appropriately. Its white flowers barely exceed two inches in diameter, and float gracefully upon the water, miniatures in appearance of our own water lily, *Castalia odorata*, so common in lakes and ponds and slow-moving streams. It is known wild in northern Idaho, Ontario and in Asia. Next to this is a beautiful little yellow one, said to be a hybrid between *C. tetragona* and *C. Mexicana*, known as *Castalia tetragona helvola*. Its flowers, twice the size of those of *Castalia tetragona*, are bright yellow with deep orange anthers. Both the last named are hardy in the latitude of New York. In the easterly pool are the hardy kinds, those which can remain permanently in their present quarters. Among the white ones of these are *Castalia alba* and its variety *candidissima*, of Europe, a close relative of our own water lily, *Castalia odorata*, but more sturdy and hence not so dainty. Most of the lilies in this pool are of hybrid origin, and some of these are rich and deep in color. Among those with yellow flowers are: *Castalia odorata sulphurea*, and especially noteworthy and a general favorite, *Castalia Marliacea chromatella*. Among the flesh-colored ones, *Castalia Marliacea carnea* perhaps takes the lead. Among other desirable sorts are: *Castalia aurora*, with the flowers yellowish rose at first, changing later to a deep red; *Castalia gloriosa*, one of the best, with large deep red flowers; *Castalia James Bryson*, with the flowers smaller, but otherwise much like those of *gloriosa*; *Castalia Wm. Falconer*, with its rich garnet flowers, *Castalia Seignoreti*, with the flowers yellow, shaded with rose and carmine; and *Castalia Laydekeri*, in the varieties *rosea* and *purpurata*, the colors indicated by their varietal names.

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PLANTS AND SEEDS.

15 plants for lily pools. (Purchased.)

3 plants from St. Thomas. (Given by Mr. J. T. Francis.)

1 plant for herbaceous grounds. (Given by W. A. Stowell.)

1 plant of *Camptosorus rhizophyllus.* (Given by Miss Barnes.)

1 plant for conservatories. (Given by Mr. Wm. A. Mandy.)

2 plants for conservatories. (Given by Mr. A. A. MacDonald.)

3 plants for conservatories. (Given by Dr. G. T. Stevens.)

3 plants for nursery. (Given by Professor L. M. Underwood.)

1 plant for nursery. (Collected by Dr. J. A. Shafer and Mr. W. W. Eggleston.)

1 plant for the conservatories. (Given by Mr. T. D. A. Cockerell.)

9 plants for the herbaceous grounds. (Collected by Dr. H. H. Rusby and Mr. W. W. Eggleston.)

24 plants for the conservatories. (By exchange with the Hope Botanic Garden, Jamaica.)

1 plant for the conservatories, from Puerto Colombia, Colombia. (Collected by Mr. W. R. Maxon.)

272 plants for the conservatories, from Costa Rica. (Collected by Mr. W. R. Maxon.)

3 plants for herbaceous grounds. (Given by Miss P. Kaufmann.)

11 plants for the conservatories. (By exchange with Mr. F. Weinberg.)

1 plant for the conservatories. (By exchange with Messrs. Siebrecht & Son.)

115 plants for the outdoor collections. (Purchased.)

4 plants for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

1 plant for the herbaceous grounds, from Vermont. (Given by Mr. D. S. Carpenter.)

31 plants for the conservatories. (By exchange with Mr. A. Berger, La Mortola Garden, Italy.)

1 plant of *Opuntia tomentosa.* (By exchange with National Botanic Garden.)

58 plants for the conservatories. (By exchange with the National Museum, through Dr. J. N. Rose.)

2 plants of *Echinocactus Grusoni.* (By exchange with the Missouri Botanic Garden.)

12 plants for outdoor collections. (By exchange with the N. Y. Zoölogical Society.)

275 plants for the outdoor collections. (Given by Mr. L. M. Palmer.)

25 plants for the herbaceous grounds, from Budd's Lake, N. J. (Collected by Mr. W. W. Eggleston.)

1 plant for the conservatories. (Given by Mr. W. C. Cusick.)

1 plant from Santa Catalina Mountains, Ariz. (By exchange with Dr. D. T. MacDougal.)

2 plants for the conservatories, from Nevada. (By exchange with Dr D. T. MacDougal.)

17 plants for the conservatories, from Mt. Wilson, Cal. (By exchange with Dr. D. T. MacDougal.)

10 plants for the conservatories, from Arizona. (By exchange with Dr. D. T. MacDougal.)

12 plants for the herbaceous grounds, from Hempstead, L. I. (Collected by Mrs. N. L. Britton.)

15 plants for outdoor collections, from the vicinity. (Collected by Mr. W. W. Eggleston.)

418 plants derived from seed from various sources.

3 packets of seed from the Philippine Islands. (Given by Mr. A. D. E. Elmer.)

1 packet of seed from Costa Rica. (Given by Mr. C. Wercklé.)

15 packets of seed from Colombia. (Given by Mr. C. Wercklé.)

1 packet of seed from New Mexico. (Given by Mr. J. C. Blumer.)

ACCESSIONS.

MUSEUMS AND HERBARIUM, JUNE, 1906.

28 specimens of cryptogams from Grenada. (Collected by Mr. W. E. Broadway.)

60 specimens of fossil plants from northeastern United States. (Collected by Dr. Arthur Hollick.)

15 specimens of *Crataegus* from Missouri. (By exchange with the Missouri Botanical Garden.)

11 specimens of *Crataegus* from Ohio. (By exchange with Mr. E. Wilkinson.)

87 specimens from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

2 specimens of flowering plants from Indiana. (By exchange with Professor J. C. Arthur.)

1 specimen of *Gyrostachys* from Minnesota. (Given by Professor J. M. Holzinger.)

3 specimens of flowering plants from Cuba. (By exchange with the Herbarium of Harvard University.)

105 specimens of *Crataegus* from Pennsylvania. (Collected by Professor C. L. Gruber.)

27 specimens of ferns. (By exchange with the United States National Museum.)

6 specimens of flowering plants from Cuba. (Given by Professor L. M. Underwood.)

115 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

2 specimens of *Polemonium* from Indiana. (Given by Professor H. J. Banker.)

213 specimens from Mexico. (By exchange with the United States National Museum.)

1 specimen of moss from the Philippine Islands. (Collected by Dr. E. A. Mearns.)

197 specimens from New Mexico. (Collected by Mr. J. C. Blumer.)

1 specimen of *Clethera lancifolia* from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII | AUGUST, 1906 | No. 80

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

CONTENTS

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

JOURNAL

OF

The New York Botanical Garden

VOL. VII. August, 1906. No. 80.

REPORT ON A COLLECTING TRIP IN COSTA RICA.

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF:

I beg to submit the following brief account of a botanical collecting trip in Costa Rica, covering substantially the months of April and May, 1906, the period of my furlough from the U. S. National Museum.

I left New York, March 31, on the Atlas Line steamer *Sibiria*, bound for Port Limon by way of Jamaica and Colombia. Kingston was reached during the night of April 5. The following day I passed at Hope Gardens as the guest of the Superintendent, Wm. Harris, Esq., with whom, in the absence of the Director, I undertook to arrange for the shipment to New York of living plants of the several species of cactuses native to Jamaica. Upon my return (May 31) these specimens were delivered to me on shipboard by Mr. Harris, according to arrangement, the details of which had been agreed upon during my absence, and were brought by me to New York. I ought to mention also that the privileges of the herbarium at Hope were freely and cordially granted me, as upon my two previous visits of longer duration.

Leaving Kingston, April 7, I reached Puerto Colombia (Savanilla), Colombia, April 9. On the tenth I collected a number of interesting cactuses and orchids from the dry hills back of the harbor and sent these alive to New York. From Puerto Colombia it was a short run to Cartagena where several hours were spent, April 11. Port Limon was reached April 13.

Port Limon, which the enterprise of the United Fruit Company has brought to a thoroughly sanitary condition, is the eastern terminus of the Northern Railway of Çosta Rica and affords the only shipping outlet for the enormous banana cultivations of eastern Costa Rica controlled by the Fruit Company. The railroad runs from Port Limon in a general westerly direction through the lowlands to Siquirres, thence south and west along the gorge of the Rio Reventazon through the wonderfully picturesque region of Juan Viñas and Santiago, steadily climbing meanwhile the steep slopes of the widening valley, which to the south of the river show an almost unbroken forest, but here on the north are mostly cleared and under cultivation, even far above to the middle slopes of the great volcano Irazu. Cartago lies in the midst of this more open country at an altitude of about 1,450 meters. From here there is a short rise to the summit of the continental divide a few miles westward, and then a sharp descent through wide stretches of coffee cultivation into the interior basin which contains San José, the capital city, shut in by mountains upon nearly all sides at an elevation of about 1,135 meters.

I traversed this route to San José, April 14, upon transportation courteously provided by Mr. E. P. Schroeppe, at that time acting manager for the Fruit Company in Costa Rica, and thereafter, up to May 28, made this city my headquarters. I brought with me from Washington and New York letters of introduction to several naturalists resident in San José, and I have experienced nothing more cordial than the warm welcome and open-hearted coöperation extended to me by the small but enthusiastic circle. Dr. Anastasio Alfaro, the able head of the Instituto Fisico-geografico Nacional — an institution which, like our own Smithsonian, controls a National Museum — immediately offered me every facility and provided for my special use a large work-room. This arrangement proved of the greatest service; for, as I had feared, the rains were now becoming too prevalent to permit of drying specimens in the field, and it was found necessary to work from San José as a base, making excursions of two and three days into the country by rail and horse, and returning to the city with the fresh material. At this season it was too damp even here to dry the plants properly, but usually two hours of sun could be had each day. Help in drying specimens was usually not available, and this required my spending at least two days between trips in caring for herbarium material alone. Under these circumstances it seemed best to give rather more attention to collecting living plants.

In as much as it was impossible to locate for any length of time in the mountains, work was restricted naturally to localities not too inaccessible from the railway. Thus, on the nineteenth, in company with Don Juan J. Cooper, I gathered near Cartago some 50 numbers, mainly orchids and bromeliads, and on the following day 55 numbers in the partially wooded vicinity of Santiago, a few miles farther east. The next day I collected in in the valley of the Rio Tiriví, near San José. Nearly half of the numbers thus far were represented by living plants, and these I sent to New York, together with some 40 living cactuses I had purchased on the seventeenth from Mr. A. Brode in San José. These 40 specimens represented all but two or three of the species reported from Costa Rica by Weber in 1902.

My next journey was by rail to the station of Turrialba at the border of the *tierra caliente*. On one of the three partial days spent here I was taken by my host, Don Juan Gómez, to the low humid forest bordering the Rio Reventazon (altitude 600 meters), a vicinity well worth future investigation. Some excellent ferns, orchids * and woody fungi were obtained here.

Coliblanco, which I next visited, setting out from Cartago, has been well described † recently by Mr. Robert Ridgway, to whom I am under obligations for the accompanying illustrations. It is an estate lying at the base of the Volcan de Turrialba, at an estimated elevation of 1,950 meters. Portions of three days were

* Coming out of the forest to the *potrero* near the river, our guide, a St. Lucien negro, pointed out in full bloom, and fully a hundred feet from the ground in the lower branches of an isolated giant tree, a plant of the famous "Turrialba" orchid (*Cattleya Dowiana*), the most beautiful of Costa Rican species. I do not know exactly how it was obtained; but next morning it was brought in and presented to me with the compliments of my friend Don Juan.

† In writing upon "A Winter with the Birds in Costa Rica." *The Condor* 7: 151–160. November, 1905.

spent here, by kind permission of the owner, Don Aurelio Lopez Calleja, of Cartago. Although the rains interfered seriously with collecting, yet a great number of interesting ferns and woody

FIG. 23. Scene above Cartago on the trail to Coliblanco; a field of corn (*Zea Mays*) in the foreground.

fungi were gathered, mainly from the humid forest ravines and slopes of the wooded *potrero* so well described by Mr. Ridgway. On several accounts I should regard it of the highest importance that, in the course of future botanical exploration in Costa Rica, especial attention be paid to this wonderful region of Coliblanco and also to the humid forest belt of the volcano above. At the time of my visit drying specimens was quite out of the question; the slopes were constantly drenched by rains and heavy clouds; nothing indoors or out could be kept dry. But in January and February, I am told, the weather is invariably fair, and extensive collecting operations could be carried on to advantage.

A similar experience, with like result, was had at La Palma, an estate situated in the mountains a few miles northeast of San

José, at an altitude of about 1,500 meters. I was most hospitably entertained here for three days by Don Enrique Fernández, to whom I desire to extend my sincere thanks, as well as to Professor J. F. Tristan, who accompanied us, and to both of whom I am indebted for assistance rendered in other ways throughout my visit. The vicinity of La Palma, like that of Coliblanco, is extremely interesting for its ferns; and the number of new or unusual ferns collected indicates that much is yet to be done here as well.

After this I spent several days at Santo Domingo de San Mateo, the only locality I visited west of San José. This vicinity (elevation about 300 meters) is exceedingly dry, and yet without a characteristic desert vegetation. My collections here were mainly of woody fungi and orchids — the latter, to the number of about thirty, in prime condition. On this trip I was accompanied by Dr. Alfaro.

Aside from minor excursions, including one to a mountain directly south of Cartago, my final and principal other trip was to Finca Navarro, recently made familiar to fern students as the type locality of many of Dr. H. Christ's new species, collected by Wercklé. Navarro lies in a mountain valley a little lower than Cartago, and about seven miles to the southeast at the confluence of the Agua Caliente and the Rio Naranjo. The former is a small river bordered by large trees from which I collected many orchids, the latter a rapid stream issuing from a small mountain ravine whose rich forested bottom and steep sides were most prolific in ferns. Besides herbarium material, about sixty numbers of living plants were collected, mostly ferns, aroids and orchids. Among the last were two terrestrial species found only once. The three days that I was enabled to spend here, through permission of the owner, Mr. George Carter, of Cartago, were most productive, and I regret that in these notes I am unable to touch even briefly upon the beautiful orange plantation he has here established, which, through his untiring industry, bids fair to prove a marked success.

Although the season proved unfavorable for securing a large collection from regions calculated to yield the best return, the

collection made serves to emphasize how great a gap is yet to be filled in our knowledge of the Costa Rican flora; and I venture to hope that it may be possible to continue the work of exploration in this extremely diversified region. A carefully planned investigation would certainly meet with earnest support in Costa Rica.

Finally, I wish to express my thanks to Mr. John M. Keith and to Don José C. Zeledon, of San José, for the numerous courtesies extended during my visit. At the suggestion of the former, Mr. R. E. Brounger, General Manager of the Northern Railway, kindly provided me free transportation over that line, which was of very great convenience. To Mr. Zeledon I am indebted for very many kindnesses and helpful suggestions. Professor P. Biolley generously donated obout 75 duplicate ferns, 8 living orchids from the Pacific slope, and several fungi, for which I extended thanks on behalf of the Garden. I wish to acknowledge also the cordial invitation of Mr. R. J. Schweppe, the resident manager of the United Fruit Company, upon his return from the United States, to spend some time in the vicinity of Santa Clara, a famous botanical locality — an invitation amended by my friend Mr. Victor M. Cutter, Superintendent of the Zent District of the same company, to include a visit to the region about Zent. It is a source of regret to me that lack of time prevented an acceptance of either hospitality so generously offered; May 28, in fact, came only too quickly. On that day I sailed from Port Limon on the *Sarnia*, reaching New York June 6. Besides herbarium material, aggregating about 800 numbers, I brought four boxes of living plants, making a total of 180 numbers secured for cultivation in the conservatories.

WILLIAM R. MAXON.

A WINTER AT THE TROPICAL STATION OF THE GARDEN.

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Dear Sir: Having been granted a leave of absence during my tenure of the Bruce Fellowship in the Johns Hopkins University, I left Baltimore on October 13, 1905, for Jamaica, where I at once took up my residence at the tropical station of the Garden, at Cinchona, remaining until May.

The general plan of my work was to make a study of the physiological plant geography of the Blue Mountain region above an altitude of 4,500 ft., and the various lines of investigation which this embodied were carried on more or less concurrently. I made a digest of the old meteorological records for Cinchona, and other nearby points, in regard to air and soil temterature, humidity and rainfall. With these climatic data as a basis I then endeavored to determine the exact departure from them of the conditions in a number of plant habitats varying in topographic position, exposure and altitude. To this end I secured weekly records with air and soil thermographs and with a hygrograph, and also made observations as to the percentage of cloudiness and fog, and took photometer readings of the intensity of light. The most salient features of the climate are the extreme constancy of the temperature, the height and constancy of the humidity, the prevalence of cloud and fog, and the large amount and frequency of rainfall.

Selecting certain characteristic trees and herbaceous plants I made a study of their rates of transpiration, using chiefly the method of weighings and the potometer method. The daily march of transpiration was determined by hourly readings, and simultaneous readings were taken of temperature and humidity and of evaporation as registered by a form of evaporimeter devised by Dr. B. R. Livingston. After thus determining the combined influence of natural conditions upon the daily cycle of transpiration in certain species, it was my plan to determine the influence in the same species of variations in heat, light and humidity operating separately, but I was able to carry out this plan only in part. The rates of transpiration showed a high degree of sensitiveness to changes in temperature and humidity, and under favoring conditions as to these factors and light some high rates were measured. However, the extremely low rates which were found to accompany cloudiness and high humidity, together with the prevalence of these conditions, particularly on the northern slopes of the Blue Mountains, point to the annual total of transpiration being very low as compared with that in tropical lowland vegetation.

Measurements of the rate of growth of leaves in a number of trees, shrubs and herbaceous plants in the moist mountain forests indicated rates much lower than in tropical lowlands or in the temperate regions, this being true even of the renewing foliage of completely deciduous trees. A series of observations was begun on the periodicity of growth, leafing-out, leaf-fall and blooming, as well as on the duration of life of leaves in forest trees and shrubs, but these observations require a longer continuous residence to be made of the fullest value.

I made observations and did some experimental work with regard to the significance of the wetting of leaves by rainfall and condensed moisture. Dripping points are but poorly developed in the native vegetation and the occurrence of epiphyceae was found to be independent of the character of the foliage. The wetting of the upper surface of leaves was found to reduce transpiration, but both direct and indirect evidence showed this to be due only in part to the cooling of the leaf.

Many interesting features were revealed by a study of the anatomy of the leaves of certain typical plants.

A field study of the habitats and local distribution of the filmy ferns was made, and supplemented by an investigation of their moisture relations, particularly the capacity of roots and leaves for water absorption, the capacity of leaves to avail themselves of atmospheric humidity, and the behavior of chloroplasts in dry and in strongly illuminated leaves. Material preserved for a study of the anatomy of the leaves promises to show some interesting structures securing mechanical stability in these thin organs.

Notes were taken for the preparation of a descriptive account of the vegetation, with a particular view to correlating differences in various habitats with the ascertained differences in physical factors prevailing there. Differences in physiographic situation were found to be at the bottom of the differences in physical factors, and to be of more importance than altitude (above 4,500 ft.) in determining both the floristic and vegetative character of the forest.

Respectfully yours,

FORREST SHREVE.

NOTES, NEWS AND COMMENT.

Dr. W. A. Cannon, member of the staff of the Desert Botanical Laboratory of the Carnegie Institution, at Tucson, Ariz., has been in residence at the Garden during part of July and August, occupied, in part, with a study of the comparative histology of two species of the evening primrose (*Oenothera*) and their hybrid progeny.

Miss Winifred J. Robinson, instructor in botany in Vassar College, has been spending the summer at the Garden herbarium, studying the fern flora of the Sandwich Islands.

Professor Edward L. Bray, of the University of Texas, spent the first week of August at the Garden, studying specimens of Texan plants preserved in our collections, and consulting the library.

Mr. C. F. Baker, Botanist of the Cuban Agricultural Experiment Station, spent part of August at the Garden, consulting the library and herbarium.

The collection of drugs in the east hall of the economic museum was completely rearranged during July, and at the same time about one hundred specimens of crude drugs were interpolated in the several series there represented. Several valuable specimens were recently added to the exhibit of india rubber and allied products in the west wing of the economic museum.

In the systematic museum about two hundred specimens have been recently incorporated in the exhibits of the synoptic collection. The red seaweeds of the local flora have been installed in the swinging frames provided for them in this museum.

In order to hasten the completion of the approach at the Woodlawn Road entrance, paving the driveway at this point was commenced late in July and completed August 20, using stone for the telford foundation already assembled there, and bringing the rest needed from the grading operations behind the museum building.

At the field meeting of the Bronx Society of Arts and Sciences held at the Garden, July 21, Dr. Britton called the attention of the members present to a large number of the native trees in the grounds and spoke of their care. The native tree flora of the Garden comprises nearly fifty species.

The driveway approach at the Mosholu Parkway entrance was completed on July 25, a steamroller having been hired, and the entire driveway from the New York and Harlem Railroad Station to this point and eastwardly around the upper lake nearly to the west end of the Long Bridge across the Bronx River was completed on August 1.

Mr. Walgrove, the Commissioner of Parks, has made application to the Department of Water Supply, Gas and Electricity, for sufficient lamps to light this portion of the driveway system. The continuation of the driveway system over the Long Bridge now only awaits the arrival of another boat-load of broken stone and screenings for its final surfacing. The telford macadam driveway system of the parks of the Bronx from the southern end of the Spuyten Duyvil driveway through Van Cortlandt Park, Mosholu Parkway, Bronx Park, Pelham Parkway, and Pelham Bay Park, is now complete with the exception of the short piece between Webster Avenue and the New York and Harlem Railroad in the Mosholu Parkway, just west of the Garden; the dirt filling needed here was made two years ago and the Park Department is now preparing to pave the road at this point.

In the JOURNAL for September, 1904, an account appeared, with illustrations, of an *Agave* which flowered about the middle of August of that year. Material of this plant was then sent to Dr. Wm. Trelease, who pronounced it to be *Agave Palmeri*. Dr. MacDougal secured two plants of this species in 1902. The first of these flowered as indicated above, the second one is now (August 1) finishing flowering and is perfecting fruit. In association with the plant of *Agave Palmeri* is a plant of *Agave Lecheguilla* Torr. This species was originally described from material secured in the Rio Grande region. The plant now in flower is about eight feet six inches tall, from its base to the apex of the flowering stem, which is densely covered with flowers for the upper three feet. The leaves are linear-lanceolate, ten to fourteen inches long and about one and a half inches wide, the margin with a narrow gray line which connects the stout awl-shaped spines, which are curved and reflexed; the leaves terminate in a stout spine, which is at first brown but afterward turns to gray. The lower bracts of the flowering stem are erect, the upper ones being reflexed. The flowers are about two inches long over all, including the much-exserted stamens, which are about one and a half inches long; the ovary and perianth are a pale green, the former one-half, the latter about five-eighths, of an inch long. The inflorescence is racemose, the flowers spreading from the main axis. In general appearance this inflorescence much resembles that of *Agave Victoriæ-Reginæ*, a description and illustrations of which appeared in the JOURNAL for July, 1906.

The total rainfall at the Garden for the month of July, 1906, was 4.12 inches. Maximum temperatures were recorded of 87° on the 3d; 89° on the 10th; 88.5° on the 18th; and 85° on the 30th; also minimum temperatures of 53° on the 7th; 57° on the 14th; 66° on the 9th and 22d; and 60° on the 27th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM JULY 1 TO AUGUST 1.

Alpen-Pflanzen Atlas. Wien, no date. (Given by Mrs. N. L. Britton.)

American Farmer. Vol. 2. Baltimore, 1821. (Given by F. R. Newbold, Esq.)

BECK, LEWIS C. *A manual of chemistry.* Albany, 1831. (Given by F. R. Newbold, Esq.)

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VIDAL Y SOLER SEBASTIAN. *Reseña de la flora del Archipelago Filipino.* Manila, 1883.

WAKEFIELD, PRISCILLA. *An introduction to botany.* Ed. 6. Philadelphia, 1811. (Given by F. R. Newbold, Esq.)

PICTURE COLLECTION.

1 photographic group taken at the Desert Laboratory, Tucson. (Given by Dr. D. T. MacDougal.)

38 colored plates. (Given by Rev. Père Duss.)

7 plates of *Equisetum.*

5 plates of ferns.

2 portraits of botanists. (Given by Dr. N. L. Britton.)

1 photograph. (Given by Dr. M. A. Howe.)

6 plates of Asclepiadaceae. (Given by Department of Botanical Research, Carnegie Institution.)

2 photographic groups of the Botanical Congress at Vienna, 1905. (Given by Dr. L. M. Underwood.)

5 colored plates of fungi. (Purchased.)

5 plates of Patagonian plants. (Given by Dr. G. Macloskie.)

17 photographs of trees. (Given by Mrs. N. L. Britton.)

5 photographs of ferns. (Given by Dr. J. K. Small.)

42 plates from Gartenflora.

45 plates from various sources.

3 illustrations of pears.

12 plates from Botanical Magazine.

1 photograph of *Cypripedium Reginae*. (Given by Mr. R. C. Benedict.)

MUSEUMS AND HERBARIUM, JULY, 1906.

126 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

2 herbarium specimens from Indiana. (Given by Professor H. J. Banker.)

201 specimens from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

52 specimens from Grenada, West Indies. (Collected by Mr. W. E. Broadway.)

27 mosses "N. A. Musci Pleurocarpi." (Given by Dr. A. J. Grout, for the Columbia Herbarium.)

3 specimens from southwestern North America. (By exchange with Dr. D. T. MacDougal.)

36 specimens of *Crataegus* from southeastern United States. (By exchange with the Biltmore Herbarium.)

29 specimens of mosses from Costa Rica. (Collected by Mr. W. R. Maxon.)

2 specimens of mosses from New Jersey. (Given by Professor W. M. Wheeler.)

1 specimen of papyrus from Egypt. (Given by Mrs. H. L. Britton.)

3 specimens from South Carolina and Georgia. (Given by Mr. H. D. House.)

1 specimen of *Geranium* from New Jersey. (Given by Dr. H. H. Rusby.)

130 specimens from northeastern United States. (By exchange with Mr. W. W. Eggleston.)

1 specimen of *Crataegus* from Ohio. (Given by Miss Emma McGee.)

9 specimens of fungi from Grenada, West Indies. (Collected by Mr. W. E. Broadway.)

1,003 specimens from the Yellowstone National Park. (By exchange with the United States National Museum.)

81 specimens from Guatemala. (By exchange with the United States National Museum.)

9 specimens of mosses from Alaska. (By exchange with the United States National Museum.)

2 specimens of palms from Jamaica. (By exchange with the Department of Public Gardens and Plantations.)

30 specimens of fungi from Mexico. (By exchange with the United States National Museum.)

76 specimens from Guatemala and Mexico. (By exchange with the American Museum of Natural History.)

710 specimens from Mexico. (Collected by Dr. C. A. Purpus.)

PLANTS AND SEEDS.

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60 plants for the herbaceous grounds. (Given by Pres. E. Brainerd.)

1 plant for the conservatories. (Given by Mrs. G. Such.)

1 plant for the conservatories. (By exchange with Mr. F. Weinberg.)

1 plant for the conservatories. (Given by Mr. F. R. Newbold.)

8 plants for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

3 plants for the herbaceous grounds. (By exchange with the Geological Survey of Canada.)

2 plants for the conservatories. (Given by Miss A. Taylor.)

2 plants for the herbaceous grounds. (Collected by Mr. A. Schell.)

1 plant for the conservatories. (By exchange with Dr. J. N. Rose.)

47 plants from Vermont, for the herbaceous grounds. (Collected by W. W. Eggleston.)

2 plants from the Adirondack Mts., for the pinetum. (Collected by Dr. H. H. Rusby.)

3 plants for the conservatories. (From Flower Show of Horticultural Society 1906.)

300 plants derived from seeds, various sources.

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No. 82. Studies on the Rocky Mountain Flora — XVI, by Dr. P. A. Rydberg.
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No. 84. The pollen-tube in some of the Cucurbitaceae, by J. E. Kirkwood.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII SEPTEMBER, 1906 No. 81

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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JOURNAL

OF

The New York Botanical Garden

Vol. VII. September, 1906. No. 81.

THE AUTUMN LECTURES.

The lectures of the autumn course will be delivered in the lecture hall of the museum building on Saturday afternoons at 4:30, beginning early in October and closing the first week in December. They will be illustrated by lantern slides and otherwise. The program will be announced on a special card. The Garden is reached by the Harlem Division of the New York Central Railway to Bronx Park Station, or by the Third Avenue Elevated Railway to Bronx Park. Lectures will close in time for auditors to take the train arriving at Grand Central Station about 6 P. M.

FURTHER REMARKS ON A SERIOUS CHESTNUT DISEASE.

A preliminary account of this disease appeared in the June number of the Journal. At the time the account was written the disease was just beginning to spread on the twigs and branches from the infected areas in which it had spent the winter. On my return to New York in August, I found it very abundant and very destructive, the warm, moist summer having been exceedingly favorable to its development. Hardly a tree in the Garden had escaped infection and many dying and recently-killed branches were observed. I now know of very few chestnut trees in this portion of the city that appear to be worth trying to save and I do not consider any immune.

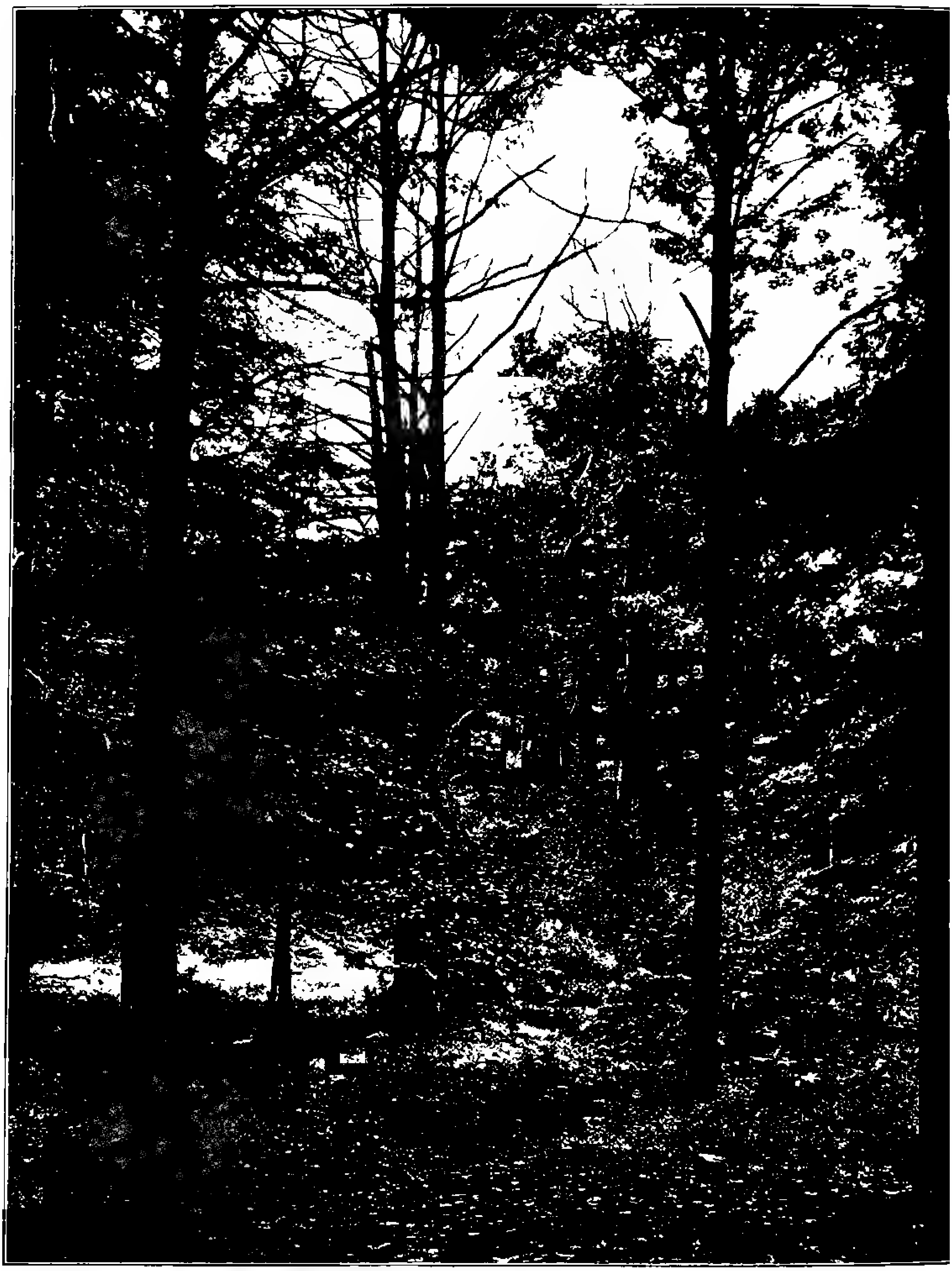

FIG. 25. Chestnut trees in the hemlock woods, New York Botanical Garden, killed disease. The clump of trees on the left near the center of the picture is entirely dead; th the right in the background have almost succumbed.

An attempt was made by Mr. Merkel, * chief forester at the Zoölogical Park, to control the disease by spraying, but I believe he considers the condition quite hopeless. Practically all of the

FIG. 26. Young chestnut trees at the propagating houses used in the inoculation experiments. The tree on the right was not inoculated, being reserved as a check. The tree on the left shows two twigs killed. The top one was inoculated with the fungus March 21 and was completely girdled by April 14. By August 26 the fungus had reached a point nearly, an inch below the junction of this twig with the adjoining one and had extended an equal distance up the latter, girdling it completely. The dead twig near the base of the tree was inoculated in the same way as the top one, namely, by scraping off the cortex and applying the growing fungus to the fresh surface. The two tubes cover twigs inoculated April 3 at the ends after pruning. In both of these the fungus had reached the base of the twig by September 1.

The tree in the center was inoculated April 3 in a fresh wound near the top of the main stem and in another near its base. The principal side branch, treated in the same way, died May 11, and by the end of August the entire stem was dead, including the young twig below the lowest infection, which was girdled by the fungus in its progress down the stem.

* "A deadly fungus on the American chestnut." Annual Report of the New York Zoölogical Society 10: 97–103, *4 figs.* July 4, 1906.

FIG. 27. Other chestnut trees used in the inoculation experiments. The tree o the right was inoculated April 3 in three different places. The small twig near th middle of the stem died on May 6, the larger one near the top on May 19. By Au gust 26 the fungus had girdled the trunk at the lowest inoculation, indicated by th tuft of cotton, and had spread downward to the two lowest twigs.

The experiments with cut twigs, covered with glass tubes, were repeated on th tree in the center, with the same result as before. Attempts were made to introduc the fungus into various buds and young twigs near the top of this tree without wounc ing the bark, but none of them were successful.

The tree on the left was treated on April 5 in the same way, several buds and youn twigs from one to five inches in length being covered with the fungus for some tim under glass; but all these attempts likewise failed. The dead branch at the top wa inoculated through a wound.

chestnut trees within his jurisdiction appear to be dying rapidly. Even the young trees in the nursery there have been either en tirely killed or rendered worthless by the fungus.

Mr. Levison reports all the chestnut trees of Forest Park, Brooklyn, to be either dead or dying, and many in Prospect Park to be seriously affected. Wherever he has found the chestnut tree in Brooklyn, he has found the disease.

The natural result must be the death of practically all the chestnut trees in the infected area, unless some exceedingly active enemy speedily appears; which is extremely unlikely. Dry summers and otherwise unfavorable conditions may delay the progress of the disease a few years, but not very long. After the disease has run its course and the dead trees have been cleared away, young healthy trees, grown from the seed, may be planted with some chance of success, especially if carefully cultivated and guarded against attacks by aphis and wounds of every description. In nearly all the new infections examined I have noticed a dead

FIG. 28. Inoculation experiments with young chestnut trees. Tree on the right killed to the base of the trunk by a body infection; tree on the left reserved as a check.

FIG. 29. Infected nursery trees removed from the Zoölogical Park to the Gard last autumn. The photograph was taken August 27, 1906. The dead tree on t right was apparently in perfect condition early in the season, but close inspection r vealed a diseased spot near the base of the trunk, which later girdled it and kill the entire tree.

The tree on the left also leafed out vigorously and appeared healthy, but w girdled about halfway up the trunk by May 15 from a diseased spot near a wou made in pruning. On May 19 fruiting pustules began to appear on the diseased ba and the leaves began to die.

twig, or dead area of some kind on the bark, apparently not killed by the fungus, from which the infection appeared to spread. The end of the branch being killed, dead spots are sure to appear lower down, from lack of food, and the spores washed down by the rain find easy entrance. Thus it frequently happens that a small infected branch will often lead to a serious infection of the main stem even before the fungus has had time to grow down the whole length of the branch.

In the case of large branches, the ends of which are killed, one side of the branch may entirely die, thus affording an easy and speedy entrance of the fungus directly into the trunk. It is on this account that pruning large infected branches often fails of success.

In this connection it may be interesting to give a brief outline of the results of the infection experiments with young trees in the propagating houses mentioned in my former article. In one set of experiments, the fungus, taken from pure cultures, was introduced through wounds into the living tissues of the branch. As may be seen from the accompanying illustrations, the branches thus infected have all died. An attempt was made in another set of experiments to infect young twigs and unfolding buds without removing the cortex. No infections of this kind were successful. Other infections were made upon the cut ends of branches and the progress of the disease down the branch toward the trunk observed. A number of check trees were kept in each case and they have all remained perfectly sound.

Interesting observations were also made on the progress of the disease during the summer in young trees in the nursery outside. One of these in particular was mentioned and figured in the June JOURNAL. A comparison of the condition of the tree early in May with its condition now, as seen in the accompanying illustration, will show how rapid and how deadly the work of this fungus may be.

I have no treatment to suggest further than the preventive measures already mentioned. I realize the extent of the calamity in New Jersey, Maryland, Virginia, and other states where the disease is known to occur, if it is as virulent as it is with us.

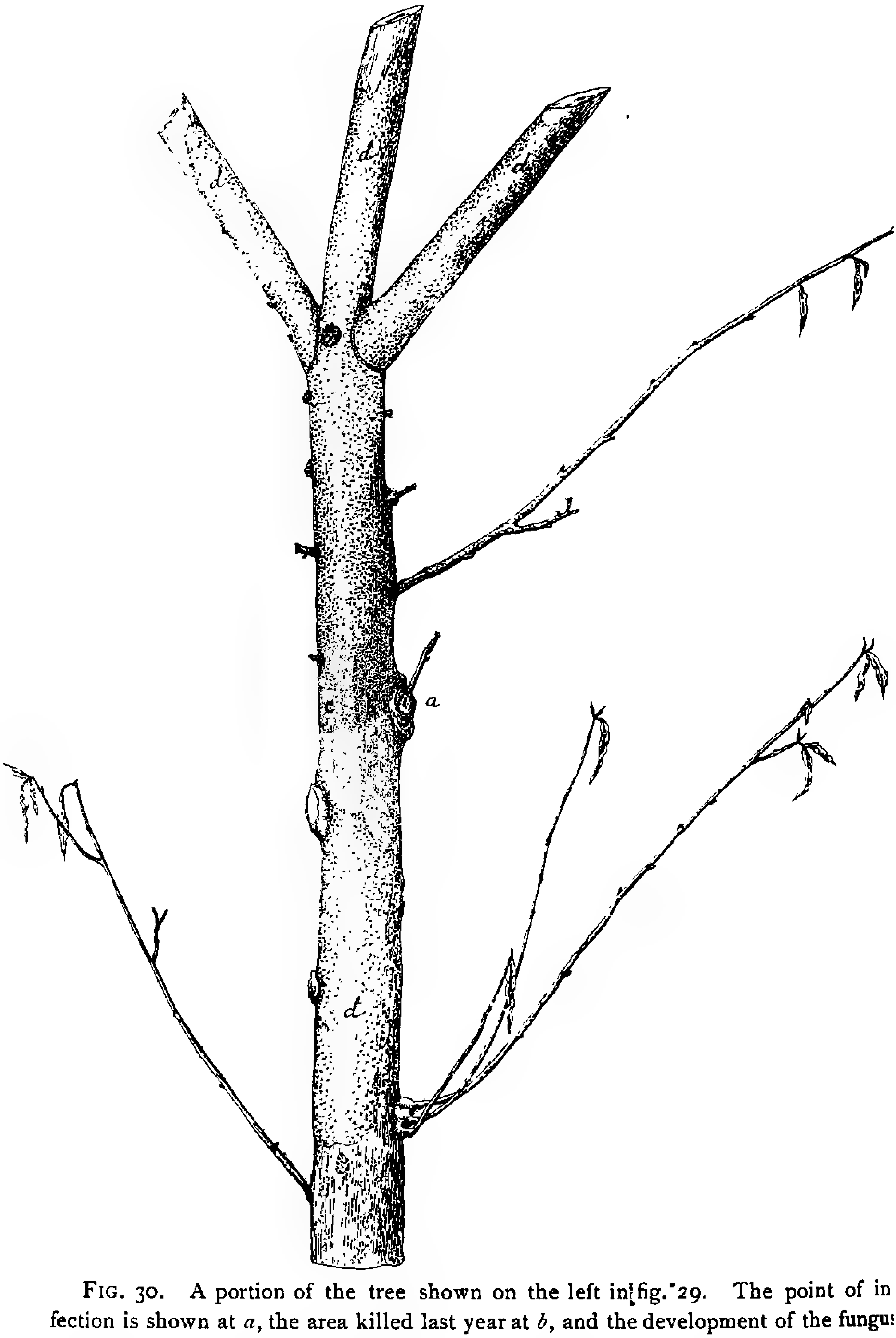

FIG. 30. A portion of the tree shown on the left in fig. 29. The point of in fection is shown at *a*, the area killed last year at *b*, and the development of the fungu by May 15 of this year, when the girdling was complete, at *c*. Between May 15 anc August 27 the fungus covered the area above and below the point of infection repre sented by *d*, a lineal distance of nearly ten inches, the progress downward bein opposed by living tissue.

Owners of woodlands in these states should cut and use all large infected trees at once. Since the fungus affects the bark only, the wood is perfectly sound unless allowed to stand and be subjected to other agencies causing decay. Small trees with body infections will soon die, so they might as well be cut at the same time. Healthy young trees with only a few diseased twigs might be treated by pruning a foot or more below the discolored area and covering the wounds with coal-tar. Care should be taken not to make new infections with the hands or pruning implements while the work is being done.

Fortunately, the disease does not spread to other forest trees: nor has it been found on any other species of chestnut, either in this country or in Europe.

In *Torreya* of this month the fungus is described in detail, with figures showing its microscopic characters, as a new species under *Diaporthe*, a large genus of the pyrenomycetes.

W. A. MURRILL.

OBSERVATIONS IN ECONOMIC BOTANY MADE AT OSCODA, MICHIGAN.

During a stay of several days at Oscoda, Michigan, in the latter part of August, I was most impressed by the disastrous effects of the destruction of the great forests which once covered the surrounding region. These forests consisted of white pine (*Pinus Strobus*); red pine (*P. resinosa*), there called Norway pine, and presenting two distinct varieties to the lumberman, the "sap Norway," its wood almost all alburnum and of little value, and "cork Norway," with very little sap-wood, and highly esteemed; and jack-pine (*P. divaricata*), a pitch pine of little value. With these were associated more or less hardwood timber, chiefly white and black oak, sugar maple and birch, and, in the low grounds, other coniferous trees, chiefly spruce, tamarack and white cedar.

In the cutting of these forests, the usual American custom of indiscriminate and total destruction was followed. The removal of the larger trees, with judicious replanting, would have preserved not only the valuable lumbering industry, but also climatic conditions of the greatest importance. As it is, we have left only vast sandy wastes covered with jack-pines, and these of the smallest and meanest description. There is no shade, and the plains are arid and desolate, affording apparently no opportunities for even ordinary agricultural operations. In Oscoda and Au Sable, contiguous towns except for the intervening Au Sable River, the twenty-odd saw-mills are now reduced to four, and these are fed principally upon "dead-heads,"—snags dragged out from the bed of the river. A population of ten or twelve thousand has become reduced to two or three thousand, with a corresponding decline in general business.

This depressing picture is repeated a thousand times throughout the once rich lumbering regions of the United States, and marks one of the most brutal cases of looting of the property of a future generation that the world has ever witnessed. It is probably not too much to say that the reforestration that is now recognized as a necessity will cost a hundred fold what it would have done to preserve the existing forests, and many times the price that has been obtained for the lumber cut. A still worse feature is that this cannot be done at all until special methods are devised. Experimental work in this direction is now proceeding, especially under the direction of Mr. Carl Schmidt, of Detroit, who has bought Cedar Lake and a large area in its vicinity.

Other industries, except beyond the limits of the sand barrens, are unimportant. Great quantities of blueberries, chiefly the low sweet blueberry (*Vaccinium pennsylvanicum*) are exported, the picking being done chiefly by Chippewa Indians, who have a settlement near by and establish temporary camps from place to place, as the harvest proceeds. Both the large and small cranberry are found in the bogs, the latter being more common, but less esteemed. Some use is made of the high bush cranberry (*Viburnum Opulus*), which grows in the edges of the swamps. Checkerberries, bearberries and bunchberries abound, but are not commercial elements, the same being true of the choke-berry. The wild red cherry (*Prunus pennsylvanica*) is not uncommon.

The common grape is the frost-grape (*Vitis cordifolia*). June-berries or Service-berries (*Amelanchier*) are abundant and excellent, but no opportunity was found for determining the species. *A. canadensis* and *A. Botryapium* were observed. Blackberries are collected in some quantity, but are of rather poor quality, and the species were not determined.

Some of the interesting plants of the sand barrens are *Lacinaria cylindracea* (Michx.) Kuntze, *L. scariosa* (L.) Hill, *Nabalus trifoliatus* Cass., with purple flowers, *Lonicera glaucescens* Rydberg, *Polygonella articulata* (L.) Meisner and *Helianthus occidentalis* Riddell. *Lycopodium sabinaefolium* is very abundant and is assuredly distinct from *L. complanatum*. Its rhizome is deeply buried, its branchlets stiffly erect, its spikes small and its color of a beautiful blue-gray.

The cedar swamps are deeply carpeted with sphagnum, in which grow many orchids. In one small spot were collected the following: *Cypripedium acaule* Ait., very large and luxuriant, *C. reginae* Walt., *C. hirsutum* Mill., *Limnorchis hyperborea* (L.) Rydb., *Lysiella obtusata* (Pursh) Rydb. and *Limodorum tuberosum* L. With these grew *Triglochin maritimum* L., of striking appearance, *Clintonia* and *Drosera*, and many other plants usually associated with them in northern bogs. The smaller cranberry was very abundant in the moss, and *Calla* grew in the streams. All the above were in fruit. While enjoying the beauties of this spot, I could not but think it perfectly feasible to establish such a one in some one of the low spots in our Garden. Probably no other plants of this region are of greater interest than the submerged aquatics which cover the bottoms of the lakes and quiet streams. Potamogetons are in great variety. I was particularly interested in *P. Richardsonii* (A. Bennett) Rydb. (*P. perfoliatus Richardsonii* A. Bennett), which is certainly distinct from *P. perfoliatus* L. *Sagittaria cuneata* Sheldon was collected in Pine Lake. *Vallisneria spiralis* L. is abundant, and its habit is strikingly different from that which it displays in our streams about New York.

H. H. Rusby.

SYMBIOSIS IN GUNNERA MANICATA.

In the April number of the JOURNAL, Mr. Nash called attention to a specimen of *Gunnera manicata* which was in full bloom at the conservatories. Since then several other specimens of the same species have blossomed at the Garden. Figure 31 is a reproduction of a photograph of two of the plants in house No. 13 of the conservatories.

Libon is said to have discovered the plant in the Campos de Lages of Santa Catharina, Brazil. It was brought to Europe and first cultivated in Linden's garden, but there is no record that it ever flowered there. In fact its flowering seems to be a rare occurrence, for Schwacke, writing in 1890, made the statement that, "Except Fritz Müller, no one has seen the flower." It has also been found in the highlands of Santa Catharina, and on the Sierra do Oratorio, at from 700–1,200 meters above sea level.

The fifteen different species of the genus differ so greatly from one another, both in habit and structure, that the genus is regarded as rather ancient. On account of these differences, also, and because of the departure of them all from the dicotyledon type, their classification has been difficult. The group was first separated as a genus by Linnaeus, in 1767. By Jussieu and Endlicher it was assigned to the Urticaceae, and by de Candolle, Eichler, J. D. Hooker, and by Bentham and Hooker to the Haloragidaceae. Baillon placed them with the Onagrariaceae, and Lindley with the Araliaceae.

According to Reinke (Morph. Abhand., Leipzig, 1873, p. 113), the geographical center of dispersal of the genus is Van Diemensland and New Zealand, for the species of simplest structure, the most primitive forms, occur there.

The fibro-vascular bundles of the stem form a rather complex network, thus varying widely from the dicotyl type, and the internodes fail to elongate, making the stem short and partly subterranean. The roots are said to possess no cambium, and so, of course, cannot increase in diameter. This is a variation from the dicotyledonous type in the direction of the monocotyledons and ferns, and from that standpoint the plant would be assigned to one of the lower groups of the plant kingdom.

Gunnera has an additional interest for the botanist because of certain peculiarities in the structure of the stem, and also because of the presence of a species of Nostoc, a blue-green alga, that lives in its stem. The stem is tuberous and largely subterranean. In cross section numerous areas of a deep-green or blue-black color are seen distributed through the tissue. On microscopic examination these areas are seen to be colonies of the blue-green alga.

Symbiosis, or cohabitation with other plants, is not uncommon in the genus Nostoc. In the case of some lichens, which are compound plants, formed by the association of an alga with a species of fungus, the algal component is a Nostoc. In such a case the commensalism is probably of mutual benefit to both organisms. The chlorophyll-bearing cells of the alga manufacture the carbohydrates necessary for the nourishment of both itself and of the fungus, while the fungus supplies water and protection to the alga, and is possibly of service in other ways. Both the alga and the fungus, however, may grow independently.

A similar relationship between a Nostoc and the liverwort *Anthoceros* is also well known. This association has recently been found by Pierce (Bot. Gaz. **42** : 55. 1906) not to be obligate, for either plant can be grown in cultures without the presence of the other.

In the present instance it is difficult to recognize any mutual advantage. The tissues of the host plant furnish a substratum for the alga, and supply it with water and other nourishment, but if the presence of the alga is an advantage to its host, we are unable to say how. If the advantage is to both plants, then this is a case, not of true parasitism, but of mutualism.

Reinke, in 1873, was one of the first investigators to observe the Nostoc colonies in Gunnera, and Merker, in 1889, refers to it as a case of symbiosis.

It is worthy of note that, although the alga is probably in complete darkness within the stem of its host, its cells develop the green coloring matter, chlorophyll, usually formed only in sunlight.

It will be of interest to ascertain at what time the alga enters

the host, whether it is present in the seeds, whether the Gunnera can thrive in sterile cultures without the Nostoc, and whether the alga can live outside the host.

C. STUART GAGER.

NOTES, NEWS AND COMMENTS.

The new driveway connecting Moshulu Parkway with the principal driveways of the Garden was thrown open to the public by the park officials on August 27.

Dr. S. P. Verner, who reports several trips made into the south central parts of Africa, called at the Garden recently to arrange an exchange of plants.

Dr. C. B. Robinson, assistant curator, spent the month of August collecting in Nova Scotia, dividing his time between Cape Breton and Pictou. About 275 species, mostly flowering plants, were obtained by him.

Dr. Murrill returned from Europe on August 18. A full report of his trip will appear in the October number of the JOURNAL.

Dr. Rydberg's *Flora of Colorado,* published as a bulletin of the Colorado Experiment Station, appeared in August. The volume consists of nearly five hundred closely printed pages.

Dr. Arthur Hollick continued the investigation of the Atlantic Coastal Plain Cretaceous flora during August, on Block Island, where fossil plants and lignites were collected which will be valuable supplementary material to that collected earlier in the summer in New Jersey and on Martha's Vineyard. The Block Island specimens collected by Dr. Hollick during this and a previous trip are the only specimens of Cretaceous plants known to have been found there.

Dr. Rydberg attended the botanical symposium at Little Moose Lake in the Adirondacks in July and went from there to Ottawa to examine the collection of Rosaceae in the herbarium and to collect fresh specimens of this family in the vicinity. Returning, he collected at Lake Placid in the Adirondacks and later visited the Catskills.

Dr. Britton left for Jamaica on August 25, accompanied by Mrs. Britton and Dr. Underwood. Professor Evans, of Yale University, joined the expedition at Kingston. Collections will be made at high elevations on the mountains about Cinchona, where the tropical laboratory of the Garden is located, and also in the lower and more arid regions of the island, suited to the growth of palms and cacti. The party is expected to return to New York in the latter part of September.

Mr. A. E. Cassé, horticultural director of Les Plantations d'Haïti, spent two days at the Garden during the latter part of August. The plantation is a large one, embracing in the neighborhood of one thousand acres, and is located at Bayeux, about eighteen miles to the westward of Cap Haïtien, on the north coast of Haïti. Work was first begun there in 1901, and has progressed rapidly, so that now the area is in excellent condition. Large numbers of cocoa trees and rubber trees have been planted, from which returns are shortly expected. Sugar is also manufactured to a considerable extent. It was here that the two expeditions sent out by the Garden to Haïti made their head-quarters, accepting the kind invitation of Mr. Herrmann, the proprietor, extended through Mr. Cassé. A large part of the success of these expeditions was due to the facilities offered by the plantation. Mr. Cassé is on his way to Europe, and expects to return early in October, stopping a few days at the Garden at that time.

Dr. H. H. Rusby visited the Field Museum of Natural History at Chicago in August and had an opportunity of seeing in progress a change in the system of installation of economic botanical material. Heretofore the basis of arrangement has been chiefly geographical; it is now being based upon systematic botany, the products of each family, with the exception of woods, being grouped together. The new cases are made air-proof and are permanently closed. The specimens are fastened against a backing of black cloth. The labels are black, with small white (aluminium) lettering, and the effect is strikingly handsome. The elaborate system of recording both economic and herbarium material at this institution was carefully studied. A large amount of duplicate material was examined and a considerable quantity selected for our collections. Among many miscellaneous specimens, the following sets are worthy of mention: three series of Japanese chip-work; two series of peas, beans and lentils; a set of rattans; products of *Attalea funifera*; shingles of various woods; a series of soaps; a series of candles; a set of products of the destructive distillation of wood.

The total rainfall recorded at the Garden for August was 3.78 inches. Maximum temperatures were recorded of 95° on the 5th; 97° on the 6th; 87° on the 14th; 90.5° on the 23d; and 89° on the 30th; also minimum temperatures of 66° on the 5th; 60° on the 13th; 57° on the 16th; and 59° on the 25th.

ACCESSIONS.

MUSEUM AND HERBARIUM, AUGUST, 1906.

8 specimens of mosses from East Indies. (By exchange with M. E. G. Paris.)

1 specimen of *Zamia Gutierrezi* from Cuba. (By exchange with the Estacion Central Agronomica de Cuba.)

1 specimen of *Hieracium* from eastern Pennsylvania. (Given by Mr. H. H. Ranck.)

8 specimens from Georgia. (Given by Dr. R. M. Harper.)

6 specimens of mosses from Costa Rica. (By exchange with the U. S. National Museum.)

113 specimens from eastern North America. (Collected by Mr. W. W. Eggleston.)

231 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

14 specimens of mosses from Guatemala. (By exchange with the U. S. National Museum.)

22 specimens of lichens from Costa Rica. (Collected by Mr. W. R. Maxon.)

79 miscellaneous specimens from tropical America. (By exchange with the U. S. National Museum.)

33 specimens from the northeastern United States. (Collected by Dr. H. H. Rusby.)

PLANTS AND SEEDS.

7 plants from Michigan for the nursery. (Collected by Dr. H. H. Rusby.)

3 plants for the nursery. (Collected by Mr. W. W. Eggleston.)

3 plants for the herbaceous grounds. (Collected by Mr. W. W. Eggleston.)

1 plant for the conservatories, from Arizona. (Given by Mr. D. McLean.)

1 plant for the conservatories. (Given by Mr. C. Gould.)

1 plant from Grenada for the conservatories. (Given by Mr. W. E. Broadway.)

1 plant for the conservatories. (Given by Mr. J. W. Young.)

1 plant from Jamaica for the conservatories. (By exchange with the Hope B. G

1 plant from Texas for the conservatories. (By exchange with the U. S. Nation Museum, through Dr. J. N. Rose.)

3 plants from Mexico for the conservatories. (By exchange with the U. S. Nation Museum, through Dr. J. N. Rose.)

22 plants derived from seeds from various sources.

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Vol. VII OCTOBER, 1906 No. 82

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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Published for the Garden

At 41 North Queen Street, Lancaster, Pa.
by The New Era Printing Company

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Vol. VII. October, 1906. No. 82.

A SUMMER IN EUROPE; SOME FOREIGN BOTANISTS AND BOTANICAL INSTITUTIONS.

Dr. N. L. Britton, Director-in-Chief.

Sir: I herewith submit my report on a trip through Europe, made primarily for the purpose of examining various important collections of North American polypores in European herbaria, and incidentally to become better acquainted with foreign botanists and the methods employed in foreign botanical institutions.

Leaving New York May 29, I arrived at Gibraltar June 9, in the forenoon, and spent several hours in the old botanical garden along the shore south of the town and among the numerous interesting wild flowers that covered the limestone cliffs about the fortress.

Naples was reached June 12. The botanical garden is small, thickly planted, and poorly kept, being little more than a park. The plant house appears quite large from the front, but it is found upon closer examination to be built against a wall and to be only a few feet deep. The entire garden was still covered with volcanic ashes when I saw it. I also spent an afternoon in the stricken region on the southern slope of Vesuvius, in Torre del Annunziata, Boscotrecase, Boscoreal and Pompeii. Here I found beds of smoking lava and quantities of ashes from the April eruptions. Huge pine trees (*Pinus sylvestris*) had been uprooted and carried along in the lava streams, and the leaves of all evergreen trees had been killed by the showers of hot ashes; but the foliage of fruit trees and of various herbaceous plants in the very extensive fields and gardens of this region was apparently uninjured. Had the eruption occurred a month or two later, the calamity would have undoubtedly been much greater.

The botanical garden at Rome is simply a large grove, containing several species of trees. It is situated just south of the Coliseum and is used as a public park. An interesting floral display, called the *Battaglia di Fiori*, took place while I was in Rome, in a beautiful park adjoining the Borghese villa. Thousands of people of all classes, armed with numerous roses, lilies, tuberoses, pinks, pansies, etc., joined in the struggle, pelting each other with flowers and leaving the ground strewn with the broken remnants and the air laden with their perfume.

Botanical work at Florence is largely under the control of the Central Botanical Society. The museum, herbarium and laboratories, which are quite extensive and well equipped, are now being enlarged and rearranged. Dr. Baccarini, the director, kindly placed the fungus collections at my disposal and pointed out to me various interesting specimens among the collections of living plants. Florence abounds in beautiful parks and tree plantations, in many of which the oriental plane tree has a prominent part. At the time of my visit, about the middle of June, this tree was just recovering from the attack of a fungus (*Gloeosporium*), which kills the young twigs and renders the tree unsightly for a few weeks, but does not usually appear to injure it seriously, unless it is already weakened in some way. Little attention is paid to the fungus by the Italian people, who are more distressed by the "Platanus cough," due to the irritating hairs that fall from the young leaves, and by the glare of the hot spring sun, which the tardy foliage of the plane tree does not serve to ameliorate.

In passing through Italy in summer, one cannot fail to be impressed with the high percentage of land under cultivation. Except on the Campagna, where hay fields abound, and in the higher parts of the Apennines, where the soil and temperature are forbidding, the whole country is practically one vast garden and orchard combined, with a succession of mulberry, olive, and cherry trees, garlands of grapevines, rows of corn, plats of wheat and clover, and other cultivated herbaceous plants of various kinds. The trees are pollarded and kept for shade as well as for the fruit, leaves, wood, etc. They also furnish a support for the grapevines and for the corn fodder when it is gathered.

The slopes of the Apennines are in many places covered with groves of the famous Italian chestnut, all carefully tended. The trees are often attacked at the base of the trunk by an interesting fungus (*Polyporus frondosus*), which is thought to do consid-

FIG. 32. The cryptogamic herbarium connected with the Jardin des Plantes at Paris.

erable damage, but the peasants are so fond of eating the fungus that they will not report its presence lest preventive measures be taken by the government.

Irrigation is practiced extensively and effectively in Italy. The swollen mountain streams are conducted by devious and complicated channels through the lowlands until entirely exhausted or greatly diminished in volume. In the absence of rivers, wells are used as the source of water supply.

The native fruits that one finds in Italy in early summer are chiefly cherries, very large and of excellent flavor, strawberries, both wild and cultivated, apricots, a few oranges, and a native fruit resembling a plum in size and color, but containing several large seeds. A little later in the season, prickly pears, grown on the old lava beds of Vesuvius, are sold on the streets of Naples.

From Florence I went to Trient, in the Tyrol, to study the splendid private herbarium of Abbé G. Bresadola. This noted mycologist was born and educated in the Tyrol, and most of his work has been done in the vicinity of Trient. The mountains about Trient, however, are steep and the excursions for specimens necessarily long and laborious; so he has been accustomed for the last five years or more to go up to Mendel Pass in the month of August for the rich and very accessible collections to be made there. It was on the Mendel that I first made his acquaintance.

The remainder of the year he lives simply in a small house adjoining the famous old cathedral of Trient, where he conducts the usual daily services of the cathedral and devotes what time he can spare from his confining religious duties to the study of mycology.

Bresadola is a great linguist, having learned Italian, French and German in childhood and acquired Greek and Latin at school. He reads English easily and once attempted to learn to speak it, but was staggered by the pronunciation. Like Chaucer's priest, he has spent much on books and is well versed in the recent literature of mycology, receiving many separates from other workers and buying many that are not given him. His own publications have been in demand, but the lithographic plates have been very costly. For a man of his years — he will be sixty next February — he is wonderfully well preserved. Without using glasses, he sees remarkably well, and his memory is something extraordinary. I spent a very pleasant week studying with him the polypores in his herbarium. Many type specimens were examined, sent by the older mycologists, and many others were found to be authentically determined by comparison with material borrowed from other herbaria. His collection abounds in specimens sent by American mycologists for determination.

A beautiful Japanese tree, *Sophora japonica*, with foliage like that of *Robinia* and smooth green thornless branches is used abundantly on the streets of Trient for shade. The horsechestnut and oriental plane are less common. *Robinia* is there mixed with species of *Crataegus* to form a very effective hedge.

Paris, my next objective point, was reached from Trient by way of Milan and the newly-opened Simplon tunnel, with a short stay at the village of Zermatt, famous for its abundant and varied alpine flowers. The cryptogamic herbarium at Paris, located in

FIG. 33. The home of Dr. Patouillard, in Neuilly, a suburb of Paris.

the building adjoining the celebrated Jardin des Plantes, is especially rich in polypores from tropical America, including the types of Montagne and others. Dr. Hariot, the curator, extended me every courtesy. Here I found Mr. C. G. Lloyd at work upon the gasteromycetes. He has made Paris his headquarters for some time because of its central location: Kew, Leiden, Berlin, Trient, and other places of great importance to the mycological student can be easily and quickly reached from this point.

The Jardin des Plantes was founded by Richelieu for the study of plants used in medicine, under the direction of the King's physician. Buffon took charge of the garden in 1739 and remained there fifty years, during which time its extent and usefulness were largely increased. The menagerie was inaugurated by Bernardin de St. Pierre, near the close of the eighteenth century, and has remained an important and attractive part of the institution up to the present time. The natural history museum was organized in 1793, with the celebrated Jussieu, the founder of the natural system of plant classification, as its first botanist.

When my studies at the Jardin des Plantes were completed, I visited Dr. N. Patouillard, probably the most distinguished living French mycologist, at his home in Neuilly, one of the suburbs of Paris. His herbarium contains about 10,000 species of fungi, represented by over 30,000 specimens, many of which are types. He has also 3,000 or more original colored drawings, in which both gross and microscopic characters are accurately and artistically shown. Dr. Patouillard is a pharmacist; but he keeps his plants in a room adjoining the shop and works at them when he has opportunity. In August he leaves the business in charge of an assistant and goes to the mountains of France or Switzerland on a collecting trip.

From Paris I went to Berlin, by way of Cologne, and spent some time with Professor Hennings in the large mycological herbarium connected with the botanical garden there. Although a prolific writer, Professor Hennings seems almost overwhelmed with the immense collections of new material brought in from various parts of the world. His own types are numbered by hundreds, and the collection also contains much valuable material worked over by older authors. At Berlin I met Jaczewski, of St. Petersburg, a splendid, vigorous, versatile man, with whom I arranged important exchanges. Dr. Paul Magnus, professor of botany in the university of Berlin, showed me every possible kindness. With him I visited the new botanical garden in Dahlem to the south of the city, where most of the living plants from the old botanical garden, now used as a pleasure park, have been installed.

The site of the new garden was a farm only four or five years ago, so that all the trees are still young. The ground is slightly rolling, and on one of the elevations an Alpinum has been constructed at great expense, with stone brought from the various important mountain systems of the world. On the lower levels there is an extensive display of shrubs and herbaceous plants, arranged in geographical, systematic and biological systems. The conservatories, situated on the northern border of the

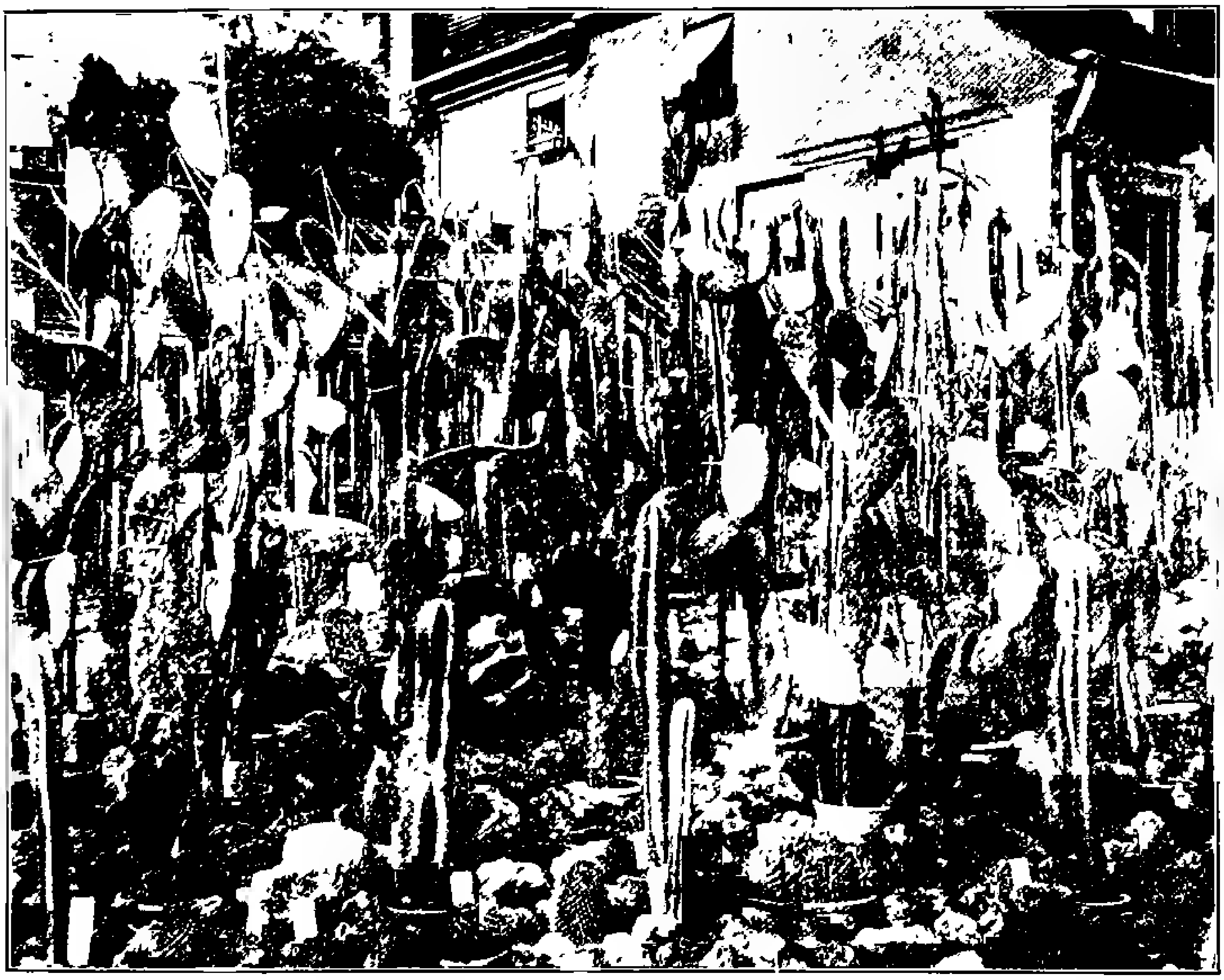

Fig 34. A cactus bed in the old botanical garden at Berlin, photographed before the plants were removed to Dahlem.

grounds, contain large collections, but the effects of removal are still evident. One of the most interesting plants to be seen in them is a specimen of *Chamærops humilis*, a palm common in Italy, brought to Berlin during the time of the Great Elector and now 25 feet high and over 250 years old. Gleditsch used this specimen to prove the existence of the fertilization process in plants, having produced ripe seeds upon it by dusting the flowers with palm pollen brought from Leipzig.

The garden is surrounded by a strong iron fence. Admission is free on certain days of the week, while on others it is to be obtained only by the purchase of one of the guidebooks on sale at the entrances. Dr. Engler, the director, and Dr. Urban, the assistant director, have beautiful villas near the west entrance, where the large museum building is situated. It is expected that the museum will be completed and the collections moved into it from their present crowded quarters in the old garden within the nextyear.

The trees of the Tiergarten, a large and beautiful park in Berlin corresponding to our Central Park, have been much improved during the last few years by careful attention to conditions of soil, moisture, light, etc. Unter den Linden, however, the center of the city's life and activity, remains decidedly unattractive in comparison with the beautiful avenues of many other cities, solely because of the motley arrangement and poor condition of its shade trees. It would be far better to cut them all down, renew the soil, and plant several rows of three or four of the best species, changing from one species to another at certain important corners.

I next made a rather hurried trip to Sweden and Denmark, stopping at Upsala, Stockholm and Copenhagen. Leaving Berlin early in the morning and traveling all night, I reached Upsala about noon the next day. In the absence of Professor Kjellman, Dr. Svedelius extended to me the freedom of the museum and allowed me to lack for nothing that could be of service in my work. The mycological collection at Upsala is of the greatest importance, since it contains and is based upon the herbarium of Elias Fries, the father of modern mycology. In addition to the specimens on sheets, there is a fine collection of fungi in bottles, arranged in cases with a black background. This method not only exhibits the specimens to advantage, but entirely eliminates the question of preserving them against insect attack. The present botanical garden contains many of the plants removed by Linnaeus from the old botanical garden, situated on the lowlands along the river, to his country home at Hammarby, and brought back to Upsala after the death of his son. The herbarium of Linnaeus, formerly housed in the little museum at Hammarby, is now to be found at the rooms of the Linnean Society in London.

At Stockholm I visited Romell, a very active mycologist with a large private collection of fungi, and arranged for the exchange of specimens in certain groups. Besides being well acquainted with Swedish fungi, he has worked considerably during the last few years with important collections at the Riksmuseum made in Brazil by the expeditions under Dr. Malme. These

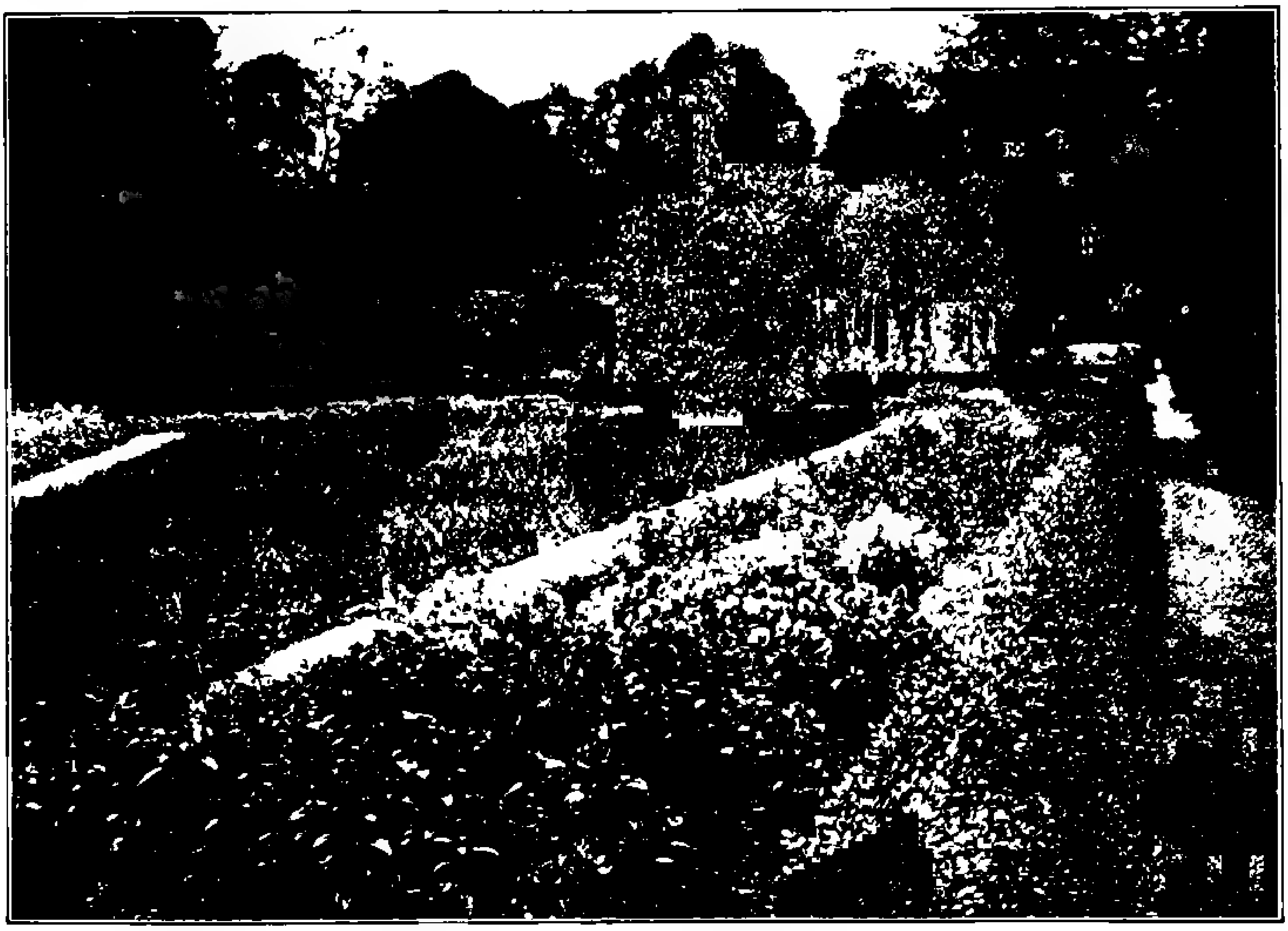

FIG. 35. The botanical garden at Upsala, with pansy beds in the foreground and hedges of Norway spruce in the rear.

collections, with the entire herbarium, are to be removed to the new botanical garden outside of the city when the museum now under construction is completed. The new garden is admirably situated and the plantations are already far advanced, under the able direction of Professor Wittrock.

The special object of my visit to Copenhagen was to examine the fungus collections made by Liebmann and Oersted in tropical America and described by Fries. Some of these descriptions were made from drawings and field notes only, and the types of some are no longer in existence; but I found several specimens of great interest not seen elsewhere. I also arranged with Professor Johannsen and Dr. Ostenfeld, at the latter's suggestion, to work over certain mycological collections recently made in the Danish West Indies. The museum is much too small for the large collections it contains, among them Professor Warming's Brazilian plants and an Arctic collection surpassing that of any other institution. The botanical garden is interestingly

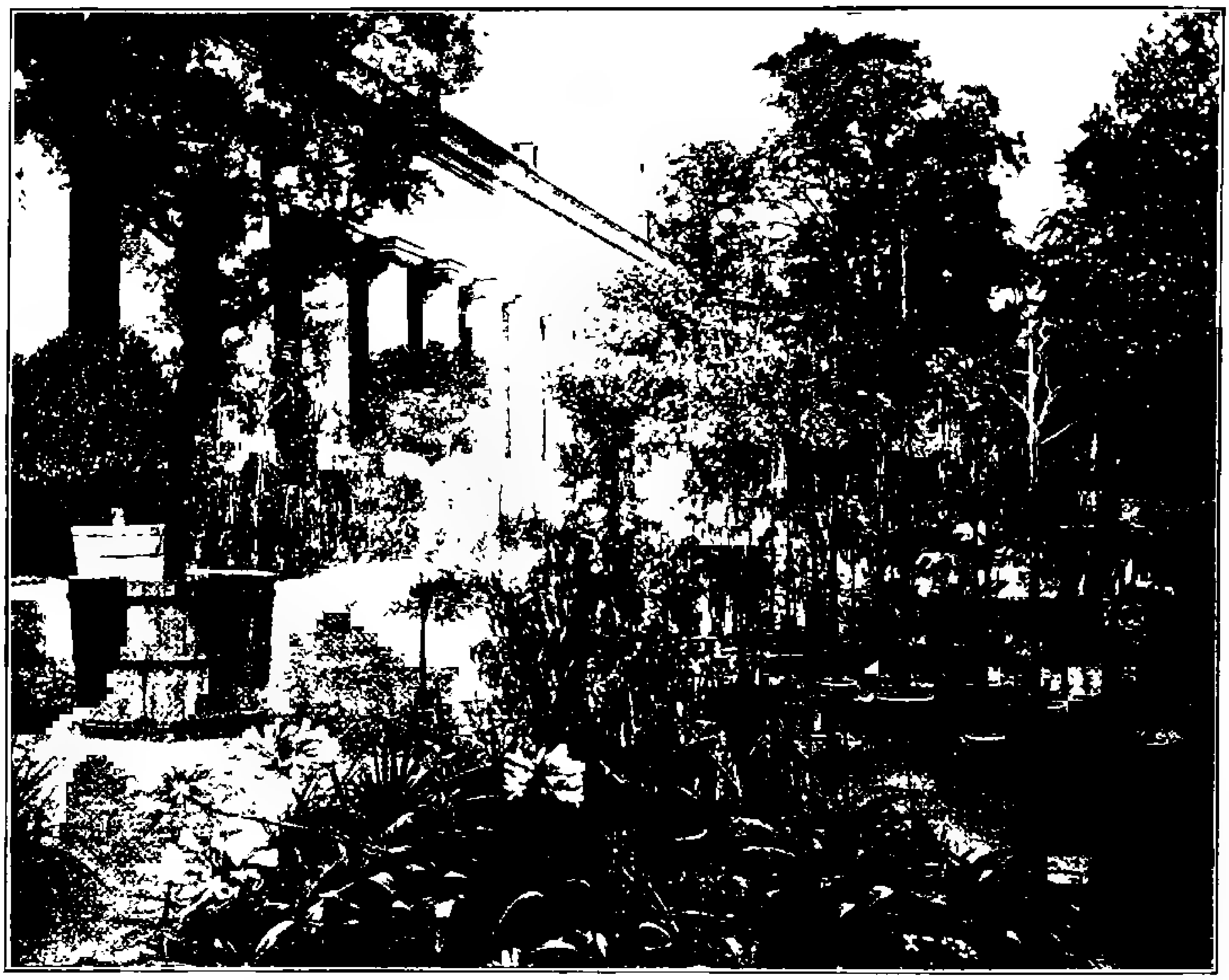

FIG. 36. The museum building at Upsala, as it appears from the south side.

situated on the old fortifications of the city, but, being within the city limits, it suffers considerably from smoke. Professor Warming, the director, was, to my regret, absent from the city at the time of my visit.

My next stop was at Leiden, in Holland, to see the Persoon herbarium. This herbarium was stored for a long time in old cupboards, and the few who saw it gained the impression that it was of little consequence ; but under Dr. Lotsy's direction it has, during the last few months, been put into shape and made available for study. The loose specimens have been poisoned and displayed in strong glass-topped boxes of various suitable sizes, and the sheet collection has been entirely renovated and arranged in a form convenient for reference. The specimens of gasteromycetes are especially fine, although pressed closely to the sheet ;

FIG. 37. A portion of the mycological collection in the museum at Upsala.

and the abundance of the Clavariaceae reflects the long and critical study of this group made by Persoon. Many of Léveillé's specimens of fungi are to be found here, but few are named. Indeed, the percentage of undetermined or questionably determined fungi in the entire herbarium is very large. My thanks are especially due Dr. Lotsy and Dr. Goethart, who aided me in every possible way and made my stay at Leiden very delightful as well as very profitable. In fact, the attractions at the Ryks Herbarium were so great that I spent much less time than I had planned to spend in the charming botanical garden a short distance away.

A short journey by rail from Leiden through the attractive tulip and hyacinth plantations in the environs of Haarlem brought me to Amsterdam, where I visited the small, but well stocked and well kept, botanical garden. Professor de Vries, the director, being in America at the time, Dr. van Laren very kindly showed me through the grounds and conservatories. A fine old tree of

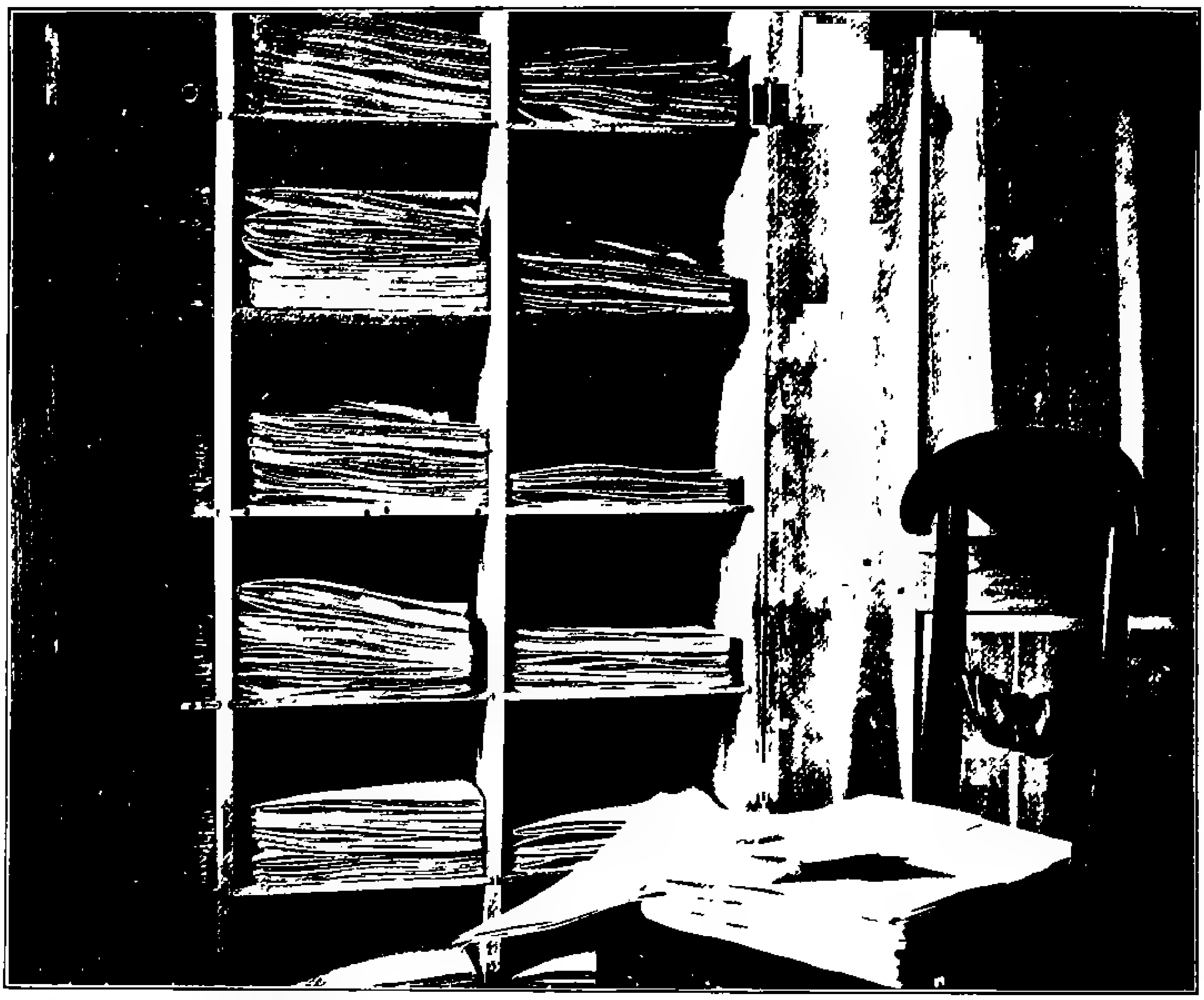

FIG. 38. A portion of the mycological herbarium of Elias Fries, in the museum at Upsala.

Dracaena Draco was seen, reaching to the roof of one of the houses; also a cycad estimated to be 2,000 years old, allowing seven years for each new ring of leaves. The walls of the fern house, covered with rough cement and small irregular stones, are artistically decorated with numerous clusters of living ferns. At one end of the house, slag, colored to imitate lava, is used instead of the cement. Splendid specimens of *Victoria regia* were seen in the aquatic house.

The famous series of experiments in mutation started by Professor de Vries about twenty years ago, were shown me in a very interesting way by the young man who has charge of them. The plants are compactly housed in two adjoining enclosures, which together form a square, the whole being covered with wire netting. Here I saw *Oenothera gigas*, *O. rubrinervis*, *O. lata*, *O nana*, etc., all in perfect order and perfectly protected. The rust that attacks certain weak forms in America was not found here,

FIG. 39. The little museum at Hammarby, which formerly contained the herbarium of Linnæus.

but the young rosettes of *O. nana* were found to be attacked by an unknown fungus that causes the top leaves to wilt and die.

A small plantation of five-leaved clover, with some of the leaves pinnate, was of special interest to me, because I first learned of Professor de Vries' experiments with clovers while studying agriculture at college, as long ago as 1885. These experiments with economic plants, also, appear to have a decidedly practical bearing.

On July 29 I arrived in London and registered the next morning at the hall of the Royal Horticultural Society as a delegate to the International Conference on Hybridization and Plant Breeding, held under the auspicies of the society during the week beginning July 30. The many important papers presented at the conference, by such men as Bateson, Johannsen, Pfitzer, Druery, Tschermak, Rosenberg, Ostenfeld, Vilmorin and others, will be published shortly in the regular report: the hearty welcome extended by the members of the Society, the good fellowship among

FIG. 40. Kew Palace, Kew Gardens.

all who attended the meetings, and the several very attractive social features arranged by the officials and their friends will be long remembered by those who were fortunate enough to be present.

The Royal Horticultural Society originated in 1804 in a book shop in Piccadilly. It now owns a splendid hall near Westminster Abbey, costing a quarter of a million dollars, and a beautiful garden for experiments of various kinds with living plants; and it has a surplus in the treasury of a hundred thousand dollars. There are over ten thousand active members in the society and the annual income is about eighty thousand dollars.

Among the Europeans attending the meeting were Messrs. Lawrence, Wilks, Stapf, Elliott, Llewelyn, Tschermak, Bateson, M. Vilmorin, P. Vilmorin, Wittmack, Foster, Pfitzer, Druery, Prain, Hemsley, Massee, Nicholson, Fenn, Johannsen, Ostenfeld, Plate, Lotsy, Veitch, Blackman, Bunyard and Salmon. Hansen, Troy, Erwin Smith and myself represented the United States; Zavitz was there from Canada, and Sir Daniel Morris and Sir William Fawcett from Barbados and Jamaica.

On Tuesday evening the conference was entertained at dinner at the Windsor hotel by the Horticultural Club, of which Sir John Llewelyn is president. On Wednesday a special train conveyed the delegates to Burford, the beautiful country residence of Sir Trevor Lawrence, the president of the Society, where luncheon and tea were served, and the conservatories, especially famous for their valuable orchid collections, were thrown open to the guests.

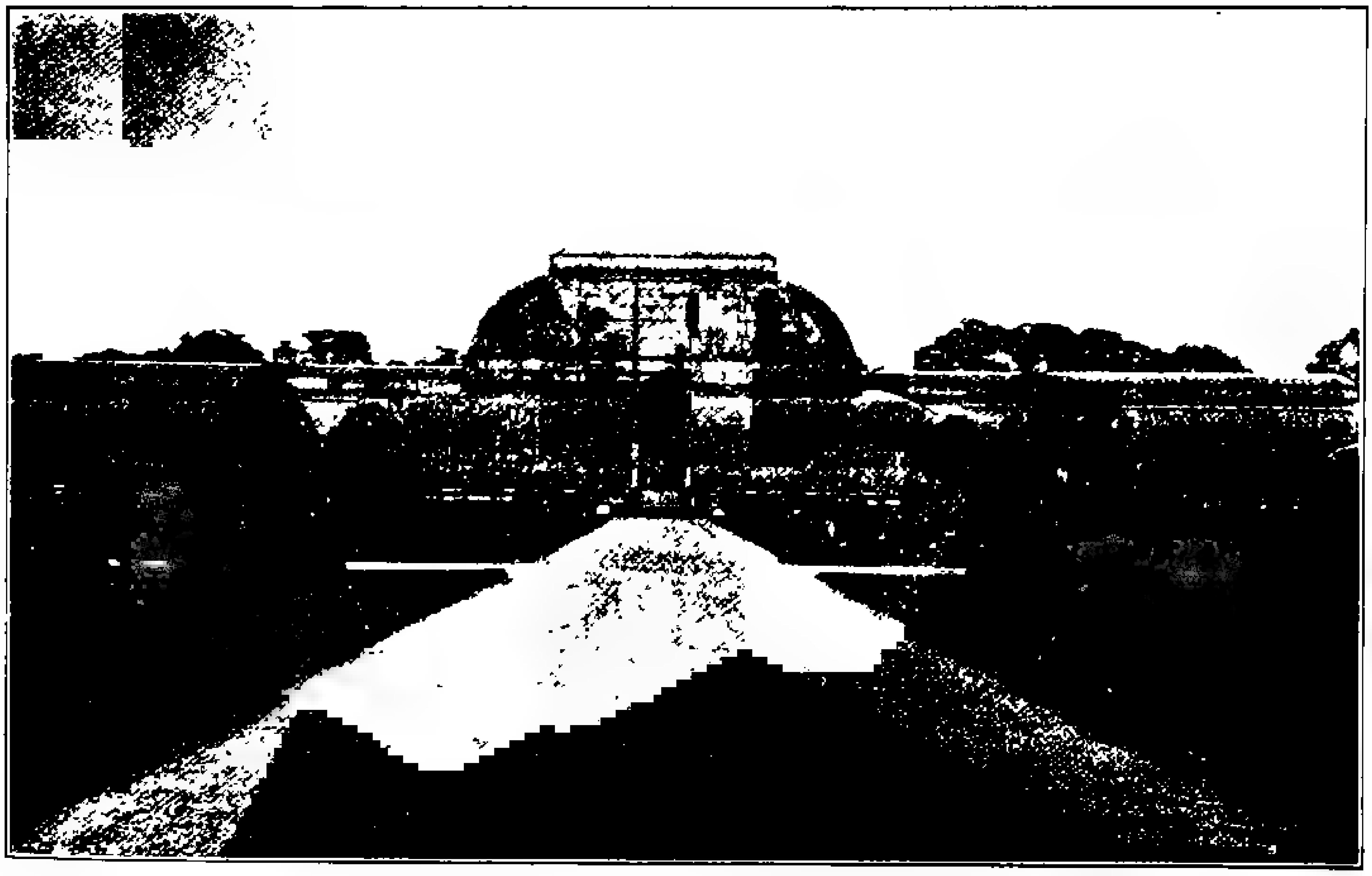

FIG. 41. The palm house in Kew Gardens.

On Thursday evening a banquet was held in the immense hall of the Society, with the customary toasts and responses. Medals were awarded on this occasion to Messrs. Bateson, Johannsen, Wittmack and M. Vilmorin.

On Friday the delegates were invited by Baron Rothschild to visit his home at Gunnersbury Park, famous for its splendid trees, spacious lawns and numerous ornamental shrubs and herbaceous plants. After luncheon and a stroll through the grounds, they crossed the Thames and spent the afternoon at Kew Gardens.

FIG. 42. A giant Cedar of Lebanon in Kew Gardens.

I spent about ten days at Kew, studying the celebrated fungus collections of Hooker, Berkeley, Curtis, Wright, Cooke and others, with special reference to American and Philippine material. Professor Massee, who has charge of this portion of the herbarium, showed me every kindness. Mrs. Murrill and I remember pleasant hours spent at his home, near the Gardens; and also at the home of Professor Hemsley, curator of the herbarium. The last two days of my stay in London I was the guest of Colonel Prain, the new director of Kew Gardens, whom I found thoroughly installed, with everything well in hand, and beloved by everyone.

The Royal Gardens at Kew, several centuries old and famous for their beauty and for their valuable collections, have been frequently referred to before in this and other botanical journals; while many of the methods there employed have found their way into the principal botanical gardens of the world.

Shortly before leaving London, I visited Dr. M. C. Cooke, the distinguished mycologist, at his home in Kentish Town, where he has lived for the last forty years. He met me at the door and gave me a hearty welcome. His cheerful voice, vigorous step, and firm round handwriting seemed hardly in accord with a busy life of eighty-one years. "Fungoid Pests of Cultivated Plants," a volume recently issued, lay on his table, while the shelves of his library were largely filled with numerous original works on a great variety of subjects. His eldest son, inheriting his father's artistic talent, is an illustrator for a well-known publishing house in London; his youngest child, a daughter, is the only one left at home. The best photograph of Dr. Cooke is to be found copied in a recent number of the Journal of Mycology; the original having been made about eighteen months ago by the royal photographer for a special series of scientific men.

My stay in Europe ended August 11, when I sailed from Liverpool for America, arriving in New York August 18.

Respectfully submitted,

W. A. MURRILL,
First Assistant.

NOTES, NEWS AND COMMENT.

Professor Raymond H. Pond, of the Northwestern University Evanston, Illinois, has been awarded a research scholarship at the Garden for six months, beginning October 1.

Professor F. C. Newcombe, of the University of Michigan, spent two days at the Garden in September.

Dr. Ira D. Cardiff, assistant in botany at Columbia University for the past two years, has resigned to accept the professorship of botany in the University of Utah, Salt Lake City, Utah. The botanical work there, formerly conducted under the department of biology, has been reorganized and a department of botany has now been established under the direction of Professor Cardiff.

Mr. Chester A. Darling has been appointed assistant in Botany at Columbia University. Mr. Darling is a graduate of Albion College, from which institution he received the degree of A.B., 1904, and A. M., 1906. During the past two years he has had charge of the science work at Defiance College, Ohio, which position he resigned to take up the work at Columbia.

Steam was turned on in the large conservatories for the first time this autumn on September 24, which establishes a record eleven days later than for any previous year in the history of the Garden. In 1903, heat was required as early as August 28.

Baron J. F. Nowack, of Vienna, recently arrived from Cuba with a thousand specimens of the "weather-plant" (*Abrus precatorius nobilis*), with which he proposes to establish a weather bureau in New York City in the near future. These plants are temporarily deposited at the Garden, where they are under observation. Several specimens of the same plant may be seen in the Garden conservatories.

Dr. Pehr Olsson-Seffer, of the Zacualpa Rubber and Coffee Plantation, Chiapas, Mexico, recently made a visit to the Garden on his tour around the world. Dr. Olsson-Seffer travels in the interest, partly of the Plantation, of which he is the botanist, and partly of the Mexican government. His aim is to study rubber-culture wherever most advantageous. He intends to visit the

Sandwich Islands, the Philippines, the Dutch East Indies, the Straits Settlements, Ceylon and other countries, on his tour, which is expected to last about a year.

The programme of lectures to be delivered this autumn in the lecture hall of the museum building, on Saturday afternoons at 4:30 o'clock, is as follows: October 13, "A Summer in Europe; Some Foreign Botanists and Botanical Institutions," by Dr. W. A. Murrill. October 20, "The Vegetation of the Florida Keys," by Dr. M. A. Howe. October 27, "How Plants Breathe," by Dr. C. Stuart Gager. November 3, "Coal: Its Origin and Development," by Dr. Arthur Hollick. November 10, "The Vegetation and Botanical Features of the Inaguas and Grand Turk, Bahamas," by Mr. G. V. Nash. November 17, "Recent Explorations in the West Indies," by Dr. N. L. Britton. November 24, "The Wild Nuts and Grains of North America," by Dr. H. H. Rusby.

These lectures will be illustrated by lantern slides and otherwise. They will not exceed an hour in duration.

The total precipitation recorded at the Garden for September, 1906, was 2.53 inches. Maximum temperatures were recorded of 91° on the 9th; 95° on the 10th; 96° on the 19th; and 75° on the 28th: also minimum temperatures of 48° on the 3d, 5th, and 16th; and 53° on the 24th. The mean temperature for the month was 72°, which was 11.4° above the normal for the State for September, and 5.2° above the monthly mean for New York City for 1905, which was the highest in the State for that year, and 0.9° above the normal for the City.

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62 specimens of hepatics from Costa Rica. (Collected by Mr. William Maxon.)

1 specimen of *Crataegus* from Vermont. (Given by Mr. W. W. Eggleston.)

2 museum specimens from Georgia. (Given by Dr. R. M. Harper.)

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VII NOVEMBER, 1906 No. 83

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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JOURNAL

OF

The New York Botanical Garden

VOL. VII. November, 1906. No. 83.

RECENT EXPLORATIONS IN JAMAICA.

TO THE SCIENTIFIC DIRECTORS,

Gentlemen: — By permission of Mr. D. O. Mills, President of the Board of Managers of the Garden, I devoted the period between August 25 and October 1 to botanical exploration in the island of Jamaica, taking advantage of the kind invitation of the Hon. William Fawcett, Director of the Public Gardens and Plantations, to visit the island. I was accompanied by Mrs. Britton, by Professor L. M. Underwood, Chairman of the Scientific Directors of the Garden, and by Miss Delia W. Marble. Professor Alexander W. Evans of Yale University and his assistant, Mr. Nichols, were with us part of the time.

Although much is known of the flora of Jamaica, considerable areas of the island have been only imperfectly explored, and some of the regions accessible only with difficulty and by the expenditure of much time, have not yet been visited by botanists. One object of the expedition was to determine upon the most practicable plans for reaching these unexplored regions, the most noteworthy of which are the so-called Cockpit Country, in the west central part of the island, and the John Crow mountains at the extreme eastern end.

We spent a week in the eastern edge of the Cockpit Country, centering at Troy and at Balaclava, under the guidance of Mr. William Harris, Superintendent of Public Gardens and Plantations of Jamaica, who had previously made several trips to this

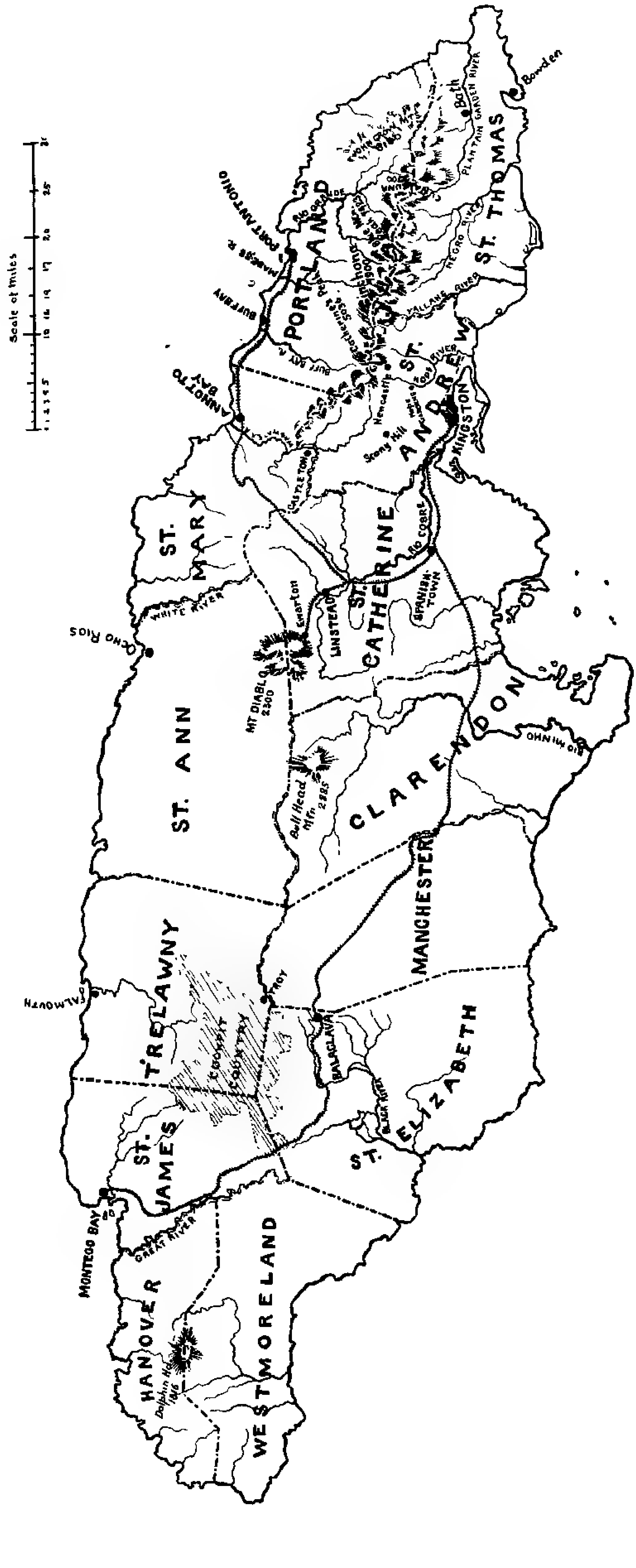

FIG. 43. Map of Jamaica.

region and penetrated farther into it than any other botanist had been able to do. During these trips he has made extensive botanical collections, including many species of trees and shrubs new to science; his work of collecting has been carried on for several years in coöperation with the Garden, and we have received from his department a complete series of all the plants secured; he led me to many of the novelties found by him, and we secured additional specimens of them; we also detected a number of other new species, including some of great interest. The region is a very rough one physiographically, consisting of a very porous limestone eroded into characteristic hills and deep hollows, the ragged edges of the rocks making passage through it, except on the few roads and trails, exceedingly difficult and necessarily slow to avoid dangerous tumbles; it has a general elevation of some 2,000 feet above the sea, its highest hills said to reach 2,700 feet, and its climate is delightful; naturally, it is very sparsely populated; we concluded that its complete exploration could only be accomplished by means of a pack-train and camp outfit, using existing trails and penetrating laterally from them as far as possible on foot; there is no doubt that this method would bring out many additional novelties, as the distribution of plants there is very local, and I hope it may be accomplished before some of them are lost to science by the somewhat irresponsible cutting of timber which is now going on.

A week was given to collecting in the higher portions of the Blue Mountains, using Cinchona, the Garden's subtropical station and laboratory as a base, and the party enjoyed while there the delightful hospitality and kindly aid of Mrs. William Fawcett, wife of the Director of Public Gardens and Plantations. Expeditions were made to the summit of Sir John Peak, the second highest mountain of the range, along a trail recently cut out by means of contributions of students who have used the laboratory, which opens up a surprisingly interesting tract of mountain forest at altitudes of 6,000 to 7,000 feet. Here the bryologists of the expedition revelled in the wealth of rare mosses and liverworts which clothed the tree-trunks, the shrubs and the ground, forming cushions and festoons of entrancing beauty; in spite of a tropical down-pour of rain, which finally drove us to shelter in hut three or four miles from the summit where a fire and h coffee soon made everybody cheerful, and the return to Cincho was made without incident and the collections safely house John Crow Peak, a much better known mountain of 6,000 fe altitude, was also visited, and extensive collections made the and at lower altitudes.

The buildings and grounds at Cinchona, leased by the Gard from the Jamaican government in 1903, for use as a subtropic station and laboratory have been repeatedly described ; I ha not visited them before, however, and was naturally much inte ested in examining the establishment, which is all that is nece sary for the purposes ; the buildings have been kept in rep and the grounds in good order by the Jamaican governme Professor Underwood will present to you a detailed report on t work hitherto accomplished by students at Cinchona, togeth with considerations relative to the future of the station. A vi of about three days was made to Hollymount, near Mou Diablo in the central part of the island, where collections we made, and, under the guidance of Mr. Harris, I was able to stu and collect at several points in the vicinity of Kingston, in t part of the island which has the least rainfall, and where ca abound. Through his collections and my own we have now s cured living specimens of all the cacti known to grow in Jamaic except one small and little known species ; this is a *Mamillar* accredited to Jamaica by Linnaeus, but not found there in ma years ; it is especially interesting as the type of the genus *Ma illaria*, mostly globose plants, so rich in species in Mexico and the arid portions of Arizona and New Mexico : I greatly desir to rediscover it, having found the related species *Mamillar nivosa* on Culebra Island, Porto Rico, last spring, and hope th the Jamaica botanists may yet run across it. The largest Jamai cactus is the plant known as *Cereus Swartzii.*

The Jamaica palms were also made a subject of special stud and I was fortunate in being able to see nearly all the kin known and to collect herbarium specimens ; seeds and you plants of several of them were also obtained ; the most remar able of them is a fan-thatch species, presumably of the genus *Thrinax*, abundant in the woods covering the limestone hills about Hollymount, which reaches a height of 50 feet with a trunk only about 6 inches in diameter; its flowers and fruit are unknown to botanists, and are apparently produced only sparingly and at long intervals; examination of several hundred trees failed to reveal them, and other botanists have had a like experience, but the old fruit-stalks seen on several trees prove that they do occur at times. Another very interesting species of *Thrinax* grows in great quantities at the mouth of Priestman's River at the extreme northeastern part of the island; this is a small tree, none seen by us being over 15 feet high, having large clusters of stalked milk-white fruits nearly half an inch in diameter. The largest native palm on the island is the cabbage-palm, the trunk of which sometimes reaches a height of 100 feet; the royal-palms of Cuba and Porto Rico do not grow naturally in Jamaica, but are freely planted for ornament. In order to study the plants of the wettest part of the island we traversed the region from Port Antonio eastward to Priestman's River, fortunately on a day with insignificant rainfall; this brought us to a view of the John Crow Mountains, the other region which I have referred to as least known botanically, but we did not get within five or six miles of the range; inquiries indicate that the pack-train method will be the only satisfactory way of exploring them.

Parts of several days were spent at the public gardens at Hope, in studying the plantations and herbarium; Mr. Harris very obligingly gave us great assistance here, allowing us to prepare and pack all our collections, and arranging for their shipment; and to this coöperation much of the success of the expedition is due.

In addition to its function as a public garden and park, Hope is a very important center of botanical and horticultural investigation, serving also as an agricultural experiment station.

The public garden at Castleton located near the center of the island was also visited and the plantations studied with much interest and profit; this is in a very wet region, permitting the growth of very many plants not adapted to the much drier climate at Hope; and a very notable collection of economic tropical trees from all parts of the world has been brought together here, including probably the most complete series of palms to be found anywhere in America, all in fine condition.

The collections of prepared specimens and of living plants made during the expedition include about 1,600 numbers, aggregating some 5,000 specimens, and are an important addition to our representation of West Indian species, the duplicates being available for exchanges; some valuable plants from the gardens at Hope and at Cinchona were also obtained.

Our thanks are gratefully tendered to His Excellency Sir Alexander Swettenham, Governor of Jamaica, to the Hon. William Fawcett, Director of Public Gardens and Plantations, and to Mr. William Harris, Superintendent of Public Gardens and Plantations.

Respectfully submitted,

N. L. BRITTON,

Director-in-Chief.

A REPORT ON THE CONDITION OF THE TROPICAL LABORATORY.

TO THE BOARD OF SCIENTIFIC DIRECTORS,

Gentlemen: — It is now just ten years since serious agitation was first aroused among American botanists relative to a tropical Botanical Laboratory. Commencing in November, 1896, the Botanical Gazette published a series of editorials on the subject* and a commission was appointed to consider Jamaica with special reference to such an establishment, two of the members of the commission actually visiting the island early in 1897. For various reasons the interest waned, and no further steps were taken until, in response to the suggestion of the present writer,† the

* Botanical Gazette, 22: 415–416, 494–495. 1896; 23: 47–48, 126–127, 202–203. 1897. *Cf.* also letters on the subject in the same journal, 22: 496–497. 1896; and 23: 50–51, 54, 129, 207–208, 291. 1897.

† *Cf.* JOURNAL N. Y. BOT. GARD. 4: 109–119. 1903.

buildings at Cinchona were leased from the Jamaican government by the New York Botanical Garden for the period of ten years from August, 1903, and thus an outfit practically ready for occupancy was secured where American botanists could take advantage of all needed facilities for tropical work under the most favorable circumstances.

Cinchona takes its name from the extensive plantations of that tree which were installed by the Jamaican government over forty years ago with the intention of producing its drug on a commercial scale. So far as leased by the Garden, Cinchona consists of a six-room house with accessory kitchen, store-room, and stable, three office buildings suitable for dormitories and capable of housing eight or ten people in addition to the house proper with its four large sleeping apartments, two low green-houses sufficient for cultivation under glass of such plants as require more moisture than that afforded by the outside atmosphere, and two laboratories large enough to accommodate nearly a dozen workers. These buildings form the greater part of the government experiment station established in 1874, which under Sir Daniel Morris (1879–1886) and later (1886–1897) under the Hon. William Fawcett was the residence of the government botanist and the center of botanical work in the island. The physical, climatic, and floral conditions at Cinchona, as well as the sanitary conditions of the location, demand attention as forming the real basis for recommendation as a tropical laboratory where students accustomed to a more temperate climate may desire to study for a longer or shorter period. These may be summarized topically :

1. *Location.* — Cinchona is located on a spur of the Blue Mountain range on the southern (xerophytic) exposure at an elevation of 4,950 feet above the sea. It is most easily reached from Kingston *via* Gordontown which is connected with Kingston by one of Jamaica's splendid carriage roads, and from which two good bridle paths lead to Cinchona either over Content Gap or past Guava Ridge. A driving road from Buff Bay on the north coast reaches Silver Hill Gap seven miles from Cinchona and is in process of construction to Chestervale three miles nearer.

2. *Climate.* — A daily record of the temperature, condition the atmosphere, and rainfall, has been kept for the past twent five years, and from the published data we learn that the tempe ature ranges from about 47° to 74° F., rarely exceeding the limits. The rainfall is about 50 inches, being of course mu less than on the northern slope of the range where it loca reaches 100–200 inches, though much more than at the real xerophytic portion of the island in the vicinity of Kingston. general, the month of May and some part of the period fro September to November include the principal rainy seasons s called.

3. *Sanitary Conditions.* — For ordinary domestic purpose rain-water, accumulated in three large cisterns, furnishes an ac quate supply. For drinking purposes and for cooking, water brought from the source of the Clyde river which forms here large limpid brook rising about six hundred feet below Cinchor This water is cold, clear, and as nearly absolutely pure as natu water derived from the earth could possibly be. There being residence other than Cinchona higher than the sources of t stream and no cultivation even above its watershed, there a absolutely no sources of contamination.

From a residence at Cinchona at three different periods of t year, January-February, 1903, April, 1903, and September, 190 the writer can personally testify as to the healthfulness and desi bility of the location. When we add to an ideal climate, the ru ged mountain scenery of Jamaica which is spread out in eve direction, with the harbor of Port Royal and the golden Caribbe nearly a mile below, the magnificent and ever-changing clo effects, now above, now below the observer — and about him well-ordered tropical garden (still maintained as a public gard by the Jamaican government), with tall *Eucalyptus*, *Grevill* *Juniperus* and *Podocarpus* trees, with tree-ferns and many oth tropical plants, and with a wide variety of magnificent rose bush blossoming at every season, we have a picture where "eve prospect pleases" and where every feature appeals to the esthet sense and contributes in a marvellous degree to the real pleasu and contentment of living.

4. *Flora.* — The botanical features of Jamaica are very rich and diversified. In 1893 Mr. Fawcett compiled a list of Jamaica plants largely from Grisebach's Flora of the British West Indies (1864) which enumerated about two thousand species of seed-bearing plants. To this list the persistent field work of Mr. William Harris has added nearly a fourth more. As is well known, the ferns and their allies form an unusual ratio to the seed-bearing plants and Jamaica possesses more species of these groups than any other equivalent area of the entire world. These were studied by the late Mr. Jenman, whose collection became the property of the Garden in 1903. With the later additions made to Jenman's work the number of species exceeds five hundred, or perhaps one-sixth of the higher flora, and at least two-thirds of these are found within a radius of ten miles with Cinchona as a center. The mosses are abundant and some grow in the greatest profusion in the higher altitudes; they have only recently been studied with any degree of thoroughness. The same may be said of the hepatics, of which probably a greater number exist than of the true mosses. Lichens are abundant and have been only partially studied. The algae which swarm in the tropical waters of the coast have been partially collected and have been listed by Mr. F. S. Collins, yet this group awaits further study. Of all the groups of plants the fungi alone seem to be deficient in number of species as compared with temperate regions, although no very serious mycological work has yet been done in the island. Within easy reach of Cinchona we find abundance of original forest conditions. Naturally shrubs and trees form the larger portion of the terrestrial element of the higher plants, while epiphytic bromeliads, orchids, and aroids, parasitic Loranthaceae and succulent Piperaceae and Urticaceae exist in great profusion. The Eusporangiate ferns are represented by *Marattia* and several species of *Danaea*, and by three genera of Ophioglossaceae; six species of Gleicheniaceae form thickets at the higher elevations wherever land had once been cleared; the moist woods beyond the divide abound in numerous representatives of Jamaica's large array of endemic tree-ferns, and filmies (Hymenophyllaceae) are found on every

bank, log and standing trunk, while epiphytic species of *Polypodium* and *Elaphoglossum* appear in bewildering variety, especially in the elevations above five thousand feet. Along the single trail from Cinchona to Morce's Gap (three miles), over one hundred species of ferns can be seen without leaving the bridle-path.

Since the laboratory at Cinchona was leased by the Garden some sixteen persons have made studies at Cinchona. The writer spent two periods of several weeks each at Cinchona just prior to the date of the lease, making a study of the ferns; on the second visit he was accompanied by Mr. William R. Maxon of the U. S. National Museum, and by Dr. Johnson and Mr. Forrest Shreve from Johns Hopkins University. During the summer of 1903 Dr. D. T. MacDougal visited the station and accomplished the formal leasing of the property for the Garden.

The later students at the laboratory are as follows:

1903. Professor A. W. Evans, of Yale University, made extensive collections of the hepaticae. He was accompanied by one of his students, Mr. George E. Nichols, who made collections of the higher flora.

1904. William R. Maxon, of the U. S. National Museum, spent some time studying the ferns of Jamaica. Miss W. J. Robinson, instructor in Vassar College, spent several weeks studying the early stages of certain filmy ferns.* Miss Mary M. Brackett, of Wadleigh High School, remained during the same period, making a study of the embryology of certain Loranthaceae.†

1905. Clara E. Cummings, professor of botany in Wellesley, spent several weeks investigating the lichen-flora of the region. She was accompanied for a part of her stay by Martha E. Merrow, botanist of the Rhode Island Agricultural College. Later in the season and continuing until the late spring of 1906, Dr. Forrest Shreve, of Woman's College, Baltimore, was in

* For Miss Robinson's impression of Cinchona, *cf.* Jour. N. Y. Bot. Garden 5: 187–194. 1904.

† A popular account of Cinchona experiences is given by Miss Brackett in *The Plant World* 8: 6–12, 29–31. 1905.

charge of the laboratory and engaged in a variety of ecological and morphological studies.*

1906. Professor D. S. Johnson, of Johns Hopkins University, accompanied by two graduate students, spent some weeks at Cinchona continuing his morphological and embryological studies, especially in the Piperaceae and the Chloranthaceae. Of his students, Mr. I. F. Lewis made a study of the fresh water algae of the Blue Mountain region, collecting about fifty species representing thirty genera, of which sixteen had not hitherto been reported from the island; and Mr. W. D. Hoyt made a study of the prothallia of the Hymenophyllaceae and *Psilotum*.

Later in the season Professor A. W. Evans, of Yale University, made further studies of the hepaticae, and his assistant Mr. George E. Nichols made a study of the distribution of the mosses of the region. Both these gentlemen were in residence at Cinchona when Dr. Britton accompanied by Mrs. Britton and Miss Delia W. Marble and by the present writer made a short visit to Cinchona, of which Dr. Britton has given a fuller account in the present number of the JOURNAL. Of the sixteen botanical students that have made use of the laboratory at Cinchona, six have already made a second visit.

Already the success of the laboratory at Cinchona has justified the wisdom of the selection of this site for a laboratory. In leasing the grounds and buildings the Garden has done all that could be reasonably expected of a single institution. A well-ordered tropical laboratory is open to American botanists, easily accessible, delightful as a place of residence, surrounded by a most magnificent tropical flora offering problems without limit, and a wealth of botanical experience is now attainable by American students at a minimum expense, unattended by the ordinary discomforts and dangers common to tropical lands. If American botanists and botanical teachers really want the advantages of a tropical botanical laboratory, they now have it in their power to coöperate to make Cinchona as profitable a botanical Mecca as the famous old-world laboratory at Buitenzorg.

LUCIEN MARCUS UNDERWOOD.

COLUMBIA UNIVERSITY, October 1, 1906.

*A brief report of Dr. Shreve's work may be found in this JOURNAL, 7: 193–196. 1906.

COLLECTING IN THE MOUNTAINS WEST OF SANTIAGO, CUBA.

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Sir: — Acting under your instructions, I left New York on the eighteenth of August for the Island of Cuba, accompanying Professor B. E. Fernow, who went for the purpose of making a forestry survey of the mountains west of Santiago. My best thanks are due Dr. Fernow for his great kindness and consideration, as well as for many practical suggestions in the field.

Arriving in Havana on the morning of the twenty-second, the Botanical Garden and University were visited; and also numerous lumber yards, so that we might become somewhat more familiar with the native woods. In the evening we left for Santiago, getting there early on the morning of the second day. Here, with the kind assistance of Mr. E. A. Whiting, we procured the necessary camp outfit, with the exception of a tent, which it was impossible to get. In the afternoon, the Museo y Biblioteca was visited, where much was learned of the Cuban woods and their rather confusing local names.

On the twenty-fifth we left for our real destination. Steaming out of the now historic harbor of Santiago, we turned to the west and cruised along the coast where the Spanish fleet was destroyed. Some forty miles to the westward we came to Chiriviquo, which was to be our headquarters for the rest of the expedition. The second floor of an old abandoned store-house, one of the two buildings in the place, made a very comfortable and tolerably dry spot to store the outfit.

Before giving a detailed itinerary of our various trips, it will render such an account more intelligible to describe some of the general features of the property.

The portion of the Sierra Maestra visited is a tract facing the Caribbean Sea and stretching from the Sevilla River on the east, some forty miles to the Peladeros, its western extremity. Its northern line is approximately the back-bone or ridge of the Sierra Maestra. This great mountain chain is considerably farther from the coast at the eastern than at the western end of the property, but, gradually converging and continuously rising in altitude, it reaches its culminating point near El Turquino, which is readily visible from the sea. It must not be inferred from this that there is a gradual descent from the ridge of the Maestra to the coast. In reality there are numerous spurs, smaller mountain-chains, and various collections of good-sized foot-hills, which in some places altogether shut off the view of the main range, and in all places make the country exceedingly precipitous and difficult to travel.

This heterogenous group of mountains is cut up by numerous rivers, the principal ones being the Sevilla, Guama, Rio Grande, Bayamita, Ubero and the Peladeros. Of these the Sevilla, Guama, Bayamita and Peladeros take their rise in the Maestra itself, while the rest, together with some others with uncertain local names, rise in the front ranges.

The Guama is one of the largest, and at the same time one of the most typical of the general river systems of the area. At this season it disappears about two miles from the sea and flows under the ground. During the rains, however, it flows in the normal bed, and becomes sufficiently deep and swift to make it quite impassable to man or horse. At its mouth the river basin is a mile or more across and the delta of the river has dissected it into numerous islands. These are truly islands only during the rains, being merely patches of land cut out by various branches of the stream at the time of our visit. This comparatively broad river basin runs back into the interior scarcely more than three miles, when it narrows down and the whole character of the country changes. The mountains come down very sharply to the river's edge, so that the stream appears to run between two great sloping walls. One can get an idea of the meandering only by viewing it from a height, where its struggles to make its way through this chaos of mountains can be traced with some degree of accuracy. These steep river sides are cut up by many cañons, at the bottom of which one usually finds a mountain torrent.

The frequent occurrence, both in the mountains and in the river beds, of gigantic boulders of granite, add amazingly to the rugged aspect of the landscape, and incidentally to the difficulty of travel.

The climatic conditions can scarcely be discussed in such a short report, but there are two rainy seasons, one in April and May and the other in October. The wind, as in the other West Indies, is the prevailing Northeasterly Trade, and, coming as it does across the lowlands of the island, it deposits great quantities of moisture on the windward side of the Maestra. This may account for the dryness that we everywhere encountered, as long as we were in the lee of the mountain range. At this time the drought was particularly noticeable, as all the lower mountains and hills were carpeted with a bed of dried leaves.

After spending two or three days in the vicinity of Chiriviquo, learning the principal trees from our guides, we started on our first trip, which was to be an ascent of the Guama river. Along the coast there is a trail accessible to horses; but after leaving the coast line this trail disappeared. By cutting our outfit down to the essentials, however, it was possible to transport it in packs each of us carrying one; and this we did for the remainder of the expedition. Our first stop was at a point only about two miles from the shore, where the plants particularly representative of the lower river basin were collected. This might almost be considered xerophytic in character, such plants as ferns, Araceae, Piperaceae and other moisture-loving plants being absent. From here we pushed on up the river until we were seven or eight miles from the sea; and, making a favorable camp on the river bank, we made various excursions into the neighboring mountains. The collecting, however, was disappointing, as the slopes were almost completely covered with *Oxandra virgata* and a species of *Calyptranthes*. There were also some trees of the Spanish Cedar (*Cedrela odorata* L.) and Mahogany (*Swietenia Mahagoni* L.), with the ever-present *Cecropia* and *Spondias lutea*. An interesting species of *Equisetum* was found in the river bed, and a balanophoraceous parasite (*Scybalium jamaicense* Schott &

Endl.) was seen growing on the roots of *Cassia emarginata* L., at an altitude of 2,100 feet.

The first real cañon we visited presented a profusion of epiphytic and tree ferns, orchids, and other moisture-loving plants; the change from the dry slopes being very sudden and very pleasing.

Unfortunately the country at this point became so rugged that it was impossible with our outfit to continue the exploration, at least Dr. Fernow did not feel justified in further attempting the ascent of the river; and I was thus forced to give up what would doubtless have been an excellent collecting ground after the higher altitudes were reached.

Returning to the coast we went on to the Rio Grande, where much the same conditions prevailed, the river being smaller and even more impassable than the Guama. Most of the time here was spent in collecting in a subxerophytic belt between the camp and the ocean. A single day only was spent at the Rio Grande, and then we started for the Ubero. On the way we crossed a mineral spring with a copious flow of hot, and very salty, water. Among the rocks of the sea beach, live specimens were secured of a branching *Cereus*, but no flowers or fruit could be found.

At the Ubero a somewhat longer stay was made and I had the opportunity of visiting two more cañons, but at this juncture an almost daily shower interfered with the collection and preparation of specimens. Without a tent, and on an expedition where only the merest handful of dryers could be transported, the work of drying plants was by no means easy.

On the return journey Dr. Fernow stopped to look over the Bayamita River valley, while I went through to Chiriviquo, to give the specimens some much-needed attention. Afterwards I visited a mountain some seven miles away and collected many interesting plants, among them *Pinus occidentalis*, which is common in a number of places on the leeward side of the Maestra, usually below 2,300 and above 1,000 feet.

On the morning of September 15, with the lightest possible outfit, we started for the Sierra Maestra. Going up the Sevilla as far as practicable, our guides branched off, and, travelling ridge after ridge, finally brought us to a point 3,500 feet above the sea, on the topmost ridge of the lower end of the chain. The collections that might be made here with a properly equipped botanical expedition would much more than repay the expense and difficulty of getting them out; for here the climate is very moist and the flora very rich. What might be found on the Turquino itself, or anywhere along the ridge or windward slope of the Maestra, can only be a matter of conjecture, but, judging from the glimpse we had, it would prove well worth the trouble. Only the most hurried visits could be made to the different peaks, as we were fitted out for only a four days' trip. On September the nineteenth we returned to Chiriviquo, having covered in the four days a distance of about forty miles.

No really comprehensive collection from this region was secured, but much valuable information was accumulated that will assist future explorers in the Sierra Maestra.

Leaving Chiriviquo on the twenty-third, and Santiago the next day, we arrived in New York on September thirtieth, having been absent just six weeks.

Respectfully submitted,

NORMAN TAYLOR.

PROGRESS IN CONSTRUCTION.

A contract for the construction of the rubble stone foot-bridge to replace the present wooden bridge crossing the Bronx River near the northern end of the hemlock grove, was awarded by the Commissioners of Parks on October 18, to M. J. Leahy for $11,000. This bridge will consist of five low arches, faced with large field stones selected mostly from old stone walls, which have been reserved for this purpose. The plans, prepared by Mr. John R. Brinley, landscape engineer of the garden, have received the approval of the Board of Managers, of the Commissioner of Parks for the Borough of the Bronx, and of the Municipal Art Commission. The contract time is one hundred working days. It is expected that some progress on the foundations will be made before the end of the year, but work will have to be suspended during the winter, so it is not expected that the bridge will be completed before May or June of 1907. Its length is 172 feet and its width 15 feet.

The necessary grading preliminary to the planting of the economic garden in the north end of the valley east of the museum building has been completed, and the planting itself has been commenced. The design of this plantation is to exhibit plants whose products are utilized in the arts, sciences and industries, and they will be grouped as food plants, drug plants, fiber plants, and plants yielding other useful products. The development of this portion of the grounds opens up the whole of the long valley, the southern and middle portions of which are already occupied by herbaceous plantations.

Much progress has been made during the autumn in laying the foundations for paths in various parts of the grounds, especially in the vicinity of the lakes northeast of the museum building, at the northeast end of the fruticetum, and about the economic garden. The grading and sodding necessary in establishing the grades of these paths has also been mainly completed.

NOTES, NEWS AND COMMENT.

Dr. N. L. Britton spent a few days during the latter part of October at the National Herbarium in Washington. He was accompanied by Mr. Percy Wilson.

Dr. J. K. Small left for Southern Florida on October 23, accompanied by Mr. J. J. Carter. Dr. Small will continue his important investigations of the flora of this region, which has already yielded so much that is new and interesting.

The regular bi-weekly conferences held at the Garden on Wednesday afternoons, alternating with meetings of the Torrey Botanical Club, were inaugurated for the present season on October 17, with "Recent Explorations in Jamaica," the principal speakers being Dr. Britton, Dr. Underwood and Mrs. Britton.

Volume 7, part 1, of the North American Flora, contribut
by George Perkins Clinton, appeared October 4. This part
devoted to the group of parasitic fungi popularly known as smı
(Ustilaginales), which is divided into two families, the Ustilag
naceae and the Tilletiaceae, represented in North America l
nineteen genera. The fascicle includes a host-index, with pa
references to the species treated.

Dr. Melville T. Cook has resigned his position as chief of tl
department of plant pathology of the Central Agricultural Expe
ment Station of Cuba. He expects to devote several months
studies at the New York Botanical Garden.

Mr. Norman Taylor returned on September 30 from a trip
the Sierra Maestra Mountains, near Santiago, Cuba. He accor
panied Professor B. E. Fernow, of Ithaca, N. Y., who went f
the purpose of making a timber survey of this region. Durir
a four weeks' stay in the mountains west of Santiago, collectio
were made for the Garden herbarium, together with some li
orchids and cactuses for the conservatory.

Dr. Arthur Hollick and Professor Edward C. Jeffrey continue
their joint field work in the Cretaceous deposits of the vicini
during the month of October, paying special attention to the li
nitic remains found at Kreischerville, Staten Island, which we
ascertained to be the best preserved for purposes of critical stud
Some of this material collected during the spring was taken l
Professor Jeffrey to England, where it aroused great intere
among the European palaeobotanists at the meeting of tl
British Association for the Advancement of Science held at Yo
last summer. A new species of *Pityoxylon*, or fossil pine woo
obtained from Kreischerville, was described by Dr. Jeffrey in tl
July number of the Botanical Gazette, under the name *P. state*
ense, and more recent examination of the accompanying materi
has shown that several other new species of pines are represente
in it.

The total rain-fall at the Garden for October was 5.81 inche
Maximum temperatures were recorded of 91° on the 9th; 9

on the 10th; 96° on the 19th; 75° on the 28th; and 56° on the 30th; also minimum temperatures of 48° on the 2d, 5th, and 16th; 53° on the 24th; and 41° on the 31st.

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Vol. VII DECEMBER, 1906 No. 84

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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Vol. VII. December, 1906. No. 84.

THE WILD GRAINS AND NUTS OF THE UNITED STATES.*

Several considerations have led to the selection of the nuts and grains, from among the many important classes of wild food-products of the United States, for association in this lecture.

As parts of the plant, these two products are closely related, both structurally and physiologically. The plants which produce them have a gregarious habit and the flowers of both are wind-pollinated. The latter are in both cases devoid of a true corolla and both are enclosed in an involucre of some sort. In both, also, the percentage of nutriment in the seed is very large and its quality is high. For this reason both are admirably adapted to human use as staple foods and have been so employed upon an extensive scale. In this particular, however, we take note of some important differences between them. The grains have been enormously used as staple foods by civilized nations, something which is just beginning to be true of the nuts. For this there are two reasons. The first is the obvious difficulty in separating the kernel of the nuts from the shell. The second is the fact that neither class, in the original wild state, possesses all the characters requisite in a food for the nations. In order that they shall acquire these characters, they must be improved by selection and breeding. This is a very simple matter in such plants as the grains, where the life of the generation is but one or

* Abstract of a lecture delivered at the New York Botanical Garden, November 24, 1906.

two years, but very difficult in that of the nuts, which require at least a human generation for the exhibition of any important effects of cross-breeding and other cultural improvements.

Let us now very briefly consider the structural relationships between the two classes. Both the grain and the nut are fruits and not seeds. Each contains a single seed, but the wall of the fruit (as to the ovary) does not open at maturity to provide for its escape. It is true that the outer portion of the chestnut, namely the bur, opens to discharge the nuts, but this bur is an involucre and not a part of the flower, each chestnut representing a separate flower. The hull of the hickory, which also separates into four parts, is by most botanists regarded as the calyx of the flower but it is not clear that it is not really a four-leaved involucre, like the chestnut bur, simulating a calyx merely because it surrounds but one pistillate flower.

However, these points in reference to the involucre do not interest us so much as questions relating to the fruit proper. This fruit, in case of the grasses, is a grain, known to the botanist as a *caryopsis*, the wall of the ovary being so tightly adherent to the seed as not to be readily separable from it. In the nut, although the seed, commonly called the kernel, entirely fills the ovarian cavity, it does not adhere to the walls of the ovary, and the two are readily separated in the shelling process.

Comparing the two from a nutritive standpoint, we note that the grains are admirably adapted to use as bread-stuffs, because their starchy nature makes them readily ground into meal or flour. All of them contain from one-half to two-thirds, in several cases more, of their weight of starch. All of them, moreover, are poor in fat or fixed oil, which is another necessity for a substance which is to yield a good flour. Even oats and corn, which, because of their larger percentage of fat, are not readily converted into fine flour, contain only 6 per cent. to 7 per cent. of it. In wheat, rye and barley it ranges from 1.5 to 2.5 per cent., while in rice there is less than 0.5 per cent. In the most important and physiologically valuable class of nutrients, namely the albuminoids, the grains are markedly rich. Even rice, the poorest of them, contains about 8 per cent. Corn and barley contain about 10 per cent., while the others vary up to 13 per cent. It is this fact which gives such strong staying qualities to bread stuffs made from grains.

Turning now to the nuts, we find them only moderately rich in albuminoids, which average probably less than half the percentage of those of the grains. This shortage is atoned for in most of them by a larger amount of fat, a nutrient requiring little digestive labor, and ready for quick utilization. To this it might be replied that nuts are indigestible, but this fact is due to the storage of their fat in cells where the digestive juices reach it with difficulty. The key to the rational use of nuts is the very thorough breaking up of their cell-walls, as is done in the grinding of the grains, or thorough cooking. The richer of the nuts contain from 30 per cent. to 40 per cent., or even more, of fatty matters.

It is in this relative richness in fat, that we find the great and important difference between the food properties of these two classes. It is an invariable rule among all nations and tribes that fat is to be added to foods made from the grains. The civilized nations use butter and olive oil, the South Sea Islanders, cocoanut oil, the South Americans and Chinese, peanut oil, the dweller of the Far North, seal-oil, the African, kokum butter. So acute is this natural requirement that the people of our Southern States, during the war, when other facts were not available, used freshly expressed castor oil upon their bread, its offensive odor and taste being avoided by care in its preparation and promptness in its use. The presence of large amounts of fats in nut foods entirely obviates this necessity, so that properly prepared bread or cakes made from them may supply the place of both bread and butter. Lastly, in this connection, we note that considerable amounts of sugar are present in most of the nuts and that in the process of keeping them, and more especially in their cooking, this amount is considerably increased through the conversion of a portion of their starch by the enzymes or ferments naturally present. This fact is very closely connected with the physiological principles of germination.

The last fact to be noticed in this comparison is most suggestive and confirmatory of the general principles which have been considered. There are some of the nuts, notably the chestnut beech-nut, and acorn, in which the percentage of starch approaches, though it does not nearly reach, that found in the grains, while the percentage of fat is correspondingly smaller thus the chestnut contains but two to four per cent. of fat, which is only one-third to one-half that in corn and oats, but with 30 per cent. to 40 per cent. of starch. Now the use of chestnuts for grinding into flour is a well-established industry, no less than 360,000 tons of them being annually so employed in Italy alone. We thus see that in two of the grains, namely corn and oats, the characters of the nuts are somewhat approached, and that a similar approach to the grains is made by some of the nuts.

A third class of seed-like fruits calls for attention in this connection. It is a very large class, and one of great importance to the North American Indians, as well as to other aboriginal peoples. This class is represented best by the sun-flower seed and the hemp seed, so-called, although as stated they are in reality small seed-like fruits. By nearly all writers on anthropology, as well as by travellers generally, these foods have been classed among the grains. The idea is clearly erroneous, having no other basis than the small size of the bodies and the fact that they are pounded or ground up in the same rude mills which are employed by natives in grinding their grains. Both structurally and nutritively, their relations are very closely with the nuts, rather than with the grains. In technical botanical language these small, one-seeded, seed-like fruits are known as akenes, and I really do not know that they can be better defined than by calling them very small nuts. They have the same solitary seed, completely filling the ovarian cavity, but not adherent to its walls. If one will kill any of the small birds which fly about fields covered with dead weeds in the fall of the year and examine their stomachs, he will find them gorged with the seeds of the *Bidens* or beggar-ticks, every one of which the birds have neatly shelled out before swallowing them. These beggar-ticks are very closely related to the sun-flower. Nearly all akenes are enclosed, like the nuts, in an involucre of some sort. A very important difference is that their flowers are almost always insect-pollinated. From a nutritive point of view, most of the akenes are closely similar in their composition to the richer or more fatty of the nuts. Sun-flower seed, for example, contains about 40 per cent. of oil or fat and about 20 per cent. of albuminoids, so that it represents a combination of the highest values of both the nuts and the grains. It is, on the other hand, devoid of starch, and this is true of most akenes. Lastly, it must be noted that one of the important grains of civilization, namely, the buck-wheat, is a true akene. It contains only 1.5 per cent. of fat, nine of albuminoids and about 50 of starch.

With these introductory remarks, relating to highly interesting facts, and facts of the greatest importance in the remainder of our study, we shall pass on to consider the individual foods of these classes pertaining to the United States. We shall begin with the grains, and note first that those in general use are all natives of the old world excepting Indian corn. It is clear, therefore, that our aborigines, before the discovery of America, had no benefit from them and, unless restricted to the use of corn as a grain, must have employed some kinds which have not yet come into cultivation. The latter is true. The grass family, to which the grains belong, is an exceedingly important one in this country It contains hardly any poisonous members and all share, in greater or less degree, the nutrient properties of the cultivated grains. In the arid regions of the Far West and Southwest, a great number of grass seeds have always been employed by the Indians, who do not discriminate very closely between them. Everything with a grain large enough and nutritious enough is gathered and used. Some of these are closely related to our domestic grains and the idea is suggested that they might be improved by cultivation, or bred into those now in use with advantage.

(The lecturer then exhibited slides illustrating the most important foods of these classes employed by our Indians, and discussed their properties and relations. Since most of these facts were published in a recent number of *Country Life in America* they are here omitted.)

H. H. Rusby.

NATURE STUDY WORK OF THE PUBLIC SCHOOLS

The lectures and demonstrations on the nature study of plant commenced last year for the public schools, and taken up agai this spring, were continued and much expanded during the au tumn. In addition to children from the schools in the Bronx th privilege was given to schools from Manhattan, children attend ing from both the 4B and the 5B grades from schools of bot boroughs. The courses commenced on October 5 and were com pleted on November 23, the afternoons of four days of each wee being devoted to this work. The general system of instructio previously followed was continued with very slight modification but with considerably greater efficiency, due to practice and t more intimate knowledge of the needs. A synopsis of the lecture and demonstrations is as follows :

Grade 4B.

Lecture I. — " Cultivation of Plants," by Mr. George V. Nash Followed by demonstration : walk from museum building to an around herbaceous grounds ; thence to greenhouses, and throug greenhouses to railway station. Observe seedlings, cuttings roots, stems and leaves, evergreen and deciduous trees, shrub and herbaceous plants.

Lecture II. — " Seedless Plants," by Dr. Marshall A. Howe Followed by demonstration : walk through museum building t second floor, around cases exhibiting seaweeds and mushrooms thence to hemlock forest to observe lichens and mosses ; thenc to greenhouses to observe ferns ; thence to station.

Grade 5B.

Lecture I. — " Industries Depending on Forests ; Plant Prod ucts," by Dr. Henry H. Rusby. Followed by demonstration walk through museum halls to observe plant products ; thenc through hemlock forest, past herbaceous grounds, to greenhouses to observe economic plants (bananas, chocolate, tea and coffee) thence to station.

Lecture II. — " Woody Plants and Plants Without Wood ; Pro tection of Trees in Cities," by Dr. William A. Murrill. Followe by demonstration: walk from museum building to and around herbaceous grounds; thence past greenhouses to station. Observe trees, shrubs, herbs, mosses, lichens, mushrooms, seaweeds.

Lecture III. — "Classification of Plants," by Dr. N. L. Britton. Followed by demonstration: walk through museum building; to and around herbaceous grounds; thence to station. Observe seaweeds, mushrooms, lichens, mosses, ferns, cone-bearing trees, plants with one seed-leaf; plants with two seed-leaves.

The records of the committee of the Department of Education having the matter in charge show that 12,769 children and teachers were given instruction, of which 9,378 were from the Bronx and 3,391 from Manhattan. The discipline of the schools is so perfect that there was no difficulty encountered in handling the numbers of children up to 800 of an afternoon, and there can be no doubt that they profited by their visits to the Garden in many ways. During the progress of the lectures, the work was inspected by many teachers from Europe who happened to be in the city at the time, and it has been warmly commended by them, and it is hoped that it can be still further expanded during the next year. At the request of teachers who were unable to attend the lectures in the afternoons, the course was repeated for their benefit on Saturday mornings.

N. L. Britton,
Director-in-Chief.

NOTE ON A LITTLE-KNOWN WORK ON THE NATURAL HISTORY OF THE LEEWARD ISLANDS.

The library secured recently a rare little volume entitled "Voyages/ to the/ Madeira,/ and/ Leeward Caribbean Isles :/ with/ Sketches/ of the/ Natural History of these Islands./ By Maria R******./ Edinburgh :/ Printed for Peter Hill,/ and/ T. Cadell,/ London,/ 1792." 12°. 105 p.

Being unable to find any trace of the name of the authoress, Mr. James Britten, the Editor of the "Journal of Botany," was applied to and he has very kindly furnished the information that

Maria R****** was the daughter of William Woodley, Governor of St. Kitts and the Leeward Islands. In 1791 she married Walter Riddell, of Woodley Park, four miles south of Dumfries, Scotland. The lady was only nineteen, but having a taste for literature, published a lively account of her voyages under the title as given above.

The youthful authoress dedicates her book to Mr. William Smellie, member of the Antiquarian and Royal Societies of Edinburgh, and with becoming modesty states that "it is by no means so correct as I could have wished; for, although a great part of it was written on an island, where I lived in almost total seclusion from society and dissipation, yet my marriage (which took place soon after) by obtruding on me a number of domestic occupations, interrupted my course of study, and prevented me from finishing, with any degree of accuracy, an undertaking that required more time and labour than I had then leisure to bestow on it."

Miss Woodley left England on the eleventh of April, 1788, on the merchant ship *Britannia* in company with her father and mother and five other passengers, bound for Madeira. Landing there she proceeds with a fair amount of detail to give an an account of the mass in "The Great Cathedral," of various convents and monasteries of the island, of the fort, and of the island generally, including some entertainments given in their honor. She speaks of "Tropical and European fruits," "lemons of a prodigious" size, "strawberries that grow wild in the mountains with astonishing profusion," "grapes which are as large as our common plumbs" and oranges that are of a "sanguine red." She mentions the cedar tree as having furnished most of the ceilings and furniture of Madeira, speaks of the dragon tree and other trees, and also adds the fact that "flowers nursed in the English greenhouses grow wild here in the fields." A few notes are also made on birds and fishes. She tells of a little hermitage on the mountains and is mnch impressed with fountains and cascades. She attends an "elegant ball and a concert" at the governor's and at the close of her visit, so as to omit nothing of interest that took place on the island, had the curiosity "to assist at one of their funerals" which she describes with somewhat grewsome details.

On the sixth of May they sailed for the island of St. Christopher. The passage was enlivened with "Tropic birds and flying fishes" and the "phenomenon of the luminous sea"; even the excitement of being "chaced by an Algerine" was not omitted. On the first of June, the *Britannia* struck a coral rock just under the lee of Nevis and Mrs. Riddell tells us that "the shock was far more violent than any earthquake I ever experienced, but we sustained very little damage, and found ourselves in deep water again almost as soon as we heard the crash." On the first of June they landed on the island of St. Christopher, and she proceeds to give quite an elaborate description of the island, of Mt. Misery, "the summit of which is lost in the clouds," of its fogs and mists, of its craters, and of the stream of water "which takes its rise higher up the side of the grand crater, is partly absorbed in the chasms and thrown out with a furious boiling noise and steam." She describes various views on the mountains and the "cataracts that are seen descending in vast torrents from the summits of these mountains in the rainy season." There seems little that has escaped her inquisitive eye. She tells of the "mischievous" monkeys that inhabit the high-lands, the birds, that she considers as being much the same as in Antigua, and she enjoys the supreme "pleasure of seeing the phenomenon of a water-spout." In 1790 she made a tour through Antigua and Barbuda, travelling with her father, mother, brother, and three gentlemen from Antigua. They visited Nevis on the way, and arrived at Barbuda "after a most unpleasant navigation." In Barbuda they "took a ride to see the island," and among other excursions embarked in a barge on a lake bordered with mangrove trees. Again a careful description of the trees and the effect they produced, and she also notes the oysters that cling to the roots of the trees.

On a Sunday morning they were "entertained with a diversion of a wild bull hunt" by a family of Caribs, and the following day investigated a spacious cavern on the eastern side of the mountain, which again brings forth a minute narration.

The last chapter in the little book is entitled "Geographical and Natural History of Antigua, 1791." Here the authoress seems to have started on a different principle and gives a descriptive list of quadrupeds, birds, amphibious animals, fishes, "vermes molluscae, or soft sea insects," and, in conclusion, one of plants. This appears to be the first attempt to enumerate the vegetable products of the island. The plants are arranged alphabetically according to the Linnaean names "with very little variation," and some of them are sketched with more detail than others and generally their medicinal and other uses are included. Several of the items are entertaining, such as, under "*anacardium-acajou*" she tells us that "the ladies in the West India Islands make use of it to extract the freckles from their faces. They sometimes spread it all over their hands, neck, and face; and, in a few days, the skin peels off in great flakes, after which the complexion appears for some time exquisitely fair, but is more liable to sun-burn than ever; besides the pain of this operation is excruciating." That the feminine uses of certain plants appealed to her is evident, for she again tells us in regard to the fruit of the prickly pear, that it is full of a sweet crimson juice, and that "the West India ladies employ it not only as a dye for their ribbons and gauzes, but also as one for their cheeks." She mentions the great quantities of coffee grown in the island, adding that "its flavour is, however, far inferior to that of the Turkey coffee"; and she says that the juice of the nut of "*croton laceiferum*" "makes a dark stain on linen, that will never erase; but, if washed, will corrode into holes." She tells us also of the manchineel tree and its poisonous qualities, and of the "Maniock plant," its deadly poisonous qualities and the method by which the negroes prepare it for food. The mangoes are also investigated, as well as the banana tree, and the leaves of the latter are noted as being "made use of to stuff the mattresses of beds, and answer that purpose extremely well."

Several species of palms are enumerated, as well as the uses to which their branches and fruit are put, and she says that the fruit of the pomegranate "is the pleasantest and most grateful imaginable." At the end of her list we are informed that "The

Linnaean Names" of the pomme rose tree, the franche pan, the conque nut, and the bell bush, are unknown.

The little book closes with the following verse:

> "Thus spring the living herbs, profusely wild,
> "O'er all the deep green earth, beyond the pow'r
> "Of botanists to number up their tribes." *Thomson.*

A second edition was issued in Salem, 1802; and the authoress is also credited with having edited the "Metrical Miscellany," published the same year.

ANNA MURRAY VAIL.

NOTES, NEWS AND COMMENT.

Dr. Marshall A. Howe left on December 9 for Jamaica, where he will continue his investigations of tropical seaweeds in coöperation with the government botanists of the island.

Mr. Dillon Wallace, the explorer of inland Labrador, has presented the Garden with a small but interesting collection of herbarium specimens, collected by him in July and August, 1905, from Groswater Bay, Hamilton Inlet, inland along the Nascaupee and Crooked Rivers to Lake Michikamau.

Work was commenced on the construction of the rubble stone footbridge to replace the present wooden bridge across the Bronx River at the northern end of the Hemlock Grove, during the first week in December, by the contractor, Mr. Leahy, who has erected the necessary derricks and brought in some construction material. He proposes to prosecute the work during the winter as it may be practicable.

The driveway approach to the Woodlawn Road entrance, recently completed, was thrown open to the public on Saturday, December 8. This was made possible by the coöperation of Hon. Joseph I. Berry, Commissioner of Parks, who permitted the use of some trap-rock screenings for surfacing the driveway, which were left over from surfacing the road between the two bridges at the Mosholu Parkway. The demand for trap-rock screenings in the Borough of the Bronxwas so great this year that it became impossible to obtain any from the quarries toward the end of the season. Considerable sodding of the banks and edges of this road was also carried out during November.

An interesting collection of over three hundred numbers of West Indian polypores, chiefly from the Danish islands, was recently sent here by the Copenhagen Botanical Garden for determination. Messrs. C. Raunkiaer and F. Borgesen were the principal collectors, though several other names frequently appeared. The collection is of value in determining the abundance and distribution of well-known tropical polypores; while it throws light upon a number of obscure species, particularly those described by Fries from Oersted's collections in San Jan.

During the early part of the present year Mr. Wm. R. Maxon of the United States National Museum, during a furlough from that institution, visited, in the interests of the Garden, the Central American republic of Costa Rica, a country almost unknown as to its botanical features. His explorations were mainly in the mountainous regions of the interior. An account of his explorations in detail will be found in the JOURNAL for August. Mr. Maxon not only brought back an interesting lot of material for the herbarium, but his collection of living plants was an extensive one. This collection was for the most part composed of members of the orchid, bromeliad, and cactus families, the satisfactory study of which, except in a living state, is most difficult. The plants were carefully collected, properly prepared for shipment, and packed with care, as was evidenced by the excellent condition in which they arrived. A number of the orchids secured have already flowered, permitting of their definite determination, and of these three have proved to be additions to the species hitherto known to science — one of them representing the genus *Zygostates*, formerly known only from Brazil and Peru in three species, but by this new fourth species brought within the limits of the North American flora. Only the flowering of the other specimens will reveal what other treasures may be contained in this collection.

The total precipitation recorded at the Garden for November was 1.36 inches. Maximum temperatures were recorded of 66° on the 3d; 61° on the 5th; 62° on the 18th; 63° on the 19th; and 60° on the 27th; also minimum temperatures of 31° on the 2d; 29° on the 9th; 28° on the 15th; and 31° on the 25th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM NOVEMBER 1 TO DECEMBER 1.

BÉLANGER, CHARLES. *Voyage aux Indes-Orientales. Botanique.* Paris, 1846. 2 vols.

BERGEN, JOSEPH Y., AND DAVIS, BRADLEY M. *Principles of botany.* Boston, 1906. (Given by Dr. N. L. Britton.)

BOLTON, HENRY CARRINGTON. *The follies of science at the Court of Rudolph II, 1576–1612.* Milwaukee, 1904. (Given by Mr. Henry Kraemer.)

CARLSON, C. S. *Contribution à l'étude comparée de la flore du massif Scandinave et du massif central de la France.* Clermont Ferrand, 1905. (Given by the Trustees of Columbia University.)

CHEESEMAN, T. F. *Manual of the New Zealand flora.* Wellington, N. Z., 1906. (Deposited by the New York Academy of Sciences.)

DAUPHINÉ ANDRÉ. *Recherches sur les variations de la structure des rhizomes.* Paris, 1906. (Given by the Trustees of Columbia University.)

Diccionario de agricultura practica y economia rural. Madrid, 1852–54. 7 vols. (Given by the Trustees of Columbia University.)

ELY, HELENA RUTHERFURD. *Another hardy garden book.* New York, 1905. (Given by Prof. Charles F. Chandler.)

FRAYSSE, A. *Contribution à la biologie des plantes phanérogames parasites.* Montpellier, 1906. (Given by the Trustees of Columbia University.)

GATIN, C. L. *Recherches anatomiques et chimiques sur la germination des palmiers.* Paris, 1906. (Given by the Trustees of Columbia University.)

GUENOT, J. F. *Contribution à l'étude anatomique des pittosporacées.* Corbeil, 1906. (Given by the Trustees of Columbia University.)

HEGI, GUSTAV. *Illustrierte Flora von Mittel-Europa.* München, 1906.

LAGARDE, J. *Contribution à l'étude des discomycètes charnus.* Burg, 1906. (Given by the Trustees of Columbia University.)

MAHEU, JACQUES. *Contribution à l'étude de la flore souterraine de France.* Paris, 1906. (Given by the Trustees of Columbia University.)

MILDE, J. *Monographia Equisetorum.* Dresden, 1865. (Given by Dr. L. M. Underwood.)

MONTEIL, PAUL. *Anatomie comparée de la feuille des chenopodiacées.* Lons-le-Saunier, 1906. (Given by the Trustees of Columbia University.)

MUTCHLER, FRED. *On the structure and biology of the yeast plant.* Boston, 1905. (Given by the Trustees of Columbia University.)

RÉAUBOURG, GASTON. *Etude organographique et anatomique de la famille des lardizabalées.* Mantes-sur-Seine, 1906. (Given by the Trustees of Columbia University.)

RIDDELL, MARIA WOODLEY. *Voyages to the Madeira and Leeward Caribbean iles: with sketches of the natural history of these islands by Maria R******.* Edinburgh, 1792.

ROCHE, M. I. *Anatomie comparée de la feuille des cistacées.* Lons-le-Saunier, 1906. (Given by the Trustees of Columbia University.)

SCHNEIDER, KARL CAMILLO. *Einführung in die Deszendenztheorie.* Jena, 1906.

SCHULZ, AUGUST. *Entwicklungsgeschichte der gegenwärtigen Phanerogamen Flora und Pflanzendecke der Oberrheinischen Tiefebene und ihrer Umgebung.* Stuttgart, 1906.

SCHUR, P. J. F. *Enumeratia plantarum Transsilvaniae.* Nova editio. Vindobonae, 1885.

SHOEMAKER, DANIEL NAYLOR. *On the development of Hamamelis virginiana.* Baltimore, 1902. (Given by the Trustees of Columbia University.)

SYLVEN, NILS. *Om de svenska dikotyledonernas första förstärkningsstadium.* Uppsala, 1906. (Given by the Trustees of Columbia University.)

SYME, WILLIAM ANDERSON. *Some constituents of the poison ivy plant.* Baltimore, 1906. (Given by the Trustees of Columbia University.)

THEVENARD, MAURICE. *Recherches histologiques sur les ilicacées.* Nevers, 1906. (Given by the Trustees of Columbia University.)

Tree Planting and Fountain Society of Brooklyn, City of New York. Annual report, 1898. Brooklyn, 1899. (Given by Mr. Howard W. Preston.)

VIGUIER, RENÉ. *Recherches anatomiques sur la classification des araliacées.* Paris, 1906. (Given by the Trustees of Columbia University.)

VINTILESCO, J. *Recherches sur les glucosides de quelques plantes de la famille des oleacées.* Paris, 1906. (Given by the Trustees of Columbia University.)

WALTER, HANS. *Die Diagramme der Phytolaccaceen.* Leipzig, 1906. (Given by the Trustees of Columbia University.

MUSEUMS AND HERBARIUM, OCTOBER, 1906.

6 specimens of *Physalis* from North America. (Given by Dr. H. H. Rusby.)

2 specimens of Mexican senna and Mexican soap root for the Museum. (Given by Mr. G. B. Bradshaw.)

1 specimen of *Empetrum nigrum.* (Given by Dr. C. B. Robinson.)

1 specimen of kumquats (*Citrus madurensis*) for the food collection. (Given by Dr. H. H. Rusby.)

250 specimens of foods. (Given by Mr. L. Bell Martin.)

3 specimens of *Podophyllum*, *Rubus* and *Malus.* (Given by Dr. J. A. Shafer.)

1 specimen of Chinese citrus fruit. (Given by Mr. F. F. von Wilmowsky.)

1 specimen of mesquite rubber from Mexico. (Given by Mr. R. L. Johnstone.)

218 specimens from British America. (By exchange with the Geological Survey of Canada.)

15 specimens from Canada. (Given by the Central Experimental Farms, Ottawa, Canada.)

1 specimen of *Adenostegia* from California. (Given by Mr. C. DeKalb.)

9 specimens from southern California. (By exchange with Mr. S. B. Parish.)

37 specimens from Mexico. (By exchange with the U. S. National Museum.)

17 specimens from New York. (Given by Professor W. W. Rowlee.)

1 specimen of fossil leaf (*Araucarites* sp.) from North Carolina. (Given by Mr. Edward W. Berry.)

44 specimens of fossil leaves from Ellsworth Co., Kans. (Purchased from Mr. Chas. H. Sternberg.)

1 : fossil plants from Long Island. (Collected by Dr. Arthur Hollick.)

8 specimens of fossil wood and amber from Staten Island. (Collected by Dr. Arthur Hollick.)

10 specimens of fossil wood and amber from Cliffwood, N. J. (Collected by Dr. Arthur Hollick.)

21 packages of seeds from western Australia. (By exchange with Mr. C. S. Thorp.)

PLANTS AND SEEDS.

3 plants from Virginia for the nursery. (Given by Mr. E. S. Steele.)

1 plant for the conservatories. (Given by Miss P. Kaufman.)

9 bulbs for the conservatories, from Central South Africa. (By exchange with Dr. S. P. Verner.)

1 plant for the conservatories. (Given by Mr. G. B. Lazzari.)

33 oaks for the nursery.

1 plant for the conservatories. (Given by Mr. G. B. Ferguson.)

1 plant for the conservatories. (Given by Mrs. Havens.)

2 plants for the conservatories. (Given by Messrs. Thornburn & Co.)

17 plants for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

1 plant from Colorado for the conservatories. (Given by Mr. T. D. A. Cockerell.)

2 plants for the conservatories. (Given by Mr. A. Müller.)

134 bulbs for trial in herbaceous grounds. (Given by Country Life in America.)

17 asters for culture experiments. (Given by Prof. E. S. Burgess.)

2 plants for conservatories. (Given by Mrs. Travers.)

1 plant for conservatories. (Given by Mrs. L. D. Greene.)

2 plants from Bermuda for conservatories. (Collected by Mrs. N. L. Britton.)

1 plant from Florida for the conservatories. (Collected by Dr. J. K. Small.)

2 plants from Pennsylvania for herbaceous grounds. (Collected by Dr. J. K. Small.)

83 plants from Jamaica for conservatories. (Collected by Dr. N. L. Britton.)

3 plants for herbaceous grounds. (Collected by Mr. W. W. Eggleston.)

1 plant for herbaceous ground. (Collected by Mr. R. C. Schneider.)

1 plant from Pennsylvania for nursery. (Collected by Dr. J. A. Shafer.)

2 plants from New Jersey for nursery. (Collected by Dr. J. A. Shafer.)

1 plant for herbaceous grounds. (Collected by Mr. R. C. Benedict.)

14 plants from Cuba for conservatories. (Collected by Mr. N. Taylor.)

13 plants from Andros, Bahamas, for conservatories. (Collected by Mr. L. J. K. Brace.)

1 plant for conservatories. (Given by Mr. G. A. Skene.)

1 plant for nursery. (Collected by Mr. G. A. Skene.)

147 plants purchased for fruticetum, arboretum, economic garden, and border.

42 bulbs purchased for conservatories.

3 plants for conservatories. (By exchange with Mr. F. Weinberg.)

20 plants for conservatories. (By exchange with Bureau of Plant Industry.)

200 plants and 55 bulbs from Mexico for conservatories. (Collected by Dr. I T. MacDougal and Dr. J. N. Rose.)

46 plants from Mexico for conservatories. (By exchange with National Museun through Dr. J. N. Rose.)

72 plants for conservatories. (By exchange with National Museum, through D J. N. Rose.)

10 plants for the borders. (By exchange with Dept. of Parks, Borough of Bronx.

1 plant from Canada for nursery. (By exchange with Dr. J. Fletcher.)

1 plant for conservatories. (By exchange with N. Y. Zoölogical Garden.)

10 plants from Laredo, Texas, for conservatories. (Purchased.)

4 packets of seeds. (By exchange with Bureau of Plant Industry.)

26 plants derived from seeds from various sources.

ERRATA.

P. 126, line 17, for *F. S. Collins* read *G. N. Collins.*

P. 127, line 18, for *two*, read *ten.*

P. 130, line 21, p. 131, line 3, and p. 132, line 9, for *Maya guez* read *Mayagüez.*

P. 133, line 13, for *Jose* read *José.*

P. 134, line 2, for *affected* read *effected.*

P. 134, line 13, for *ariods* read *aroids.*

P. 136, line 16, for *was* read *were.*

P. 138, line 9, for *tree* read *trees.*

P. 170, line 9, read "for the month *of June.*"

P. 171, line 2, for *amazonica* read *regia.*

P. 194, line 27, for *Livingston, Dr. B. R.*, read *Livingston, Dr B. E.*

P. 196, line 15, for *Edward* read *William.*

P. 200, line 11, for *Cypripedium Reginae* read *Cypripedium hir sutum.*

P. 254, line 30, for *Martha E.* read *Harriet L.*

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North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies and Central America. Planned to be completed in thirty volumes. Roy. 8vo. Each volume to consist of four or more parts. Subscription price $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

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BRONX PARK, NEW YORK CITY

Journal

of

The New York Botanical Garden

Volume VIII, 1907

Published by the aid of the

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JOURNAL

OF

The New York Botanical Garde

EDITOR

WILLIAM ALPHONSO MURRILL

First Assissant

VOLUME VIII

WITH 5 PLATES AND 37 FIGURES

1907

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.

BY THE NEW ERA PRINTING COMPANY

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EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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VOL. VIII. January, 1907. No. 85.

COLLECTING CACTI IN SOUTHERN MEXICO.

DR. N. L. BRITTON,

DIRECTOR-IN-CHIEF,

New York Botanical Garden.

Dear Sir: — In accordance with the agreement by which the Department of Botanical Research of the Carnegie Institution of Washington is to aid in the investigations of the Cactaceae by yourself and Dr. J. N. Rose, 31 cases of living specimens were shipped to you from Tehuacán, Puebla, *via* Vera Cruz, on Sept. 13, 1906. Some of the specimens included are of massive size, and if induced to grow in New York will soon furnish material to illustrate their entire life-history. A set of photographs illustrating the habits of many of the species is being sent you by mail.

In connection with the activities of the Desert Laboratory an effort is being made to obtain a comprehensive idea of the vegetation of the arid areas of the continent with especial regard to the composition of the flora, the factors affecting distribution, and the general physiological behavior of the more highly specialized forms. A study of several localities in southern Mexico with these ends in view was made in August and September, 1906, and I was so fortunate as to do this work in company with Dr. J. N. Rose, who is engaged in a taxonomic study of the flora of the regions in question. This arrangement greatly facilitated my own work, and by our joint efforts a large number of species were secured, some of which are as yet undescribed, and many have

not previously been represented in horticultural or botanical collections.

In our first trip afield we were guided by Dr. C. G. Pringle to a locality on the lava slopes of the Pedregal, a few miles south of Mexico City. The irregular surface of this volcanic formation is pitted with cavities and caverns, some of which are large enough to enclose an ordinary dwelling house, and the variety of conditions of moisture and shade gives opportunity for a wide range of vegetation. So luxuriantly do the plants grow in these places that the openings of the caves, or pits, will be choked with their branches and foliage.

This locality has been visited by Dr. Pringle many times and

FIG. 2. *Opuntia* and Dr. C. G. Pringle.

is a type locality for many species collected by him. We found several species of prickly pear, some of which have not yet been described, and it was also seen that species so closely related as not to be easily separable were in the closest proximity.

Early in September we started to examine the desert valleys which lie along the main backbone of southern Mexico in the states of Puebla and Oaxaca at elevations of 1,200 to 6,000 feet. Tehuacán, situated in one of the northernmost of these arid valleys, was chosen as a favorable place for centering our work and assembling living plants for shipment to New York, Tucson and Washington. Headquarters were made at the Hacienda El Riego, west of the city, near the foothills of the range bounding the valley on the west. We met Mr. W. L. Morkhill, general manager of the railway, the Ferrocarril Mexicano del Sur, in his office at Puebla, and in his car at Tehuacán, and plans were made by him by which laborers and materials were secured for us by Sr. Daniel Tellez, superintendent of the tram lines of the railway system. In addition Mr. Morkhill arranged with the general manager of the Interoceanic Railway that the car loaded with plants at Tehuacán should be sent through without change or delay to the wharf at Vera Cruz where the crates could be lightered out to the steamer. It is difficult to acknowledge properly the amount of material aid and kindly coöperation received from Mr. Morkhill in this enterprise.

The town of Tehuacán lies in the middle of a valley running north and south on the eastern side of the main continental ridge, and this and the neighboring valleys and slopes are a part of one of the most striking deserts in the world, the xerophilous vegetation offering features of adaptation and distribution not previously encountered elsewhere. The abundance of the Cactaceae rivals or surpasses even that of the southern part of Arizona and of Sonora, and, a half dozen of the species being massive forms, the landscape is highly characterized by them. *Cereus Weberi, C. geometrizans, Cephalocereus macrocephalus, Pilocereus fulviceps, P. chrysocantha, P. tetetzo, Escontria chiotilla,* together with four or five other undescribed forms reach a height and attain a bulk as great or greater than the saguaro. The amount of water stored by such plants on any given area is so great that planters have actually considered the feasibility of obtaining it in quantities by crushing the plants with machinery.

Nopals, tunas, and prickly pears in general are in abundance, and here as elsewhere in Mexico more than one variety practically free from spines have been under cultivation for some time. Of the half dozen species of *Echinocactus* one forms huge mounds of small individuals as much as three yards across, while *E. grandis* might as rightly be included among the trees as the saguaro (*Cereus giganteus*).

The fruits of a large number of species of *Opuntia* and of a few of *Cereus*, are used in quantities for food and may be found in great abundance in the local markets. A few of the prickly pears produce a fruit, which is shipped long distances, and even finds a way to New York markets. A liking for these fruits is

Fig. 3. *Echinocactus grandis*, and Dr. J. N. Rose, on Rancho San Diego east of Tehuacán.

an acquired taste; probably a residence in Mexico would hasten the acquisition, the insipidity of these fruits forming a possibly wèlcome contrast to the fieriness of the "chile" and the corrosive effect of mescal. Many of these plants are grown around the primitive homes of the natives as apples, peaches or pears might be around a farmhouse in the United States. In addition to yielding fruits the stems make admirable hedges or barriers, although when planting for this purpose alone some species of Cereus are generally used.

The evaporation in the Tehuacán region must be much in excess of the precipitation, yet it was noticeable that the various species of *Opuntia* were to be seen growing on dirt roofs of adobe dwellings, on stone walls, and even in crevices of brick and stone high up on cathedrals and other tall buildings. The air temperatures are favorable to such exposure but the protective and regulatory devices of such plants must be of the highest kind.

No desert has yet been visited by the writer in which the storage function is so highly developed and exhibited by so many genera of plants as in the arid region of Tehuacán. In addition to the cacti, euphorbias, agaves, and related forms, the tree morning glory (*Ipomoea* sp.) has a soft thick trunk into which a knife may be easily thrust to the hilt and is chiefly a storage organ. Three species of *Beaucarnea*, relatives of the yucca, known locally as "sotol" have the bases of the trunks swollen to a thickness of seven or eight feet with a height not more than two or three times this measurement, by the formation of an immense mass of spongy tissue with great capacity for retaining water. Like many other plants showing similar adaptions these trees sit directly on the surface and may be easily pushed over, especially after dead.

On the jungly slopes we encountered *Rhus potentillaefolia*, and found its poisonous effect on the skin as virulent as that of any American species, and the results as severe and lasting.

Here as elsewhere in Mexico it was found that the broad leaves of the agave are sliced and the dried plates used in covering the huts and enramadas of the peons and Indians.

After a general preliminary reconnaisance around Tehuacán we proceeded southward by rail to Oaxaca de Juarez, where we were so fortunate as to encounter Prof. Conzatti, of the Escuela Normal, who has long been known as an ardent student of the flora of this region. From him we obtained much valuable information not only as to distribution and general features of the region, but also as to the uses of various vegetable products found in the local markets.

Oaxaca lies on an elevated plain. The precipitation in the immediate neighborhood is rather high owing to the close proximity of the mountains which act as condensers, although at an elevation but little below, the vegetation becomes distinctly xerophytic. Here it was found that the Indians and travellers in general used a peculiar storm cloak, consisting of a mat made from the leaves of a palm with three rows of overlapping thatching inserted on one side. A second pattern, not seen so often, was thatched more densely by leaving free ends of the fiber over

FIG. 4. Group of natives in storm cloaks of thatched palm.

the whole surface. With two of these carried in a roll by a cord across the shoulder the traveller was provided with clothing by day and bedding by night. Lying upon one of these waterproof cloaks with the second above him the Indian seems heedless of the fact that the legs from the knees downward were exposed to the night air.

Following the line of least resistance it was found that the facilities for travel provided for going to the ancient ruins at Mitla 35 miles to the southeast would take us into a region densely populated with cacti and affording a view of the surrounding desert. The journey was made by diligence, and the route lay through the village of Tule made famous by the giant ahuehuetl, or cypress (*Taxodium mucronatum*), which stands in the church yard. This tree by the claims of local patriotism is the greatest in the world, while for a long time it has been cited as the oldest living. Both these claims are incapable of actual proof, although the tree has much to justify an interest in it. It measures i 54 feet and 2 inches six feet from the ground, but it may be really two or three individuals fused together as it divides into that

Fig. 5. View of basal portion of giant cypress of Tule, Oaxaca.

many main branches within fifty feet, as may be seen from the accompanying illustration. This tree has been an object of observation for more than two centuries, and on one side is a tablet, partly covered by the growth of the outer layers of the trunk, signed by the great naturalist, Baron von Humboldt, and probably placed there by his direction a century ago.

The road to Mitla runs down the drainage system of a tributary of the Tehuantepec river, among fields of maize and agaves, and is fringed much of the way with hedges of cacti especially in and near the villages. Among these were seen several species which seemed to lack descriptions among known records.

The village of Mitla is situated in latitute 17° N., at an altitude of about 4,000 feet, conditions which coöperate to give the vegetation a pronounced desert character. The famous ruins near by testify to the former existence of a type of civilization with the indelible impress of the desert upon it: a civilization in which coöperation or communism was carried to the greatest

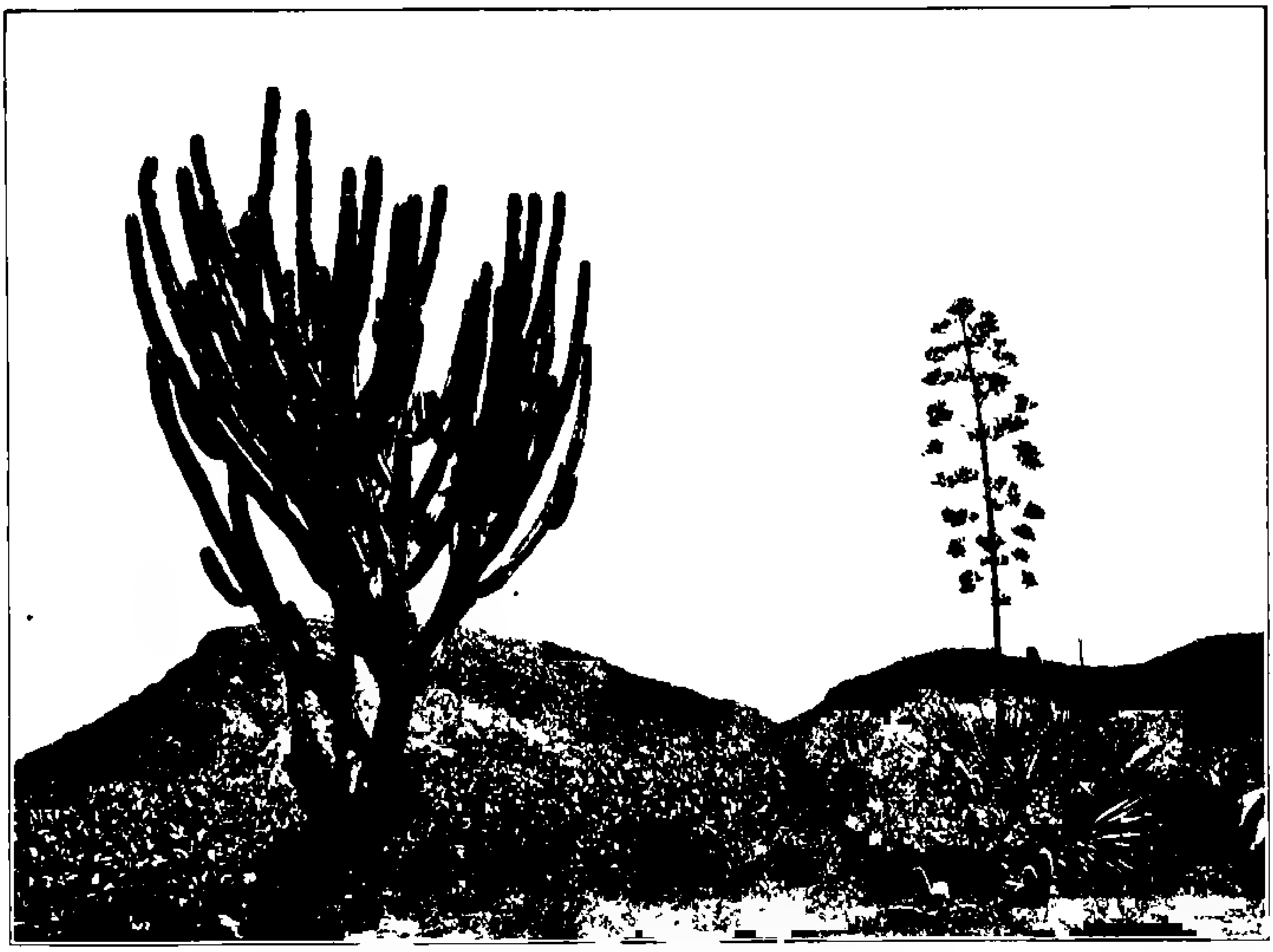

FIG. 6. Roadside scene between Oaxaca and Mitla. *Cereus eburneus, Cereus* sp., *Agave* and field of maize.

extreme, as it must have been among the ancient pueblos of the deserts of the United States. In the light of the conclusions of the meteorologist we may assume that no matter how long ago these ruins were peopled, yet a climate similar to that of to-day must have been experienced by the builders of the ancient temple.

Before leaving Mitla we were afforded the opportunity of inspecting a distillery for making mescal, the fiery whiskey derived from the juice of the agave. When the great rosettes of this plant (several species are used) are mature they are uprooted and the blades are cut away near the base, leaving a core made up of leaf bases and the lower end of the undeveloped inflorescence axis. A rock-lined pit is filled with the cores and baked thoroughly, and after cooling the juice is pressed out and collected in great vats of rawhide supported on a framework of mesquite branches. After a week of reeking fermentation in the open air distillation is accomplished by a crude but effective apparatus in which condensation is secured by the cooling effect of running water brought hither in earthen and wooden conduits. So far as experience and information may be relied upon the devotees of this beverage cherish the ambition to quaff it as fresh from the

FIG. 7. Agave, "chular miel," from which a tlachiquero is taking the sap for pulque. A reservoir made of the raw skin of a pig is carried on the back.

still as it is possible to get it, and before any of its stinging qualities have been lost. Several kinds or types of this fluid are made, of which one of the better quality is known as tequila.

In addition to these various preparations the production of pulque seems to be one of the profitable industries in the agriculture of Mexico. The agaves used for this purpose have the centers of the rosettes hollowed out when mature and the sap exudes by bleeding pressure into this cavity, from which it is collected and taken away once or twice daily. This is deftly accomplished by the use of a long gourd in the hands of the tlachiquero, who thrusts one end of the gourd into the liquid and puts his lips to the other perforated end and sucks, with the result that the sap is drawn into the gourd and then emptied into the whole pigskin carried upon his back. Fermentation quickly ensues and the resulting pulque is used in enormous quantities. It has the appearance of skimmed milk diluted with water and is characterized by an ill-favored odor which clings long to the person imbibing. The water supply, even in the remoter parts of central and southern Mexico is not of the best quality, and the traveler is between the danger arising from drinking from contaminated streams, and the disagreeable necessity of using the illy flavored pulque with the general result that one is endured at times and the dangers of the other are incurred when the taste of the safer beverage palls.

On the return to Tehuacán Dr. Rose and I left the train at Santa Catalina where we were met by a section crew with a push car and taken down to Tomellín, thus giving an opportunity for the examination of the vegetation at closer range than that afforded by a moving train. Many interesting and unrecognizable plants had been seen on the journey southward and we expected to secure some valuable material by the trip. In this we were not disappointed, and by the courtesy of Mr. Morkill who arranged the matter for us we experienced one of the most thrilling rides in Mexico.

The railway grade drops 2,346 feet in the descent from Sta. Catalina to Tomellin, a distance of 22 miles, running down a steeply walled cañada most of the way, crossing the stream by bridges at various angles and curves, through tunnels and around curves in a short radius made possible by the narrow gauge of the track. Our car was a wooden platform about eight or nine feet long and half as wide which rested by open, wooden U-bearings upon two pairs of car wheels. Our crew were evidently of the determination to show us that a Mexican could slide down hill as fast as an American. Standing erect the foreman used a handspike thrust through a hole in the platform against one wheel as a brake, while we sat with feet dangling from the front edge of the platform, the middle being occupied by agaves, cacti and other plants collected, while the crew formed a fringe to the rear. Within a few hundred yards the car would gain a speed of over thirty miles an hour at which rate we would dash down to the apex of a curve around a cliff, which we would round with the wheels climbing the outer rail, the track visible only a few feet ahead, and a very sufficient drop below us.

The slopes examined during our frequent stops were replete with interest. Crassulaceae were abundant, the sago-palm, *Dioon edule*, was found in the ravines, a *Beaucarnea* was abundant on the northern slopes, while in one place we faced a great hillside thickly covered with tetetzo (*Pilocereus tetetzo*), the individuals of which were as large as the giant cactus of Arizona.

Tomellin was reached in the evening, where we found shelter in the staff house of the railway by the courtesy of Mr. Morkill. Portions of two days were spent here in securing additional material and shipping all of our collection to Tehuacán. At this elevation we found the principle giant cactus to be *Cereus Weberi*, a huge form which divides a few feet from the ground into a cluster of thirty to fifty branches which may be eight or ten inches in diameter. This species, growing at an elevation of 1,200 feet in latitude 19° N., is perhaps the most tropical of the massive forms. Here was also to be found the much-branched slender *Escontria chiotilla*, also a tree.

Arriving at Tehuacán on September 8 we began immediately to complete our observations and prepare living specimens for shipment. A gang of laborers, a team, and a carpenter were kept busy for a week measuring standing cacti, by which suitable wooden jackets could be built, and packing all securely for the journey. The entire lot was assembled on a vacant piece of ground near the baths of El Riego and from there was taken to the freight station at Tehuacán on a tram car from which a transfer was made to a freight car. The latter was sealed and sent despatch to Vera Cruz. To this point Dr. Rose proceeded to attend to matters of clearance and shipment, and when the plants where safely aboard the S. S. Monterey they were accompanied to New York by Mr. Joseph Rose Jr., who had assisted in the preparations throughout.

The shipments to the Desert Laboratory came through safely and are already in use in our experimental observations.

The regions visited by Dr. Rose and myself during the trip were easy of access and many of the localities had been previously seen by Dr. Pringle, Dr. Rose, Prof. Trelease or other botanists. We had almost constantly in view, however, mountain ranges and valleys from which no specimens have ever been obtained and in which no examination has been made of the flora. In fact, this applies to the greater part of southern Mexico not directly accessible from the railways and stage lines. It would be safe to say that not more than one-tenth of the main topographical regions of southern Mexico have been explored by the botanist. Some of this territory might be reached from haciendas, but the greater part may be investigated thoroughly and profitably only by means of a small independent expedition carrying its own outfit and supplies, as most of the country has nothing beyond the resources of scattered Indian villages in which the traveller is apt to meet with little beyond "no hay" and the tardy service of a people living in the very home and seat of the spirit of "mañana."

Respectfully,

D. T. MacDougal.

THE RAPID GROWTH OF THE YOUNG PAULOWNIA.

The tree from which the accompanying illustration was made was purchased early in May, 1905, and placed in its present position near the drinking fountain but a short distance southeast of the Museum. It was a rather sorry looking object upon its arrival, and at that time did not appear to have before it a long and prosperous career, but appearances are often deceptive, as the sequel here will show. The tree was planted and the first year made two new shoots from the roots, one of which was removed. The wonderful growth of this one shoot during the past summer shows clearly that it is not always safe to venture an opinion as to what a young tree may do, even though it

FIG. 8. A young Paulownia tree (*Paulownia tomentosa*).

appear a weakling, for it may have wonderful recuperative powers. The shoot, when spring opened up last year, measured two feet six inches in height, and at the end of the growing season the stem had attained a stature of sixteen feet six inches, a gain of fourteen feet in one season's growth. As indicated in the illustration, its leaves are large and showy, giving quite a tropical aspect to the plant, which has attracted considerable attention from visitors to the Garden. This tree is known to botanists as *Paulownia tomentosa*, or sometimes as *Paulownia imperialis*.

Its rapid growth and magnificent foliage when young are not the only attractive features of this species. As it matures it spreads out into a shapely tree with widely spreading branches, bearing leaves much resembling those of the catalpa or Indian bean. During the late summer and fall the flower clusters are formed. Their growth does not proceed beyond the bud stage, however, and they remain in this condition during the winter, the tree at that time presenting an odd appearance with its two kinds of inflorescences, those bearing the brown woolly flower buds, and those with the much larger capsules which are pointed and black and remain attached to the tree for a long time. About April or May the flower buds expand, before the leaves are fully out, and a full-grown tree at such times is a delight to the eye, with its rich mantle of scented flowers borne in great profusion in large clusters. The flowers are purple and resemble those of the common foxglove in color and form. A fine specimen of this tree is located near the Lorillard mansion in Bronx Park. It is many years old and perhaps has not many more to live, but it is still vigorous enough to put forth a wealth of flowers nearly every year.

This tree is a native of Japan, where it is known as Kiri or Tô. It attains there a height of thirty to forty feet and a trunk diameter of two to three feet. It is found most commonly in the southern parts of the country, thriving in the valleys, especially in those exposed to the hot sun. It was originally described by Thunberg as a *Bignonia*, under the name of *Bignonia tomentosa*, and it was not until some years later that Siebold and Zuccarini recognized it as the type of an undescribed genus, to which they gave the name of Paulownia, in honor of Anna

Paulowna, a hereditary princess of the Netherlands. It was introduced into cultivation in Europe by Siebold, and seems to have flowered in England for the first time out of doors about 1852. It is a member of the figwort family, to which belong also the foxglove, the mulleins, the speedwells or veronicas, the beard-tongues or pentstemons, and many others of our well-known plants.

George V. Nash.

NOTES, NEWS AND COMMENT.

Dr. M. T. Cook has been awarded a research scholarship at the Garden for 3 months, beginning January 1.

Professor J. C. Arthur and Mr. F. D. Kern, both of Purdue University, Lafayette, Indiana, are continuing their researches on plant rusts in the Garden herbarium during the month of January, and completing their monograph of these minute destructive fungi for publication in "North American Flora," part of it being already in press.

The Botanical Society of America met at the Garden on December 29. The programme, including the address of the retiring president, was completed by 1.30 P. M. Over a hundred persons remained to luncheon.

The lichen collection of Dr. H. E. Hasse, of California, consisting of about 3,000 species and many duplicates, has been recently presented to the Garden by Mr. John I. Kane. Most of the specimens are from America, many of them having been collected by Dr. Hasse in California, while a goodly number of European specimens are scattered through the collection.

Mr. Guy West Wilson, one of the student guides at the Garden, presented an interesting paper on the "Downy Mildews" at the meeting of the botanical convention, December 5. The members of this class are filamentose alga-like fungi which are either aquatic or aerial. The aquatic forms, of which *Saprolegnia* is an example, are parasitic on fishes and other animals. The aerial members of the class are parasitic upon green plants.

These are divided into two families upon the basis of habit of growth and method of germination. The first, Albuginaceae, contains a single genus, *Albugo*, the species of which are known as white rusts. This genus numbers about fifteen species, seven of which are North American. Of the latter all but one are of economic importance. The second family, Peronosporaceae, known as the downy mildews, contains seven genera with about one hundred and ten species, sixty of which are North American and many of which are of economic importance.

Miss Gertrude S. Burlingham has been conducting some experiments at the Garden to determine the effect of magnesium salts upon plant growth. Magnesium salts in the absence of calcium salts are generally considered to be toxic to plants. Dr. Loew makes the statement that "Plants succumb soon when placed in diluted solutions of magnesium salts and no other. In fact magnesium salts can exercise their nutritive functions only in the presence of a sufficient amount of calcium salts." With the view that the inhibitory effects noted by Loew might have been due to the use of excessive amounts of magnesium, experiments were undertaken to determine the effects of magnesium sulphate in dilute solutions, using the water culture method. Seedlings of abutilon, pea and corn about 3 cm. long were used. They were suspended over the mouth of beakers either through holes in paraffined cork, or from glass rods. Growth was measured for the first 168 hours. The magnesium sulphate solutions were made up with distilled water and chemically tested Kahlbaum salts. In each series seedlings were grown in distilled water as a control. From the results obtained these conclusions are drawn: that as with calcium, so with magnesium, there is a dilution in which the toxic action is lost and stimulation begins, this dilution varying with the type of seedling; that from this point there is a gradual increase in stimulation with each successive dilution until a maximum is reached beyond which the growth decreases to the control; and that the vitality of seedlings grown in proper dilutions of magnesium sulphate is greater than in seedlings grown in distilled water.

Two notable contributions to fossil botany by Dr. Arthur

Hollick have been issued during the past month by the United States Geological Survey and by the Maryland Geological Survey. The first * represents the results of about fifteen years of field work and critical examination of material collected by the author and others on Staten Island, Long Island, Block Island, Martha's Vineyard, Nantucket, the Elizabeth Islands and Cape Cod. A large part of this material, including many of the type specimens, is the property of the Garden, and the remainder belongs to either the Staten Island Association of Arts and Sciences, the Long Island Historical Society or the United States National Museum. The work was undertaken at the suggestion of the United States Geological Survey in order to solve, if possible, several perplexing problems in the geology of the region by means of the evidence afforded by fossil plants, and the results attained in this connection are condensed on p. 29 in a correlation table of the insular and allied formations. The total number of species described is 222, including 31 which are new to science. The ferns and fern-allies number 6, the conifers 27 and the angiosperms 189.

In the second of these contributions, † Dr. Hollick has written the part on fossil plants, in which some 40 species are described and figured, including 11 new to science. Under agreement with the Maryland Geological Survey a free set of the specimens upon which this part of the work was based will become the property of the Garden. It is by far the most extensive contribution to the palaeobotany of the Pleistocene formations which has been published in America and the material represents a collection which is not duplicated elsewhere in this country.

The total precipitation at the Garden during the month of December, 1906, was 2.36 inches. The following maximum tem-

* "The Cretaceous Flora of Southern New York and New England." | By Arthur Hollick. | Monographs of the U. S. Geol. Survey, Vol. L. | 4to, cloth, pp. 217, pls. i–xl. | Washington, Govt. Printing Office, 1906.

† "Systematic Paleontology of the Pleistocene Deposits of Maryland." | By Wm. Bullock Clark, Frederick A. Lucas, O. P. Hay, E. H. Sellards, E. O. Ulrich and Arthur Hollick. | Pliocene and Pleistocene Rept., | pp. 153–281, pls. xxxiv–lxxv. | Maryland Geol. Survey, Johns Hopkins Press, Baltimore, December, 1906.

peratures were registered: 55° on the 6th, 55° on the 15th, 46.5° on the 21st, and 42° on the 29th. The minimum temperatures during the same period were: 9° on the 4th, 14° on the 12th, 9° on the 19th, and 12° on the 24th.

ACCESSIONS.

PICTURE COLLECTION.

1 photograph of Professor T. C. Frye. (Given by Mrs. N. L. Britton.)

1 photograph of group of botanists at Vienna, June, 1905. (Given by Mrs. N. L. Britton.)

1 photograph of the original Concord Grape vine. (Given by Dr. L. M. Underwood.)

30 plates from various sources.

12 photographs of scenery and buildings in the New York Botanical Garden.

3 photographs of Professor Hugo de Vries' Garden at Amsterdam. (Given by Dr. D. T. MacDougal).

2 photographs of portrait of Governor Cadwallader Colden. (Given by Miss A. M. Vail.)

1 photograph of Arbor Vitae at Natural Bridge, Virginia. (Given by Miss A. M. Vail.)

1 photograph of Botanical Garden at Brussels. (Given by Miss A. M. Vail.)

2 photographs of Idaho scenery. (Given by Miss A. M. Vail.)

MUSEUM AND HERBARIUM.

28 specimens of North American Ustilaginales. (Given by Mr. G. P. Clinton.)

21 specimens of *Oxalis* from Mexico. (By exchange with the U. S. National Museum.)

4 specimens of mosses from New Hampshire. (By exchange with Miss Annie Lorenz.)

10 specimens of mosses from Nova Scotia. (Collected by Dr. C. B. Robinson.)

13 museum specimens of *Caulerpa* from Ceylon. (By exchange with Dr. Nils Svedelius.)

200 specimens of fungi from the western United States. (By exchange with the Missouri Botanical Garden.)

1 specimen of fungus from Washington, D. C. (Given by Mr. P. L. Ricker.)

6 specimens of fungi from Nova Scotia. (Collected by Dr. C. B. Robinson.)

50 specimens of fungi from England. (Collected by Mr. C. E. Hartley-Smith.)

1 specimen of fungus from Georgetown, Conn. (Given by Professor L. M. Underwood.)

176 specimens of North American plants. (By exchange with the Herbarium of Harvard University.)

8 specimens of Swedish plants. (Given by Dr. Nils Svedelius.)

172 specimens from California. (Collected by Mr. A. A. Heller.)

3 specimens from Nova Scotia. (Collected by Mr. C. L. Moore.)

87 ferns from Cuba and the Isle of Pines. (By exchange with the U. S. National Museum.)

30 specimens "Musci Acrocarpi Boreali-Americani" (Distributed by Professor John M. Holzinger.)

224 specimens from Guatemala. (Collected by Mr. Charles C. Deam.)

30 specimens of fungi from California. (By exchange with Mr. S. C. Edwards.)

17 specimens of fungi from Grenada, W. I. (Collected by Mr. W. E. Broadway.)

1 specimen of *Physcomitrium Kellermani* from North Dakota. (Given by Dr. J. F. Brenckle.)

23 mosses from Alabama. (By exchange with the Geological Survey of Alabama.)

97 specimens from British America. (By exchange with the Geological Survey of Canada.)

1 specimen of *Catharinea crispa*. (By exchange with Miss Annie Lorenz.)

7 specimens of fossil plants from North America. (By exchange with Professor D. S. Martin.)

32 specimens of hepatics from New Zealand. (By exchange with Mr. T. W. Naylor Beckett.)

1 specimen of oak gall from New Jersey. (Given by Mrs. W. A. Lyall.)

3 specimens of conifers from North America. (By exchange with the U. S. National Museum.)

2 specimens of *Juniperus Knightii* from Wyoming. (Given by Professor A. Nelson.)

100 specimens of wild vegetable foods of North America. (Given by Dr. H. H. Rusby.)

5 specimens of blackberries. (Collected by Dr. P. A. Rydberg.)

1 specimen of roots of *Brauneria angustifolia*. (Given by Messrs. Peck and Velsor.)

15 specimens from Michigan. (Given by Dr. H. H. Rusby.)

400 specimens from the Barbados. (By exchange with the Department of Agriculture, Barbados, W. I.)

900 specimens from Jamaica. (Collected by Mr. William Harris.)

184 specimens from Washington. (Collected by Mr. Carl C. Engberg.)

1 specimen of *Pinus strobiformis*. (By exchange with the Forest Service.)

150 specimens from Indiana. (By exchange with Mr. Charles C. Deam.)

3 specimens of conifers from California. (By exchange with the Forest Service.)

6,000 specimens from Porto Rico. (Collected by Dr. N. L. Britton and others.)

57 specimens from British America. (By exchange with the Geological Survey of Canada.)

1 specimen of plant impressions in calcareous tufa. (Given by Mr. Guy W. Wilson.)

500 specimens from Nova Scotia. (Collected by Dr. C. B. Robinson.)

2,400 specimens from Costa Rica. (Collected by Mr. Wm. R. Maxon.)

700 specimens from Cuba. (Collected by Mr. Norman Taylor.)

33 specimens from Colorado. (By exchange with Mr. George E. Osterhout.)

8 mosses from Rarotonga, Cook Islands. (By exchange with Mr. T. W. Naylor Beckett.)

69 specimens from Utah. (Given by Professor A. O. Garrett.)

1 specimen of *Cuscuta* from Georgia. (Given by Dr. R. M. Harper.)

2,000 specimens from subtropical Florida. (Collected by Dr. John K. Small and Mr. J. J. Carter.)

39 specimens of fungi from Nova Scotia. (By exchange with Dr. A. H. Mackay.)

1 specimen of *Andreaea rupestris* from Massachusetts. (Given by Miss Cora H. Clarke.)

5,000 specimens from Jamaica. (Collected by Dr. N. L. Britton and others.)

100 specimens, "Fungi Columbiani" Century XXIII. (Distributed by Mr. E. Bartholomew.)

92 specimens from Mexico. (By exchange with the U. S. National Museum.)

279 specimens from California and Lower California. (Distributed by Mr. A. A. Heller.)

318 specimens from the Philippine Islands. (Collected by Mr. A. D. E. Elmer.)

2 specimens of orchids from New England. (Given by Miss A. M. Vail.)

50,000 specimens of mosses, being the herbarium of the late Mr. William Mitten.

15 specimens of fungi from New York. (Collected by Dr. W. A. Murrill.)

2 specimens of fungi from Oneida, New York. (Given by Mr. William R. Maxon.)

10 specimens of fungi from Brazil. (Given by Mr. G. Bresadola.)

83 specimens of marine algae from New Zealand. (Collected by Mr. R. M. Laing.)

1 specimen from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

4 specimens of fungi from Alabama. (Given by Dr. R. M. Harper.)

50 specimens of fungi from New Hampshire. (Collected by Mr. P. Wilson.)

100 specimens of fungi from British Honduras. (Collected by Mr. Morton E. Peck.)

6 specimens of fungi from Europe. (Given by Mr. L. Romell.)

1 fungus from South Carolina. (Given by Mr. E. W. Berry.)

5 specimens of fungi from New York. (Collected by Mr. G. W. Wilson.)

PLANTS AND SEEDS.

2 plants for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

1 plant for the conservatories, from Cienfuegos, Cuba. (By exchange with Mr. F. Weinberg.)

2 plants for the conservatories. (By exchange with the N. Y. Zoölogical Garden.)

2 plants for the conservatories. (By exchange with Mr. F. Weinberg.)

389 woody plants for the borders. (Purchased.)

214 plants derived from seeds from various sources.

16 packets of seeds. (Given by Mr. C. Wercklé.)

2 packets of seeds. (By exchange with Bureau of Plant Industry.)

1 packet of seeds. (By exchange with Prof. T. D. A. Cockerell.)

1 packet of seeds. (By exchange with Royal Gardens, Kew.)

1 packet of seeds from Oklahoma. (By exchange with Dr. J. C. Arthur.)

1 packet of seeds from Jamaica. (By exchange with the Public Gardens.)

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Vol. VIII FEBRUARY, 1907 No. 86

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA

BY THE NEW ERA PRINTING COMPANY

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The New York Botanical Garden

Vol. VIII. February, 1907. No. 86.

EXPLORATION OF SOUTHERN FLORIDA.

Dr. N. L. Britton, Director-in-Chief.

Sir: In a former report on an expedition to Southern Florida,* I called attention to the fact that it had been our good fortune to explore some of the islands lying in the everglades southwest of Miami while they were yet uninhabited. During our recent expedition to the same region, the value of our earlier explorations was emphasized by what we saw of the destruction caused by the hurricane that had recently swept south Florida. Had we not acquired a fundamental knowledge of the native vegetation of that unique and fascinating region as early as we did, our knowledge of the relation of the flora of south Florida to that of tropical America would have remained very imperfect.

With your permission I left New York on the twenty-second of last October, and proceeded direct to Miami, Florida. I was joined on the way by Mr. J. J. Carter, of Pleasant Grove, Pennsylvania, who continued my tireless associate throughout the expedition. Upon the invitation of Dr. Ernst A. Bessey, who is in charge of the Subtropical Laboratory of the United States Department of Agriculture, we established our headquarters in the laboratory building of that institution, and to Dr. Bessey and his associates, Mr. Fawcett and Mr. Wester, we tender thanks for their constant coöperation and association. We were also accompanied during most of the field work by Dr. H. C. Cowles, of the

*Jour. N. Y. Bot. Gard. 5: 49. 1904.

University of Chicago, who, together with Mrs. Cowles, is studying certain features of the Florida flora.

The object of our field work was mainly two-fold; first, we had planned a survey of Long Key and several adjacent everglade islands which, taken together, form the southwestern extremity of the chain which appears north of the Miami River; second, we had arranged to continue the survey of the Florida Keys, in order to secure and to preserve the knowledge of the native flora of that singular chain of islands before it becomes further obscured or wholly destroyed by the advance of civilization. The high water in the everglades prevented us from getting more than a distant view of Long Key, consequently we continued exploration on the larger group of islands lying between Miami and Camps Longview and Jackson, and through the courtesy of Mr. Johnson, of the Florida East Coast Railway engineer corps, we were enabled to penetrate a wholly unexplored section of the everglades lying between the present terminus of the railway and Key Largo, including a portion of Cross Key. Our interesting experience on the latter island indicated further important discoveries when its flora shall be more thoroughly explored. This island, together with a parallel and almost similar formation, constitutes the only natural and approximately complete land-connection between the Florida Keys and the mainland of the peninsula.

As we reached the field about a week after the occurrence of the hurricane already referred to, we had an opportunity to observe its effects on the vegetation. The everglades were exceptionally full of water, a condition caused not only by the heavy rains of the recent storm, but also by those of a very wet season preceding it. On the islands of coral sand-rock, the pinelands were uninjured except for the relatively insignificant loss of myriads of pine trees which were blown over by the wind, the number being especially large because of the fact that the trees growing directly on the exposed rock cannot make tap-roots. The islands ranging from the vicinity of Homestead Station southward had been completely submerged during the latter stage of the hurricane; the water lying to the northwest being pushed out of the everglades by the extremely high winds, swept over the islands, and poured into the everglades to the southeast. The hammocks were greatly injured, the very small ones isolated in the higher portions of the pinelands being especially damaged. With only the slight external protection of the slender pine trees to break the force of the wind, their vegetation was practically mowed down.

These little hammocks were the homes of many of the botanical treasures of the region. Within them were formerly discovered numbers of West Indian plants not known to occur elsewhere on the North American mainland. The half dozen of these hammocks which we examined critically during this last expedition were found to be almost total wrecks. Their complete natural restoration will be a question of at least a century, if the homesteader does not finish the destruction already accomplished by the wind. Formerly, the spreading tops of the tall trees, whose trunks varied from two to four feet or more in diameter, interlaced with one another, and the branches were further bound together by means of numerous herbaceous and woody vines. The direct sunlight was thus wholly excluded from the inside of the hammocks, and no matter at what angle the sun might be, twilight reigned there from sunrise to sunset. Many species of plants, both flowering and flowerless, that could not even exist elsewhere in the vicinity, were found to thrive there luxuriantly.

In the case of the Florida Keys, some of the upper islands were twice completely submerged during the hurricane, first by the water blown in from the ocean while the wind came from the southeast, and then by the water blown out from the bay when the wind came from the northwest. Elliott's Key was a conspicuous example of devastation. Under normal conditions the vegetation of this key is luxuriant, both the herbaceous and woody plants growing in such masses as to be almost impenetrable at most places, and, as seen from the bay or from the ocean, exhibiting a solid bank of green. During our last visit this key presented the aspect of a desert; the herbaceous vegetation and small shrubbery was temporarily almost annihilated by the deluge of salt water, while the trees and shrubs presented leafless and apparently dead skeletons, the wind having whipped off every leaf. Several weeks after the storm all of the trees, as if recovering from the shock, started simultaneously to put forth not only new leaves, but also flowers.

Our investigations on the keys were confined to the northern ones, and we have learned that on account of their floras, as well as their position, Virginia Key and Key Biscayne, which lie opposite Miami and Cocoanut Grove, are to be associated with the mainland, which ends as a narrow peninsula just north of them, and not with the rest of the keys ; from which, moreover, they are separated by an interval of almost ten miles, leaving out of consideration the insignificant Soldier's Key, which is a mere isolated sand-bar about five miles south of Cape Florida. Their vegetation consists of a dense growth of mangrove on the side facing the bay, the usual tropical beach flora along the ocean and a few of the sand-dune plants which are common for many miles northward along the coast.

Our work on the mainland was considerably impeded by the effects of the hurricane, the high water in the everglades, which in some sections partially submerged the islands and filled all of the prairies, and the fallen trees throughout the pinelands greatly delayed our progress. We experienced the most difficulty in making progress to the southwest of the settlement of Cutler, where time was consumed in mending both harness and wagon. Naturally, accidents happened in the more unfavorable places. At one point in the everglades, when the doubletree and one singletree of the wagon and three traces and several minor straps of the harness all broke simultaneously, the driver, before he recovered from the shock, had the charity to suggest that he ride the horses to the nearest point of dry land and that the rest of us pull the wagon out. Contrary to the exhilarating effect which the environment of these rugged and uninhabited regions had on most of us, it seemed to have a uniformly depressing effect on our drivers. This was most plainly shown by the fact that we had a new driver on each successive excursion. The monotony of wading the submerged prairies, which are usually dry at that season, was varied by both the depth of the soft mud and the number of the treacherous pot-holes in the rock bottom under the mud. In fact, we became so accustomed to an amphibious mode of life that several of the party complained that they did not feel natural when deprived of the aquatic stage for any length of time.

We have now accumulated enough knowledge of the flora of these islands of coral sand-rock in the everglades to make the solution of many problems, both general and local, very interesting. This chain of everglade keys is a miniature of the Florida Keys, both in its crescent shape and its flora, and also of the West Indies in the character of its vegetation. It is surrounded by the everglades, except where the upper islands touch Biscayne Bay at points from Miami to Cutler. Before these islands were elevated to their present altitude, they were probably surrounded by a shallow sea just as the Florida Keys are at the present time. This being the case, we can easily account for the tropical American flora now inhabiting them. After sufficient elevation had taken place, the surrounding sea was transformed into the vast spring now known as the everglades. Conditions becoming favorable, the plants of the flora of northern peninsular Florida advanced southward and naturally took complete possession of the area that was formerly the sea, thus surrounding and isolating the wholly different flora of the islands. In fact, the two floras are so sharply delimited that one can often stand with one foot on plants characteristic of the high northern regions and the other on plants restricted to the tropics. It is not an uncommon experience to see colonies of plants common in Canada, such as the arrowarum (*Peltandra*), the lizard's tail (*Saururus*) and the ground-nut (*Apios*), growing side by side with tropical palms, cycads, orchids and bromeliads.

The total area of these islands is perhaps about one hundred and fifty square miles. Those that we have explored have yielded between five and six hundred species of native flowering plants, surely a very large number when we consider that the solid rock is exposed everywhere and that soil in the sense that we are accustomed to think of it does not occur there. The close relationship of this flora to that of the West Indies is now established by the fact that considerably more than one half of the species found on the islands south of Miami are also native in Cuba and the Bahamas.

Since the publication of my last report on exploration in southern Florida,* and a subsequently printed paper on the species added to the flora of that state,† we have secured over fifty more species not before known to grow on the North American mainland. Eight or ten of these are complete novelties, inasmuch as they are not yet described. Noteworthy among the recent collections, which make an aggregate of 3,200 specimens, are seven species not previously included in the arborescent flora of the United States.

Respectfully submitted,

J. K. SMALL,

Head Curator of the Museums and Herbarium.

THE MITTEN COLLECTION OF MOSSES AND HEPATICS.

William Mitten died at Hurstpierpoint, Sussex, England, on July 20, 1906. Following his last request, his daughter, Miss Flora Mitten, offered his entire collection of mosses and hepatics to Mrs. N. L. Britton and the collection was purchased for the New York Botanical Garden for £400, the donors being Messrs. D. O. Mills, Andrew Carnegie, J. Pierpont Morgan, Jas. B. Ford, Geo. W. Perkins and Charles F. Cox.

At the request of Dr. Alfred Russell Wallace, Mr. Mitten's executor, a representative of the Garden, Mr. R. S. Williams, was sent to pack and ship the collection, which was received safe and in good condition on December 6, 1906. Besides twenty large boxes full of mosses, the collection contains ten boxes of hepatics. Mrs. Britton also received as a gift from Miss Mitten a large photograph of her father and his personal copy of the "Musci Austro-Americani," his greatest work, which, strange to say, is absolutely without notes or writing of any kind, as Mr. Mitten was in the habit of laying memoranda and descriptions of subsequent additions in the covers with his specimens.

* Jour. N. Y. Bot. Gard. 5 : 157–164. 1904.

† Bull. N. Y. Bot. Gard. 3 : 419–440. 1904.

Two accounts of Mr. Mitten's life and work have appeared, one in the Journal of Botany for October, 1906, by W. Botting Hemsley and the other in the Bryologist for January, 1907, by William Edward Nicholson, both of which are interesting personal sketches, the latter giving a bibliographical list, but neither of them containing any account of his collections. In a letter dated September 5, 1906, Dr. Wallace states that "Nobody ever touched, or hardly ever saw these collections but Mr. Mitten himself and a few specialist visitors. Although I have never examined them myself, as a friend (and a son-in-law) of Mr. Mitten for forty years, I know something of them and I am inclined to think that they constitute the richest (or nearly the richest) private collection of those groups in existence, while it is doubtful if any public collections are much richer. Mr. Mitten, as you know, has studied and described mosses for nearly sixty years, and for a long time was the greatest British authority on them, and received collections to sort, name, and describe from collectors, museums, and travelers, in every part of the world. Of all these he reserved sets for himself, and has thus accumulated an enormous collection, the nomenclature and arrangement of which he was at work at up to the end of his life."

Beginning in 1851 with a list of mosses and hepatics from the vicinity of his home in Sussex, the 57 titles which follow include studies of the mosses and hepatics from Quito, Portugal, New Zealand, Panama, the East Indies, Tasmania, Fiji, Tropical Africa, the Azores, Japan and China, Samoa, Ceylon, St. Paul, and St. Helena, Bermuda, Kerguelen, Cape of Good Hope, Morocco, Polynesia, British Guiana, Socotra and Borneo.

His largest and chief work was the description of the mosses of South America, including Central American and West Indian species. This was published as Vol. 12 of the Journal of the Linnean Society in 1869. It contains 659 pages and includes 603 species and 19 genera new to the region, of which the types are in his herbarium. It was largely based on the collections made by Richard Spruce in his travels up the Amazon, Orinoco and Rio Negro and across the Andes, and by Jameson, in Peru; as well as those made by Lindig and Weir in New Granada;

Burchell and Glaziou in Brazil; Funck and Schlim in Venezuela; Martens, Galeotti and Bourgeau in Mexico; Godman and Salvin in Guatemala, and by Seemann in Panama. Collections from the West Indian islands include the following: From Jamaica by Swartz, Purdie, Wilds, Wilson, Hart, Jenman and Harris; from Cuba by Wright; from Grenada by Broadway; from St. Christopher by Breutel; from Trinidad by Fendler and Cruger; and from Haïti and Santo Domingo by Swartz. He had very few mosses from the French Antilles, a lack which has already been supplied in the Garden collections by the purchase of the herbarium of Père Duss, made in the islands of Guadeloupe and Martinique, which contains many species whose type localities have since been destroyed by the volcanic eruption of Mt. Pelée.

His collections are not as rich in European exsiccatae as that of Jaeger, but they supplement those already at the Garden with several sets that were lacking, notably Spruce's Mosses of the Pyrenees. There are also two fine sets of Drummond's First Arctic and Canadian Collections of North American Mosses, secured during the second Land Arctic Expedition under the command of Sir John Franklin, in 1828. One of these sets was the property of Sir John Richardson. He also had a set of Drummond's Second Collection from the Southern States, 1841, one of Sullivant's Musci Alleghanienses, 1845, and one of Sullivant and Lesquereux's Musci Boreali Americani, First Edition, 1856. Besides these he had collections from Richardson made in the Northwest Territory from the vicinity of Great Bear and Great Slave Lake; from Davis Strait and Arctic America by James Taylor; from Lake Winnipeg, Saskatchewan and the Rocky Mountains by Bourgeau in Palliser's British North American Expedition, 1859; and from the Northwest Coast, Vancouver Island and British Columbia by Menzies, Lyall and Douglas. The mosses of the 49th parallel, or the northern boundary of the United States, were named and listed by Mitten, in the Proceedings of the Linnean Society, 1864. From John Macoun, he received a fine set of the mosses of Ontario. He also had specimens sent by Dr. C. W. Short from Kentucky, Chapman from Florida, T. P. James from New Hampshire, and John Torrey rom New York.

Among the most valuable of his collections are those made by the various Arctic and Antarctic Expeditions. Among these are the sets of mosses from Spitzbergen collected by Parry and Ross in 1819–1820, from the herbarium of Robert Brown, and those collected in Greenland, Baffin's Bay and Melville Island by Franklin in his search for the Northwest Passage. There are also collections made by Seemann on the Voyage of H. M. S. Herald in 1845–1851 at Panama, by the Transit of Venus Expedition in 1874–1875, by Moseley on the Voyage of the Challenger in 1875, including specimens from Bermuda, and by the Roraima Expedition in British Guiana in 1884.

Asiatic mosses are represented by collections in the Himalayas by Hooker and Thomson ; in Nepal by Griffith ; in Ceylon by Thwaites ; and in Burma and the Straits Settlements by Griffith. A few Chinese and Japanese mosses also were described in 1864. Those from Borneo, Sumatra and Java, including Fleischer's Musci Archipelagi Indici, will be very useful in naming the recent collections made in the Philippines by Mr. R. S. Williams. The collections from New Zealand made by Hutton and Kirk and from Samoa by Powell seem to be largely duplicated and available for exchanges. Besides these, there are other Polynesian mosses from Fiji and New Caledonia, and Australian mosses from Melbourne, Port Philip, Gippsland, Victoria and New South Wales,

African collections were received from Central Africa, collected by Bishop Hannington and from Kilimanjaro by H. H. Johnston ; from West Africa from the Cameroons and River Niger ; from Southern Africa, including Rehman's exsiccatae of 1875–1877 ; from the Cape of Good Hope by Milne and Eaton and McGillivray and Burchell ; from Madagascar by Pool ; from Mauritius by Ayres, Balfour and Telfair ; from Bourbon and Socotra by J. B. Balfour ; from St. Thomas by G. Mann ; from Algiers and Morocco by Sir John Ball ; and from Fernando Po and St. Helena, the Azores, and the Atlantic Islands of Madeira and Canary.

Local mosses from the vicinity of Hurstpierpoint and other parts of Sussex and Kent, which had been made up into sets for exchange, are also well represented ; together with several duplicate sets of Drummond's mosses of Scotland and collections of his own from Wales.

The entire collection abounds in beautiful drawings, which usually accompany the specimens. It frequently happens that every species in a cover is illustrated.

NATURE-STUDY AS AN EDUCATION.*

Nature-study has been exploited during the last score of years in this country in various ways. It began here as an off-shoot of the so-called object-lessons introduced by Dr. Sheldon into the Oswego Normal School, and received further stimulus in the Cook County Normal School under Dr. Francis Parker and Mr. W. S. Jackman, who attempted the first formulation of nature-study as a distinct subject, and prepared a text-book of numerous isolated suggestions for the teacher, these suggestions ranging through many subjects and sometimes going far afield. And yet the key-note of the book as stated by the author rings out strong and true: "Let us place the children in the woods and fields that they may study nature at work."

About the same time (1889), Mr. Arthur C. Boyden of the Bridgewater Normal School championed the new idea, began teaching in the state institutes of Massachusetts, and got out a pamphlet on the "Study of Trees in Plymouth County"; one of the first of a long series of fluttering nature-study leaflets by men and women who, knowing much or little or nothing at all about the subject, have found the theme a good one to write upon. At the same time, also, a department ot nature-study was organized in the Summer School of Cottage City under the name of elementary science, and in the latter part of the eighties, nature-study under the name of elementary science was receiving consideration in many schools in several states.

From 1890 to 1895, exhibits of nature-work were common in cities, the display at the World's Fair in Chicago being the culmination of this phase of development.

* Read before the convention of the New York Botanical Garden January 23, 1906. Published simultaneously in the Garden JOURNAL and the Nature Study Review.

About ten years after the first introduction of elementary science into the grades, two men came forward to whom children will be grateful for centuries to come. Of all the numerous writers who have considered nature-study from one standpoint or another, the principles set forth by Professor Bailey of Cornell and Professor Hodge of Clark, are as sane and practical as anything yet presented. To little people shivering over their first experience in the clear, cold atmosphere of science, a warmer temperature and more genial atmosphere were eagerly welcomed.

While there is no doubt of the constant advance of nature-study over the country as a whole, yet the gain is not the mushroom growth of the first few years, and this is well. There has been lack of fibro-vascular tissue, and in more than one place nature-study has been dropped after a trial. This has occurred in a few large cities where the problem is most difficult, or where the school-board has failed to recognize the value of nature-study as a means of education, or in some cases where the teaching has been inadequate.

Nature-study, then, has already passed through various phases with us: first came the experiment followed by the exhibition which so inspired the on-lookers that it straightway became a fad; then came the period of reaction and criticism when nature-study became less serious — more of a recreation — and here came the opportunity to run in the unusual, the exceptional, the sensational in nature literature, which is not nature-study at all, though it may be very good literature; and now our leading lights tell us that nature-study is an idea, an atmosphere, an attitude, — in a word, it is spirit. This, then, is the promise of the future, and our prophets prophesy wisely and well. But we cannot hope for any universal fulfillment of the prophesy for several generations to come — not until there has been time to train our teachers, and they in turn have had the opportunity of training the children who are to be the parents of the next generation. In the next generation we may begin to look for parents who will not destroy the attitude, the atmosphere of nature-study, which is an inherent part of the nature of the normal child. He inherits from ancestors remote a primitive love of nature and every natural object. Any child of three years turned loose in a small space out-of-doors where there is good clean dirt with worms in it, and pebbles, where green things are growing, where the chance caterpillar and toad and small snake are free to come and go, has amusement for a summer. Some one has well said:

> "Out-doors, God amused him; in-doors his mother;
> And the finite can never satisfy as the Infinite."

It is only when the child learns from others that he "must not touch the toad or he will get warts," that the harmless garter-snake is a poisonous reptile, that the caterpillar will bite; that his faith in nature is shaken, the nature-study atmosphere darkened, and the nature-study spirit hampered.

Dr. M. T. Cook says that in Cuba he frequently gave his one-year-old son small snakes to play with, and the child considered them the most interesting kind of a plaything, until at the age of four he began to run with other children. In a short time the boy became afraid of snakes and is still afraid of them. Professor Hooker, of Mt. Holyoke College, had a little visitor whom she found it hard to entertain, so she brought out some snakes which she called her "little friends." The child was delighted, and played with them happily until she heard some one call them snakes, then dropped them in fear and disgust.

A child in the first primary grade of the University School for Girls in Chicago brought a tiny leafless twig to her teacher and asked her to use it for the nature-study lesson. The teacher thought it a rather small affair, but a leaf-bud or two offered suggestion, and the teacher held out for what seemed to her a very creditable length of time and then turned with relief to a gay picture of an oriole on the wall. But the children did not want orioles in pictures on the wall; they wanted a little live twig, and the small girl who had brought it in raised her hand and asked severely, "Why don't you go on with the nature-science?"

That which we are to aim for, then, we have at the very beginning; but by the time that the child goes to school he has lost more or less of it, and it is more difficult to restore it in a soil that has been sterilized than it would be to start anew in fresh soil. Allowing for individual exceptions, I have found it true that interest in nature-study in schools where the subject is not a vital one varies inversely with the age of the children, and that the difficulty in exciting an interest varies directly with the age.

The problem that confronts us is, how shall we recover that which has been lost ; how shall we reach the ideal, the pervading atmosphere that colors, the idea that permeates the whole life, the nature-study spirit. Now the child of the graded school has many teachers. It is a chance if he ever has one who really understands and fully comprehends just what Bailey means by atmosphere and attitude and idea and spirit. It is possible that one may be all this and that the school may have the spirit and never know it. I am not sure but this is the essence of the whole thing — the spirit free because unconscious of itself.

At one of the State Summer Schools held in Bennington, Vermont, a young teacher came to me and told me how much she regretted the impossibility of having any nature-study in the little rural school where she taught. "The parents are not willing that the time should be given in school," she said, "the programme is already crowded, we have no money with which to buy books. But," she added, "there is a little brook back of the school house, and the children and I stay out there about all the time at recess and noon and we all go early in the morning before school. We have a series of pools, and in them we have several kinds of fish, and in one pool we have some salamanders, and in another turtles, and in another pollywogs. We feed them and keep the pools in order and the children do have such a good time. Then a little house-wren came into the school house and built her nest on the stove-pipe by the chimney, right in the school room. And the children would keep just as still as possible so as not to disturb her."

This dear girl assured me over and over again with tears in her eyes that she would be so glad to have nature-study in her school, but that it was simply an impossibility ! This illustrates how difficult it is for one to grasp the real significance of the study as presented by even so plain and simple and straightforward a speaker as Professor Bailey.

Atmosphere is intangible at best, and not an easy mark for the inexperienced. One may be sure the arrow will hit somewhere, even if sent at random, and many of our public-school teachers have evidently taken refuge in this thought, and the result is random and haphazard.

The result would be the same and perhaps the idea might seem more definite, if, with the idea of attitude as the ultimate goal, we should begin by aiming at some nearer mark. To inspire the boys and girls with a vital rational interest in their immediate natural environment — an interest that shall continually widen with the circles of growing experience and knowledge founded on experience, and so lead to a wider environment — this is concrete and feasible.

In the country, there is such abundance of material that the question is one of choice; in the more cramped conditions of the larger cities, the question of choice is largely eliminated, and here it is necessary to seize upon every natural object that comes within the reach of the children and to widen their pathetically limited environment by constantly reaching out, always from something they have seen or experienced, to the things beyond, and to inspire them with a desire to learn what lies outside the few blocks which immediately surround them. Settlement-workers tell us that most children in the crowded tenement districts seldom go beyond the half-dozen blocks which supply the necessities of life. A little girl of nine years was taken to the country for the first time. She was amazed beyond measure; she had attended the public-schools, but she had never been told that the earth was not paved all over, and it had never occurred to her that it could be any other way. Let us teach the children to love the parks, not simply as pleasant places in which to play but as places where one can know the trees as individuals that in time may become one's comrades and friends. To know the trees that are in our parks, to know them by their outlines and buds and twigs and leaves and flowers and fruits, and to watch the changes in them from week to week and season to season is to have an unfailing resource for pleasure throughout life. To teach the child a proper appreciation of our parks and scenery and to make him feel a sense of ownership in them is to make him some day a better man.

We can do no better and go no farther today than did Aristotle when he said:

"It is clear then that there are branches of education and learning which we must study with a view to the enjoyment of leisure, and these are to be valued for their own sake; whereas those kinds of knowledge which are useful in business are to be deemed necessary, and exist for the sake of other things. It is evident then that there is a sort of education in which parents should train their sons, not as being useful or necessary, but because it is liberal or noble."

In commenting upon this passage, Burnet in "Aristotle on Education" says:

"Here in simple form is the perennial problem as to whether the end of education is culture, or to fit us for the business of life. The most ardent business men will tell you that they work hard in order that they may be able to retire; the misfortune is that when they have retired they are very often at a loss what to do with their time.

"An education which took as its aim to train people in such a way that they could rightly enjoy the rest which they have earned by a life of toil would, we can see, have a good deal to say for itself, and might be quite as "practical" as one which merely anticipated the "useful and necessary" activities of the business life itself. It might sound strange at first, but it would not be amiss if we were once more to speak with Aristotle of the noble enjoyment of leisure as the end of education in its highest sense. It is just the want of such an education that makes men put up with that very poor and cheap substitute for theoria, the life of amusement.

"The Gospel of Work is a noble one and has been nobly preached, but the neglect of the still higher Gospel of Leisure has produced the results which Aristotle has indicated so clearly. We cannot always work, and if our education has not fitted us to use our spare time rightly, we are sure to take to the life of mere amusement. We all know men who would be transformed if only they knew what to do with themselves when they are not at work. We can all see that whole classes of the community are sunk in needless degradation just because their lives are a succession of periods of overwork and intervals of low or vicious relaxation. And we can see too that the end of the nineteenth century, the century of work, has been marked by a morbid, an abnormal growth of the craving for amusement and excitement which has threatened at times to break up society altogether. It is from the Greeks that we can best learn the cause and cure of these ills."

Of the thousands of poor and ignorant people who visit the New York Botanical Garden during the spring and summer and autumn months, on the one day of leisure in the week, one does not dare to venture a guess at the per cent. of those who really care for the things of the park aside from space and coolness. If only these people had been educated to an appreciation of nature, what an additional inspiration this place would become in their sordid lives!

President Cleveland went fishing when the affairs of state became too taxing; President Roosevelt hunts bears. When the little boy in the first grade of to-day becomes president, the same instinctive craving for nature may be satisfied in a simpler way if nature-study be rightly taught. It was not the fish that President Cleveland wanted; he could have bought them with much less trouble at the market. It is not the bear-skins that President Roosevelt wants; he can buy them at the furrier's. What both men want is the free pure air, the untrammeled woods, the sound of rippling water, the call of the thrush, ferns, moss and wild things; in a word, nature. And, after all, fish and bears are only excuses; just the same results could be had by hunting with a camera, or in listing the trees or studying the ecology of a region, or in hunting for rare ferns.

The most serious problem of nature-study just now is the teacher of nature-study. At present she must be born, for she cannot be made, except in a few places. Without question there are some excellent teachers who would never become good teachers of nature-study, no matter what advantages they might receive. But with these rare exceptions, the good teacher would also make a good teacher of nature-study if only she knew her subject. How can she have any adequate comprehension of that which she has not herself experienced? She did not have nature-study in the grades when a child herself; she did not get it in the high school except in rare instances; there are scarcely a score of normal schools that offer nature-study as nature-study; and the number of colleges that offer such courses can be counted on the fingers of one hand. Courses in biology, including botany and zoölogy, are now generally offered in the college, the normal school and the high school; but these courses are largely dominated by the spirit of the scientist and the specialist — and rightfully so.

A little girl said to me: "I don't care at all for botany, but I just love flowers." Now the specialist may love botany and not care for flowers. Particularly if he works along histological or embryological lines, he may be wholly ignorant of nature in any field except the somewhat limited one bounded by the horizon of his microscope. I one day asked a most enthusiastic and successful instructor in one of our leading universities what a certain common wild-flower of that region, new to me, looked like. This man had made something of a specialty of the points brought out in the development of this particular flower and had prepared many slides from it. He replied that he did not know what the flower looked like, and did not care, that that was not the point; that he did not know any flowers by their names in the field, he had no time to learn them, and he did not know what good it would do him if he did know.

A student had just finished her research on a problem connected with pines and had taken her degree. She was out driving with a friend who inquired about some pines they were passing. "Oh, I don't know anything about our native pines, not even their names," was the reply.

Even in the high school the courses in botany and zoölogy have been until quite recently too technical and limited to certain lines to fit the requirements of college entrance. Fitting for college and fitting for life have been two quite different things.

And nature-study should be taught in the grades. Where shall the teacher learn? Can she get it from books? A few summers ago I was riding on the front seat of a trolley car through a beautiful Vermont valley at sunset. A woman whose dress and general air bespoke culture and refinement sat beside me. She was wholly absorbed in the pages of a book and utterly oblivious to the surrounding beauty and glory. I concluded that she was doubtless so familiar with the place that its charms were no longer felt, and I pitied her. We passed a large and stately building on a hillside. "Pardon me," I said, "will you kindly tell me what that building is?" "I'm sure I don't know," was the reply. "I was never here before," and she relapsed into the book again. Then I was seized with curiosity to know what she could be reading. The car gave a favorable lurch, I leaned over, and caught the title of the book, "Self-Culture," and the chapter-heading at the top of the page read "The Love of Nature."

In addition to the quickened and widened environment of the child, which should be the first aim of the teacher of nature-study, we may look with assurance for many valuable results which are by-products. In the past one or another of the by-products has too often been mistaken for the main object. This was especially true at first when it was claimed that the greatest gain to be derived from the study of natural objects is increased power of observation. This increase is a natural result; one looks at the things he is interested in, and the more things one is interested in and the more he is interested in some one thing, the more he sees. "It is active seeing, not passive looking which constitutes observation," says Professor Ganong. The result should culminate in visualization — the power to reproduce subjectively that which has been seen objectively.

The nature-teacher said to the third-grade class of a school in Missouri: "Children, I want you to watch a spider and see if you can learn something about it that you did not know before. Then I would like you to write down whatever you find out and bring it to me." The next day Locke Sawyer brought in the following to his teacher: "Onct I sawn a spider spin his web. He span it on the winder-pain. I watched him as clost as I could. He went along in front and spun behind." Here is the real thing — visualization: one sees the spider with the boy, "going along in front and spinning behind." The delighted teacher, carried away by the enthusiasm of the moment, began to tell the children how spiders spin, how they have a little reservoir of adhesive liquid substance within, which is forced out and hardens into a thread on exposure to the air. Locke was vastly interested; he wanted to write down what the teacher had said, and at his request his paper was returned. This is what he added: "Inside of himself the spider has two tin cans. These are for its web, which is glue before it is spun."

A second scientific value of nature-study is that it develops the power of reason. One learns to generalize from the particular and to make critical comparison. The whole subject of adaptations comes in here and appeals strongly to the child. Bills and beaks and teeth and feet and tails take on new interest when one grasps the fact that they are to serve some special need. Nature-study leads to faith in causality, which involves the belief that every phenomenon is linked with preceding factors. The child is freed from superstition; and bats that cause your hair to fall out, and toads that cause warts, and devil's-darning-needles that sew up your ear if you ever told a lie, lose their terrors and become objects of interest and perhaps companionship.

Of the cultural instincts which are developed, we may note briefly:

1. Power of expression; the child can talk about the thing he is interested in, he can write about it, he can make a picture of it. But let his teacher remember that these are the products of nature-study, and that nature-study can never be the product of talking or writing or drawing. The child's language should be more accurate and logical. He should learn to tell the truth and not exaggerate. Laboratory methods should lead to greater skill and dexterity in the use of the hands.

2. Knowledge for its own sake and love of knowledge should result from the widened environment of the child. Knowing his own surroundings, he is able to interpret what he reads and geography takes on a new meaning.

3. The æsthetic values of nature-study are not to be overlooked in a time when utilitarian ideas are as prominent as today. Let the child know that the sky and clouds and sunset coloring and the river and hills beyond are his in the same sense in which the parks are his — to appreciate and enjoy. Whatever one can see that is beautiful is his own as much as though it were his individual property. All that any one can do with a beautiful object is to contemplate it with appreciation and enjoyment. It is possible for the poorest child to be richer than the multi-millionaire.

4. The industrial and economic side of the question appeals to many, especially to parents and school-boards. Plants and animals beneficial and injurious, pests and their extermination,

problems of food and clothing, of shelter and sanitation and personal hygiene, all become a legitimate part of the great subject.

5. Finally, the ethical value of nature-study which results in happiness to the individual is most important. One is never happier than when riding a hobby and riding hard. Birds or butterflies, trees or mosses, ferns or fungi — it doesn't matter, so long as one has an absorbing interest in the world without. Health and happiness are not to be despised in these days of nerves and constant demands for new sensations.

To the love of all created things nature-study should lead, and if it be true that love is the greatest thing in the world then nature-study is indeed justified. A man who ranks high in the scientific world showed this spirit when he carried a tub of sea-water back to the beach from which it came, a distance of some rods, and poured the water into the sea saying, "I could not see any life there but it would be a pity to run any risk of destroying life needlessly."

That the country-boy will see more of interest and beauty in his surroundings, and that the city-boy will learn greater appreciation of the country may be reasonably expected ; but not until the agricultural side of nature-study has been much developed can we hope for that which will help to solve the greater problems of rural districts. Nature-study has no need to demand more than rightfully belongs to her.

MARY PERLE ANDERSON.

NOTES, NEWS AND COMMENT.

Mr. C. F. Millspaugh, of the Field Museum of Natural History, Chicago, spent about two weeks at the Garden before his departure for the Bahamas.

Dr. N. L. Britton and Mrs. Britton left New York on February 11 for the Bahamas, where they will spend several weeks in botanical exploration. Mr. C. F. Millspaugh will join them at Nassau.

Dr. Marshall A. Howe returned on January 30 from an expedition to Jamaica, where he devoted five or six weeks to collecting and studying marine algae in Kingston Harbor and vicinity and at Montego Bay. When the disastrous earthquake of January 14 occurred, he was at Montego Bay, where the shock was comparatively light. His Kingston collections, which were stored at the time in a wooden office building on the water-front of that ill-fated city, were uninjured by the earthquake and escaped the subsequent fire.

In connection with the New York meeting of the American Association for the Advancement of Science, during Convocation Week, 1906–1907, an exhibition was held at the American Museum of Natural History, from December 28 to January 14, by the New York Academy of Sciences. The purpose of the exhibition was to illustrate the most recent advancement in the different branches of science. The Associate Committee for botany consisted of C. Stuart Gager (Charman), George Francis Atkinson, William L. Bray, John Merle Coulter, Margaret Clay Ferguson, Byron David Halsted, Edward Charles Jeffrey, Duncan Starr Johnson, and Lucien M. Underwood. The botanical exhibit, assembled from various institutions and workers throughout the United States, consisted of herbarium, alcoholic, and living specimens, photographs and drawings, microscopic preparations, new apparatus, and literature; representing recent advancement in physiology, morphology, taxonomy, palaeobotany, teratology, pathology, cytology, horticulture, the pedagogy of botany, and the development of botanical gardens and laboratories. There was a total of about forty-five entries, making the botany exhibit the largest, but one, of the exhibition.

Of the precipitation for January, 13½ inches of snow fall were recorded in addition to 1.54 inches of rain. Maximum temperatures were recorded of 58° on the 4th, 67.5° on the 7th, 52.2° on the 20th, and 37° on the 22d. Also minimum temperatures of 27.5° on the 6th, 16.5° on the 10th, 10° on the 17th, 0° on the 24th, and 11° on the 31st.

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287 specimens "Musci Indiae orientalis." (Collected by Mr. W. Gollan.)

3 specimens of fungi from British America. (By exchange with Mr. E. W. D. Holway.)

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Vol. VIII MARCH, 1907 No. 87

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA

BY THE NEW ERA PRINTING COMPANY

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JOURNAL

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The New York Botanical Garden

Vol. VIII. March, 1907. No. 87.

REPORT ON A VISIT TO JAMAICA FOR COLLECTING MARINE ALGAE.

Dr. N. L. Britton, Director-in-Chief.

Dear Sir: Pursuant to your instructions, I spent six weeks during December, 1906, and January, 1907, on the island of Jamaica in making collections and field studies of marine algae, and I beg to offer at this time a brief and informal report on the expedition. I left New York December 9 on the *Prinz August Wilhelm* of the Hamburg-American line and reached Kingston the evening of December 14. Through the kind intercession of Mr. William Harris, the superintendent of Public Gardens and Plantations of Jamaica, Mr. David Henderson, one of the leading merchants of the island, very generously placed at my service a workroom in an office-building in a lumber-yard near the waterfront of Kingston at the foot of East Street. The first day after the unpacking and settling down was spent in company with Professor Charles Wright Dodge of the University of Rochester in getting acquainted with some of the peculiarities of Kingston Harbor, the "Palisadoes," and the outlying islands or "cays," under the able tutelage of a resident naturalist, Mr. P. W. Jarvis of the Colonial Bank. In conditions like those found in Kingston Harbor and vicinity, very little in the way of marine collecting is possible without using a boat, so I engaged by the week the services of two negro boatmen, with their dug-out canoe *, in which sails could be raised when the breezes favored.

* Made from the trunk of the "cotton-tree," *Ceiba pentandra*.

Kingston Harbor is nearly enclosed by a low narrow tongue of land about eight miles long known as the "Palisadoes." The bottom of the harbor is for the most part muddy, and wide stretches of it are covered with "eel-grass" or "turtle-grass" — *Thalassia testudinum*. In the Bahama Islands, Bermuda, the Florida Keys, and Porto Rico, the *Thalassia* is often accompanied by interesting marine algae of such genera as *Penicillus*, *Rhipocephalus*, *Halimeda*, *Udotea*, and *Caulerpa*, and its leaves often bear a variety of algal epiphytes, but in Kingston Harbor, at least at the time

FIG. 9. Hope Gardens, Kingston, showing herbarium- and office-building young date-palms, etc.

of my visit, this eel-grass seemed to occupy the field to the exclusion of nearly everything else. However, certain kinds of algae were to be found on either shore of the harbor; and on the roots of the mangroves, which were especially abundant near the mouth of the harbor, were collected the species of *Bostrychia*, *Polysiphonia*, *Catenella*, etc., which commonly affect such situations throughout the West Indian region. In a little creek connecting two mangrove-fringed lagoons were found a few specimens of the rare and interesting *Acicularia Schenckii*, occurring in surroundings very similar to those in which I found it some years ago in Bermuda.* On the long outer beach of the Palisadoes—the low, brush-grown, cactus-covered reef and sandbar which forms the harbor's seawall — several rather uncommon deep-water seaweeds, such as *Dictyurus* and *Haloplegma*, were picked up in considerable quantity. But the low islands and scarcely covered reefs lying in the open Caribbean from one to five or six miles outside the harbor afford the most interesting collecting grounds for marine algae in the Kingston region. Of special interest among the algae found on these cays may be mentioned the forms of the lime-coated Galaxauras, several species of the unjointed corallines —a group which had previously been little collected in Jamaica—, and the very luxuriant display of *Caulerpa clavifera* and of the related but evidently quite distinct *Caulerpa racemosa* (*C. uvifera*). *Caulerpa clavifera* formed extensive handsome mats on coral reefs mostly from the low-water line down to a depth of only one or two feet; *C. racemosa* grew in slightly deeper water and in somewhat more protected places, yet the two were often found intermingled and retaining their distinctive characters perfectly. I had noted the association and distinctness of these two species (*forms* or *varieties* of various authors) on several other of the West Indian islands, but nowhere else have I observed the two in such luxuriance and perfection of development. It may be remarked here that the tides at Kingston are so light (usually with a range of one foot or less) that they can be ignored in the practical work of collecting. A smooth sea, especially if one is to reach the outside cays in a dug-out canoe, is of much greater importance than a low tide. In December, at least, on the south shore of Jamaica the sea is commonly calm during the morning hours and indeed up to eleven or twelve o'clock, by which time the daily breeze has made its surface more or less rough. I therefore planned to make my collections in the morning and forenoon and to arrange and prepare the specimens in the afternoon. On only two or three days of my nearly three weeks' stay in Kingston was the sea sufficiently boisterous to make venturing outside the Palisadoes in a

* See Bull. Torrey Club 28: 323. 1901.

canoe unsafe. And there was not a drop of rain during this period (nor for some weeks before and after) at Kingston. The bright warm sunshine made the possible discomforts of sea-wet clothing scarcely noticeable.

On January 3, I went by rail to Montego Bay on the northwest coast of the island, a distance of 114 miles, as the cars run, from Kingston. Here ten days were devoted to the collection of marine algae, with good results, a considerable number of species occurring here that were not met with on the south shore. The Bogue Islands, in the southern part of Montego Bay, with their

FIG. 10. Montego Bay, Jamaica.

outlying shoals and reefs, formed an especially good collecting ground, and reefs to the north and east of the town also proved to be of much interest. With the aid of a carriage I was able to explore the coast more or less thoroughly for a distance of fourteen miles to the westward of the town of Montego Bay and for eleven miles to the eastward. Except among the Bogue Islands the sea roughened earlier in the forenoon and was in general less easily workable than in the vicinity of Kingston. On arriving in

Jamaica, I had engaged return passage on the *Prinz August Wilhelm*, scheduled to leave Kingston the twenty-fourth of January. It was my plan after finishing the work at Montego Bay to spend a few days in collecting at Port Antonio and then make a brief visit to Cinchona, the tropical station of the New York Botanical Garden, in the famous Blue Mountains of Jamaica. But something happened which had not entered into human calculations. At about 3:35 o'clock on Monday afternoon, the fourteenth, while I was picking up my specimens and collecting outfit for moving on

FIG. 11. The Bogue Islands ("pseudo-atolls"), Montego Bay.

to Port Antonio, occurred the great earthquake which made itself felt throughout the island and brought ruin to its metropolis, Kingston. Little damage was done at Montego Bay, but the few, brief, and conflicting telegrams which reached us that evening and the following day told us plainly enough that a great disaster had overtaken certain other parts of the island. The next day I was on the point of going on board one of the United Fruit Company's banana-laden steamers bound for Port Antonio, as I had previously planned, but was finally dissuaded by the company's local agent, who told me that the hotels in Port Antonio were reported to have been destroyed by the earthquake, that it was accordingly a poor place for one requiring board and lodging to go to, and that I would better remain where I knew I had a good roof over my head! When it was too late for my purpose we learned that this story about Port Antonio was false or at least enormously exaggerated, but, at the time, coupled with the reports that were coming from Kingston, it seemed plausible enough. Wednesday, the coast-wise steamer *Arno* of the Royal Mail line was due, going towards Port Antonio, and I decided to take passage on that. But the *Arno* came neither that day nor

FIG. 12. Shore scene on northern coast of Jamaica, near Montego Bay.

the next and it was announced that her captain had been killed in Kingston (which proved to be true) and that whether the *Arno* would come or not was quite unknown. Meanwhile my goods had remained packed awaiting developments, though it may be said that heavy rains in the forenoons and stiff breezes in the afternoons would have interfered seriously with collecting during those days, even had it been attempted. On the following Saturday, however, a fair day's work in collecting about Montego Bay was accomplished. By Thursday the telegraph office was receiving messages for Kingston and I tried to ascertain by telegram how my friends in the Hope Gardens had fared and whether the proposed visit to Cinchona, for which partial arrangements had already been made, was still feasible. This telegram, as I afterwards learned, was delivered the following Saturday evening. The telegraphic reply, to the effect that the friends in the Hope Gardens were uninjured but more or less homeless, and that the

FIG. 13. View near the foot of East Street, Kingston, taken eight days after the earthquake of January 14, 1907, showing effect of the shock alone without fire (The writer's laboratory was half a block from this, on the opposite side of the street.)

projected trip to Cinchona was no longer to be thought of, I have not received yet. However, on Monday, one week after the memorable fourteenth, I started by rail in the direction of Kingston, going on that day as far as Spanish Town, where the night was spent and whence, with the aid of the next morning's light, I proceeded to reconnoitre the stricken capital of the fair island. The havoc wrought to the second largest city in the West Indies by a few seconds of heaving and trembling of the earth's crust and by the subsequent fires was something fearful and saddening to look upon. The principal business part of the town had been devastated by fire as well as by earthquake, and in the completeness of its ruin was now quite suggestive of an exhumed Pompeii. In the remainder of the city and in the suburban residential areas, about ninety per cent. of the seemingly more substantial buildings had been either destroyed or very seriously damaged by the force of the earthquake shock alone. The number of human lives blotted out by the catastrophe was then and will probably forever remain unknown, but the true number is doubtless somewhere between one thousand and two thousand. At the time of my return, eight days after the disaster, the streets had been sufficiently cleared of débris for the passage of carriages, but remains of human bodies were still occasionally being recovered from the ruins of the buildings. As is usual in cases of earthquake, the wooden houses had suffered the least of any, and as my collections made in the Kingston Harbor and vicinity happened to be stored in such a building which the subsequent fire did not reach, I had the fortune of finding all my specimens of algae safe and uninjured. I was also greatly relieved to discover that comparatively little damage had been done in the Hope Gardens, which are about six miles outside of Kingston, though Superintendent Harris's home, in which I had enjoyed the privilege of residence during my stay in that region, had been rendered uninhabitable for the time being. In leaving Kingston Harbor for New York on the morning of January 24, it was of much geological interest on passing Port Royal at the harbor's mouth to note the evidences of a considerable subsidence at this point as a result of the earthquake. The former sandy and pebbly beach had disappeared, the water now reaching the sod-covered soil, and a group of cocoanut-palms previously, of course, growing on *terra firma*, was now partially submerged, their crowns and the upper parts of their trunks appearing above the ocean at a distance of several yards from the present shore-line (Fig. 14).

The marine algae secured on this expedition to Jamaica comprise possibly 3,000 specimens, representing 605 collection numbers. As usual, the dried material for the herbarium was supplemented by specimens preserved in fluids. The marine flora of Jamaica had previously received considerable attention and is perhaps as well known as that of any of the West Indian islands with the possible exception of Guadeloupe and Barbados. Sir Hans Sloane, who lived in Jamaica from December, 1687, to March, 1689, was apparently the first to collect, figure and describe any of its seaweeds, and his descriptions and the specimens that he carried back to England were cited by Linnaeus, Ellis & Solander, Dawson Turner, and other of the earlier writ-

FIG. 14. View showing subsidence at Port Royal as result of earthquake of January 14, 1907. The former sandy beach has disappeared, and cocoanut-palms at the point of the peninsula are now surrounded by water and partially submerged.

ers. In more recent years, the lamented Dr. James Ellis Humphrey, who in 1897 fell a victim there to the "island fever," Dr. J. E. Duerden, then of the Institute of Jamaica, and Mrs. Cora E. Pease and Miss Eloise Butler, who made visits to the island in 1891, 1894, and 1900, have brought together somewhat extensive collections which have formed the basis of Mr. F. S. Collins' paper on "The Algae of Jamaica," published in 1901. Mr. Collins' list includes 224 marine species.

The specimens now secured will add a considerable number to this list, though several there mentioned were not observed. It is to be hoped that at some time in the near future it may be possible to make another visit to Jamaica in order to explore especially its northern and eastern shores, which should materially supplement the present representation of the Jamaican marine flora in our herbarium.

Respectfully submitted,

MARSHALL A. HOWE,

Curator.

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NOTES, NEWS AND COMMENT.

Professor William Trelease, director of the Missouri Botanical Garden, left St. Louis on January 24 for an expedition to the West Indies.

Mr. John F. Cowell, director of the botanical garden at Buffalo, paid the Garden a visit early in March to examine the living collections of tropical and desert plants.

Dr. John A. Shafer, Museum Custodian, returned on the first of March from a collecting trip of several weeks duration in the island of Montserrat, West Indies.

Bulletin No. 17, containing the annual reports of the Director-in-Chief and his associates for the year 1906, appeared March 7, 1907.

Mr. W. T. Horne, who spent considerable time at the Garden in 1903–'04 while holding the fellowship in botany in Columbia University, has been appointed head of the department of plant pathology in the Estación Central Agronómica de Cuba, a position recently held by Dr. M. T. Cook.

Volume 7, part 1, of the North American Flora, contributed by Professor J. C. Arthur, of Purdue University, Lafayette, Indiana, appeared March 6, 1907. This part is devoted to two families and a portion of a third in the large and important group of parasitic fungi popularly known as rusts (Uredinales).

The total precipitation recorded for the month of February was 2.19 inches, of which there were 11 inches of snowfall on the 5th, 1 inch on the 6th, and 6 inches on the 25th, making a total of 18 inches of snowfall for the month. Maximum temperatures were recorded of 47° on the 2d, 48° on the 10th and 14th, and 37° on the 20th; also minimum temperatures of — 2° on the 6th, 1° on the 13th, 3° on the 23d, and 2° on the 27th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

25 specimens "North American Musci Pleurocarpi." (By exchange with Dr. A. J. Grout, for the Columbia University Herbarium.)

20 specimens of fungi from England. (Distributed by Mr. C. E. Hartley-Smith.)

25 specimens of fungi from Utah. (Distributed by Professor A. O. Garrett.)

70 specimens of flowering plants and ferns from central New York. (Given by Dr. J. V. Haberer.)

2,800 specimens of marine algae from Jamaica. (Collected by Dr. M. A. Howe.)

245 specimens of hepatics from North America. (Given by Miss Caroline C. Haynes.)

47 herbarium specimens from Utah and Idaho. (By exchange with Oberlin College.)

125 specimens, being the plants collected on the late Peary Polar Expedition. (Given by Dr. L. J. Wolf.)

8 specimens of fungi from various localities. (By exchange with the Royal Gardens, Kew, England.)

71 specimens of fungi from western Pennsylvania. (Given by Professor D. R. Sumstine.)

11 specimens of fungi from Europe. (By exchange with Dr. P. Sydow.)

15 specimens of fungi from southern California. (Given by Mr. S. B. Parish.)

4 specimens of parasitic fungi. (Given by Dr. M. T. Cook.)

92 specimens of fungi from Mississippi. (Given by Mrs. F. S. Earle.)

200 museum specimens of marine algae from Jamaica. (Collected by Dr. M. A. Howe.)

163 specimens of fungi from Honduras. (Collected by Mr. Morton E. Peck.)

113 specimens of fungi from the Philippine Islands. (Given by Professor A. D. E. Elmer.)

7 specimens of fungi from Pennsylvania. (Given by Professor D. R. Sumstine.)

70 specimens of fungi from Vermont. (Given by Miss Gertrude S. Burlingham.)

1 specimen of Ravenelia Piscidiae. (Given by Professor J. C. Arthur.)

15 specimens of fungi from various localities. (Given by Mr. Perley Spaulding.)

30 specimens of fungi from Jamaica. (Given by Dr. D. S. Johnson.)

PLANTS AND SEEDS, FEBRUARY, 1907.

2 plants for the conservatories from Mexico and Lower California. (By exchange with National Museum through Dr. J. N. Rose.)

1 plant for the conservatories from Acklin's Is., Bah. (Collected by Mr. L. J. K. Brace.)

1 plant for the conservatories. (Given by Mr. Pauls.)

1 packet of seeds from Biscayne Bay, Fla. (Collected by Dr. J. K. Small.)

2 packets of seeds from Holland. (By exchange with Professor H. DeVries.)

20 packets of seeds from West Australia. (By exchange with Mr. C. S. Thorp.)

35 packets of seeds from S. California. (Given by Mr. S. B. Parish.)

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OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Vol. I, 1900, viii + 213 pp. Vol. II, 1901, viii + 204 pp. Vol. III, 1902, viii + 244 pp. Vol. IV, 1903, viii + 238 pp. Vol. V, 1904, viii+242 pp. Vol. VI, 1905, viii+224 pp. Vol. VII, 1906, viii + 300 pp.

Bulletin of the New York Botanical Garden, containing the annual reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations carried out in the Garden. Free to all members of the Garden; to others, $3.00 per volume. Vol. I, Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Vol. II, Nos. 6–8, 518 pp., 30 plates, 1901–1903. Vol. III, Nos. 9–11, 463 pp., 37 plates, 1903–1905. Vol. IV, No. 12, 113 pp.; No. 13, 193 pp., 12 plates; No. 14, in press. Vol. V, No. 15, 105 pp., 1906; No. 16, 88 pp., 17 plates, 1906; No. 17, 115 pp., 1907.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies and Central America. Planned to be completed in thirty volumes. Roy. 8vo. Each volume to consist of four or more parts. Subscription price $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Vol. 22, part 1, issued May 22, 1905, contains descriptions of the order Rosales by Dr. J. K. Small, and of the families Podostemonaceae by Mr. Geo. V. Nash, Crassulaceae by Dr. N. L. Britton and Dr. J. N. Rose, Penthoraceae and Parnassiaceae by Dr. P. A. Rydberg.

Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

Vol. 7, part 1, issued Oct. 4, 1906, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by Professor G. P. Clinton.

Vol. 7, part 2, issued March 6, 1907, contains descriptions of the families Coleosporiaceae, Uredinaceae and Aecidiaceae (pars), by Professor J. C. Arthur.

Memoirs of the New York Botanical Garden. Price to members of the Garden, $1.00 per volume. To others, $2.00. [Not offered in exchange.]

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Vol. III. Nos. 51–75, vi + 398 pp. 26 figures in the text and 21 plates.

RECENT NUMBERS 25 CENTS EACH.

No. 85. Systematic Palaeontology of the Pleistocene deposits of Maryland: Pteridophyta and Spermatophyta, by Arthur Hollick.

No. 86. Two new coralline algae from Culebra, Porto Rico, by M. Foslie and M. A. Howe.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII APRIL, 1907 No. 88

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

JOURNAL

OF

The New York Botanical Garden

VOL. VIII. April, 1907. No. 88.

REPORT ON THE CONTINUATION OF THE BOTANICAL EXPLORATION OF THE BAHAMA ISLANDS.

TO THE SCIENTIFIC DIRECTORS.

Gentlemen: Pursuant to your authorization I continued botanical exploration in the Bahama Islands during parts of February and March of this year, being absent from the Garden for this purpose from February 11 to March 29. I was accompanied by Dr. C. F. Millspaugh, curator of botany in the Field Museum of Natural History in Chicago, who has been coöperating with me in previous work in this field, the expenses of several expeditions and the museum and herbarium specimens obtained having been divided by the two coöperating institutions. I was also accompanied by Mrs. Britton, who rendered much assistance in collecting and preparing specimens, and at Nassau the expedition was joined by Mr. L. J. K. Brace, a botanist resident there, who had previously done much collecting in various parts of the archipelago in the interests of this investigation, his remuneration and collections being also divided between the Garden and the Field Museum.

Dr. Millspaugh, accompanied by Mrs. Millspaugh, proceeded to Nassau by steamer from New York, while Mrs. Britton and I went by way of Florida; this course permitted me to revisit the Subtropical Laboratory of the United States Department of Agriculture at Miami, Florida, now in charge of Dr. Ernst A. Bessey, the base which has been used by the Garden's several exploring expeditions in southern Florida. The valuable experimental work of this institution is being vigorously continued, especially in plant breeding investigations, and its usefulness as a scientific center has been much increased by the purchase of a power-launch, secured by private subscription which was aided by several members of the Garden. By means of this boat we now expect to obtain a much more complete knowledge of the plants of the Florida keys and of the mainland shores, its use being provided without further expense to the Garden. I discussed some details of this desirable work with Dr. Bessey, and also plans for the further exploration of the Everglades, and hope to be able to detail Dr. John K. Small, head curator of our Museums, to make a part of the needed exploration this year, in continuation of his previous studies, inasmuch as it is most important that the flora of southern Florida be as accurately known as possible by the time the botanical survey of the Bahamas is completed, there being an intimate relationship between the floras of these two regions.

Arriving at Nassau by steamer from Miami on February 14, two days were given to outfitting and to the collecting and observation of certain plants growing on the island of New Providence, relative to which additional information was desired. Mr. Brace was commissioned to explore the northern part of Andros Island, situated some 30 miles west of New Providence, where a number of species known in the Bahamas only from that region were collected in 1890 by Dr. and Mrs. John I. Northrop. Dr. and Mrs. Millspaugh had reached Nassau two days before our arrival and had attended to most of the details of preparation for our trip to the out-islands, and on February 16 the party sailed for Eleuthera on Mr. W. J. Pinder's staunch schooner "Nellie Leonora," previously chartered for our use, and used by us during our cruise to the northern Bahamas and to the Exuma Islands in 1905. The landing point sought was the picturesque cleft with steep rocky walls, called the "Glass Window," where Eleuthera Island is very narrow, though its total length is more than 70 miles; here easterly storms send the surf through in tremendous volume and with magnificent force. This point is distant only about 60 miles from Nassau, but very light winds delayed our arrival until late in the morning of February 17. We immediately landed and walked northward about two miles to the beautiful nearly land-locked bay on which the town of Harbour Island is situated, obtaining among other interesting plants additional living specimens of the Bahaman agave which we had previously seen on many other islands, but which grows here in large quantities, and some plants were in full flower. The plant is really so abundant at this point as to give character to the landscape and is known by the natives here as elsewhere under the name of bamboo. We reached the town by sail-boat and here Mrs. Britton and Mrs. Millspaugh remained for two weeks, Mrs. Britton exploring northern Eleuthera, while Dr. Millspaugh and I returned at once to the "Glass Window" where the schooner awaited us and proceeded with the study of the flora of Eleuthera from that point southward.

On February 18, we walked southward about five miles to Gregory Town, the schooner preceding us along the coast. This walk and the one of the previous day gave us a very good idea of the flora of the north-middle part of the island; the most interesting plant secured was a small cycad (genus *Zamia*) with very narrow leaf-segments growing in white sand in the shade of shrubs, evidently a rare species, as this is the only point known to us where it occurs, although we were told that it grows elsewhere on this island; like the other Bahaman *Zamias* it is called "bay rush" and its roots furnish starch similar to that obtained from the sago palms (genus *Cycas*). Near Gregory Town we saw the spiny shrub *Catesbaea spinosa*, with its large drooping yellow flowers, dedicated by Linnaeus to Mark Catesby, a celebrated botanist who explored some of the Bahama Islands in 1725 and 1726 and subsequently published two folio volumes with two hundred colored plates entitled "The Natural History of Carolina, Florida, and the Bahama Islands," a rare work, of which our library possesses a good copy. It is known that Catesby visited Eleuthera, and it is possible that the shrubs seen by us are descendents of those originally found by him, although the species occurs elsewhere on this island; it is also found on other Bahamian islands and is in cultivation in gardens in Cuba and Jamaica. Sailing south the afternoon of the same day, we reached Governor's Harbor and devoted February 19 and 20 to the study of the vicinity of that town, the bridle road enabling us to cross the island, here less than two miles wide from west to east, and return a different way; we collected specimens of many interesting species on these section lines, some of them not hitherto known from Eleuthera, the best ground being a valley lying parallel to the eastern shore where fresh water wells supply the washerwomen of the town with water. Here there is also a considerable area of fresh water marsh and numerous small plants seldom seen in the Bahamas occur, among them a rare little grass and a purple-flowered aster related to the asters of our own coastal marshes. In white sand near the town we found a showy yellow-flowered *Mentzelia*, new to the Bahamas. Governor's Harbor is a center for the cultivation of pineapples, especially on "red-lands," which occupy swales and valleys where the soil resulting from the washing down of the leached limestone by rainwater contains much iron; these lands are much esteemed in the Bahamas for this industry.

Our next collecting point to the south was Rock Sound, a large shallow bay on which the town of New Portsmouth is situated,. which is one of the best harbors for small vessels in the Bahamas; two days were spent here, an east and west road across the island making a cross-section of its vegetation practicable: it may be remarked that the Bahaman scrub-lands and coppices are usually nearly impenetrable, except for very short distances, without a road or trail, owing to the dense growth of the shrubs and trees. In this vicinity we first found the "pepper bush" (*Croton*), a fragrant shrub of the Spurge Family which we had long desired to see growing; a low prickly pear cactus (*Opuntia*) with extraordinary armament of spines was secured for the conservatories, and complete specimens of another shrub of the Spurge Family (*Lasiocroton*) with leaves strikingly reticulated on the under side, hitherto known in the Bahamas only from Andros Island. Sailing south around Powell's Point, the two days of February 23 and 24 were given to a study of the extreme southern part of Eleuthera, where low rocky plains and sand-dunes yielded some species not found further north.

Little San Salvador, an island some 6 miles long and averaging perhaps one mile wide, lies nearly directly east of the southern end of Eleuthera and about 9 miles distant, and here we spent February 25 and 26. It is uninhabited, but some farming is done by people who come from Cat Island, about 9 miles to the east or northeast. The soil is mostly white sand, and indian corn and guinea corn are the principal crops. The island is interesting from the great abundance of the hog cabbage palm (*Pseudophoenix Sargentii*), its common name referring to the use of its trunk for pig food ; this palm, which formerly existed in quantities on some of the Florida Keys, but has now been nearly or quite exterminated there, exists on Little San Salvador in thousands, and was in full fruit at the time of our visit, the clustered bright-red three-lobed berries being conspicuous in the landscape. The palm occurs on nearly all the Bahaman Islands, but in the inhabited ones is much used for pig food, and is thus liable to extinction ; we already have good specimens in the conservatories both from Florida and from the Bahamas, but a supply of the ripe berries for growing a crop of seedlings was collected. There is excellent fishing on the reefs about this island and a plentiful supply of several kinds was caught in a couple of hours in one afternoon.

The northern end of Cat Island was reached during the night of February 26, and Orange Creek was made the base of operations for the next two days, including a walk under the guidance of a native completely around the northern end of the island, covering some 15 miles or more, the longest tramp that we indulged in, which brought us back to the boat after dark, but with large collections. Cat Island was long supposed to be the land first reached by Columbus and the name San Salvador was applied to it and accepted by the English ; in fact, San Salvador is still the name used by the Bahaman government, or at least by some of its departments, though it is now known that the real San Salvador of Columbus is Watling's Island, which lies some 40 miles further to the southeast. It is unfortunate that the name given by Columbus has now been generally abandoned for either island, although an attempt has been made on the sailing charts to restore the name San Salvador to Watling's Island, with the result that when San Salvador is mentioned one is left in doubt as to which island is really meant. In the vicinity of Orange Creek we first saw one of the rarest and most interesting small trees of the Bahamas, apparently related to the trees known in Jamaica as "pride of the valley" (*Spathelia*), classified by authors in the Rue Family, but whose botanical relationship is somewhat doubtful. These trees form slender unbranched trunks bearing large pinnate sumac-like leaves in crowns at the top; they grow for several or many years and then produce a large cluster of flowers and fruit above the crown of leaves, after which they die; the tree was seen again further south on the same island, but in both instances in fruit, its flowers being still unknown.

The Bight Settlement, some 16 miles north of the southern end of Cat Island, was our next collecting ground, and here we went into camp in a house for six days while the schooner sailed back to the "Glass Window," took the ladies on board and carried them to Nassau, returning to us with stores and mail on the morning of March 7. This stay of six days enabled us to obtain a quite complete knowledge of the plants growing within 5 or 6 miles of the Bight, and we secured specimens of a number of rare and interesting species; among these, mention may be made of another practically spineless prickly pear cactus (*Opuntia*) with small red flowers, growing abundantly in rocky soil, and new to our collections, a duck-weed (*Lemna*) not before known in the Bahamas, covering the surface of a small shaded pond and doubtless brought there on the feet or feathers of some migratory bird, specimens of an interesting shrub of the Vervain Family, known in the Bahamas only from Cat Island, and a most viciously spiny *Acacia*, a shrub or small tree to be handled only with great caution. The work on Cat Island was concluded by spending March 8 at Port Howe near Columbus Bluff, a bold rocky headland at the southern end of the island, where, among other interesting plants, good specimens of a rare spiny shrub related to the potato (*Solanum*) were collected, the species being known only from this island and from Great Exuma, about 50 miles to the southwest, where it was found by us on our trip of two years ago.

Cat Island is some 45 miles long and is more hilly that any of the other Bahamas; the charts maintain that it contains elevations of about 400 feet; I ascended several of the hills, which in each case were claimed to be the highest on the island by the residents, but could find no altitude by the aneroid barometer greater than 205 feet, though it is possible that some of the hills may be slightly higher; this cited height of 400 feet had been doubted by Mr. Brace, and so far as my observations go there is probably no elevation as great as that on the island.

Conception Island, lying about 25 miles southeast of Port Howe, was next visited, and studied on March 9 and 10; this is the smallest of the islands studied by us on this cruise, being only about 2 ½ miles long by somewhat less than 2 miles wide. It is inhabited by only one family, and farming operations are carried on on a small scale but are successful. It is highly elevated in places, but the middle part of it is occupied by one of the most continuous and striking level salt-plains that I have seen anywhere in the islands, subject to overflow at high tides, but quite dry at this time. The flora is not strikingly different from that of the islands further north and west, but good living specimens of the tall woolly cactus previously found by us on Cave Cay of the Exuma chain were obtained and the sandy portions of the island were beautified by the trailing white passion-flower of these islands. A few species known hitherto only from farther south were found here.

Watling's Island, topographically, historically, and in some respects botanically the most interesting of the islands visited and the most eastern point reached on our cruise, was explored from March 12 to 15 and we should have been glad to spend more time upon it, for as it was we studied only its northern part. The island is about 12 miles long and 6 miles wide, rather hilly, with a maximum height according to the charts of about 140 feet, and contains numerous salt-water lakes, unconnected with the ocean, the two largest of these occupying perhaps one fourth the total area of the island; these large lakes give a character to the topography and landscape not seen elsewhere in the Bahamas. The course of our exploration during these four days extended from Cockburn Town on the western side across and around the larger lakes to the fine lighthouse on the northeastern side which section was explored from Graham's Harbor at the northeast end southward some five miles to where the monument to Columbus stands, and then from Graham Harbor back to Cockburn Town across the northwestern part of the island. We found the *Agave* ("bamboo") which we were seeking well developed at one point on the shore of the largest lake and obtained good specimens of its fruit, leaves, and young plants for cultivation. As it had passed flowering we were unable to obtain the blossoms. It seems to be somewhat different from the common species of the northern island, having leaves which are much more feebly bristle-margined, and pods which are sharp-pointed and much larger. The common species also grows on Watling's Island and plants were brought along for comparison. The shrub or small tree of the Mallow Family discovered here several years ago by Professor Coker, during the expedition of the Geographical Society of Baltimore to the Bahamas, and named by me *Malvaviscus Cokeri*, was seen in abundance at the type locality where it was obtained by him, and also in many other places along the lakes and on the borders of swamps, and we obtained good specimens of its fruit, which was not before known, as well as of its pretty bell-shaped greenish-red flowers. The plants of the northeastern side of the island proved to be in many instances different from those of the western side and among them we saw for the first time the Bahamian *Mimosa*, a shrub which grows in great quantities on the borders of marshes, but formerly known only from islands further south. Graham's Harbor is very picturesque, its bold cliffs of white limestone contrasting finely with the green vegetation of the shores and the deep blue water of the ocean.

The monument to Columbus erected by the Chicago Herald in 1891 stands on a headland about five miles south of the northern end of the island on the eastern side, and we were much interested, of course, in going to the locality determined at that time as the most probable point where Columbus first landed, and in taking note of the plants which he presumably saw here. These are all well known Bahaman species and species growing also on the shores of many other West Indian islands; it is probable that the one which first attracted the discoverers of America was the sea-grape (*Coccoloba Uvifera*), a common shrub or tree of all West Indian sea coasts, which gets its common name from its edible grape-like bunches of fruit. The headland on which the monument stands is locally known as Crab Cay. The structure is unpretentious and was believed by my companion from Chicago to be a chimney of a ruined house until he reached it; it is about 12 feet high and constructed mainly from loose rocks picked up in the vicinity; it bears a marble globe with an outline of the continents engraved upon it and a marble slab which states that at this point Columbus first set foot upon the soil of the new world. A small cube of granite and a brick, which we were informed by one of our sailors, a native of Watling's Island, was brought from the house of Columbus in Genoa, complete the decoration of the monument.

Our explorations were completed by a visit to Long Island, lying some 50 or 60 miles southwest of Watling's Island, where there is one good harbor on the eastern side at Clarence Town, which was made a base of operations from March 16 to 19. Long Island lies on the same bank as the Exuma Islands, which we explored two years ago, and contains many of the species which we collected on that chain; a few were found which we had not before collected in the Bahamas, the most interesting of these being a low spurge (*Euphorbia*). Sailing north from Clarence Harbor, or rather drifting, as we were here delayed by two days of calm, we touched for a few hours at Cape St. Maria at the northern end of Long Island on March 21 and returned to Nassau, arriving there early in the morning of March 23, and proceeded to pack the collections, Dr. Millspaugh returning to New York on the Royal Mail Steamer "Oronoco" on March 25, Mrs. Millspaugh having preceded him, and Mrs. Britton and I returning on the twenty-sixth by way of Miami.

Having March 27 at Miami, I was enabled to again visit the Subtropical Laboratory of the United States Department of Agriculture and to select some plants for our conservatories and to collect some specimens in the vicinity. We reached New York on the afternoon of March 29.

Our work in the Bahamas was aided in many ways by the residents, and our thanks are due and are gratefully tendered for information and assistance to Hon. Herbert A. Brook, Registrar of the Colony at Nassau; to Rev. John P. Jackson of Rock Sound, Eleuthera; to Andrew S. M. O'Brien, Esq., Resident Justice; to Rev. C. P. Shaw of the Bight Settlement, Cat Island; to Mr. Simeon Devoe, Assistant Resident Justice, at Port Howe, Cat Island; to Mr. F. L. Christie of Conception Island; to Rev. Marshall M. Cooper, and Resident Justice Rigby of Cockburn Town, Watling's Island, and to R. G. Williams, Esq., of the Harbor Estate, Watling's Island; to Rev. C. B. T. Wilkinson, M.A., Resident Justice, Gilbert Albury and Charles A. Abbott, Esq., of Clarence Town, Long Island.

Before leaving Nassau, I had a very pleasant interview with Sir William Grey-Wilson, governor of the Bahamas, and consulted with him relative to the additional exploration work which is necessary to make our survey complete, in so far as an examination of islands as yet unvisited by us or our agents will complete it. The principal points still remaining for examination are the southeastern islands of the archipelago, including the island of Samana, Miriguana Island, the several islands of the Caicos bank, the Ragged Cays, and at the extreme southwest of the archipelago the small islands on the Cay Sal bank. I secured from Mr. Pinder the use of the same schooner for a proposed trip to these islands toward the end of the present year. The governor was much interested in the further exploration of Andros Island, the largest of the group, and the nearest large island to New Providence. The interior of this island at its widest part, which is 40 miles or more, is unknown, either geographically or botanically, having never been penetrated, and no one knows what the conditions are in this terra incognita. He assured me of governmental coöperation at some future time when it might be convenient to attempt the penetration of this presumable wilderness, and I hope that we may be able to explore it.

Respectfully submitted,

N. L. Britton,
Director-in-Chief.

REPORT ON A VISIT TO THE ISLAND OF MONTSERRAT.

Dr. N. L. Britton, Director-in-Chief.

Sir: Pursuant to your instructions, I visited the island of Montserrat, and spent about five weeks there in botanical exploration. I embarked from this city on the Quebec S. S. *Korona*, January 5, landing at St. John's, Antigua, on January 15, where I was somewhat delayed, awaiting an opportunity to cross over to Montserrat, which presented itself on the night of the 17th in the shape of a little sloop, on which I secured passage. Arriving off Plymouth about dawn the next morning, I was quickly passed by the officers of the port and shortly after 7 o'clock found myself in the delightful home of Mr. F. W. Driver, of the Montserrat Company, to whom I had letters of introduction from Mr. T. A. Hedley, their agent in New York. Mr. Driver became very much interested in our proposed work, and after giving me much timely advice drove with me to the house of Mr. Dudley Johnson, on Cocoanut Hill, where I secured accommodations and made headquarters during my stay on the island. The remainder of the day was consumed in securing and arranging my equipment, recovering from the effect of the previous night's experiences on the sloop, and becoming acquainted with my surroundings. The next day, January 19, just two weeks after leaving New York, I was at work collecting the plants of the region immediately surrounding my headquarters, and exploring a nearby "gut," as the deeply eroded ravines are called. During the weeks that followed almost continuous collections were made in all sections of the island.

Owing to the ruggedness of the country, the multiplication of distances by the necessarily circuitous roads and trails, and the steepness of the mountain sides, the employment of horses and negroes was a very necessary inconvenience. Much time was also lost by the nightly return to headquarters, which the lack of suitable camping facilities made necessary, especially as it was prudent to get back, at least to good roads, before the early tropical darkness set in. The exploration of the higher and floristically richer portions of this or similar islands would be greatly expedited if one were equipped so as to be able to remain in the higher altitudes several nights in succession.

My plants were dried in numerous well-ventilated packages of dryers not over three inches thick. These were spread out in the sunshine and frequently turned; also promptly brought under cover in case of showers, which occurred rather frequently, by a boy who was employed for this and other purposes about headquarters. This arrangement expedited matters very materially and relieved me of much anxiety concerning the undried material while afield.

Active exploration was kept up to within a day of the time of departure, early in the morning of February 21, when I took passage on a Royal Mail steamer for Antigua, where I had a day and a half to await the S. S. *Parima* for New York, thus giving me time to have the partially dried specimens taken to the botanical station at St. John's. Facilities were kindly put at my disposal there, which, with a day of bright sunshine, enabled me to dry most of them and prepare the remainder for the rest of the voyage, through which they came in good condition, arriving in New York with me at noon, March 2, just eight weeks from the time of departure, three of which were consumed in transit.

Montserrat, situated in latitude 16° 45′ north and longitude 61° west, is one of the British administrative group called the Leeward Islands. It is about 27 miles southwest of Antigua, the seat of government, but about 40 miles from port to port, its greatest length, 11 miles, being approximately north and south, while its greatest width is 7 miles. The outline is quite irregular and is estimated to contain about 40 square miles. The island is wholly volcanic in origin and is very mountainous, the highest peak, Chance's mountain, reaching an altitude of 3,000 feet, while several others are 2,500 feet or more in height. The coast is generally very rugged, except for a narrow beach on either side of Plymouth, about three miles long, and one of smaller extent on the windward side. There are no enclosed bays and the several salt marshes are very small. Two of those which I explored contained little of interest, except for the fact that most of the species one would expect to find there were absent. In one I found a few small bushes of black mangrove, *Avicennia nitida* L. A third marsh, which I saw from the distant hills, is said to contain mangroves, but I was unable to visit it or to ascertain which of the three genera they represented.

The beach affords the usual plants common to a similar environment throughout the West Indies, while the old-world plants, *Vinca major* L., the periwinkle of our gardens, and *Calotropis procera* R. Br., the so-called French cotton, were very conspicuous, the former exceedingly abundant. The much-feared manchioneel, *Hippomane mancinella* L., is very abundant and reaches large dimensions. The most common woody plants near by are "wild coffee," *Clerodendron aculeatum* (L.) Griseb., "French cashaw," *Prosopis juliflora* DC. and the "cashaw," *Acacia tortuosa* Willd., the latter very common throughout the dryer portions of the island. On the coastal cliffs the dry thickets are composed of a variety of shrubs and stunted trees, conspicuous among them being several species of *Croton*, *Plumieria alba* L., and a tall upright cylindrical cactus belonging to the genus *Cereus*.

On the windward side the bleak wind-swept cliffs support a species of *Agave*, two prickly pears, *Opuntia*, a Turk's-cap cactus, *Melocactus*, and *Plumieria alba* L., while the more gentle slopes are covered with an impenetrable thicket composed mostly of the currant tree, *Jacquinia armillaris* L., and "white cedar," *Tecoma Leucoxylon* Mart. The northern end of the island is very rough, rocky and dry, its highest point, Silver Hill, being less than 1,300 feet. It is covered with a xerophytic growth composed largely of the above-mentioned plants, together with fiddle-wood, *Citharexylum quadrangulare* Jacq., white alley, *Guettarda*, three or four species of *Coccoloba*, and a great variety of other woody plants in lesser numbers, among which are found several orchids and bromeliads, one curious association being an attractive yellow-flowered orchid growing among the spiny stems of a tall cactus. On the wider portion of the island the slope from the sea to the base of the mountains which run east of the longitudinal axis is quite gradual and is under cultivation, except where the spaces between the deeply eroded guts are too difficult of access. These guts as a rule are very dry and barren, and are strewn with large boulders, showing the effect of the torrents that occasionally rush through them. The most conspicuous, if not the commonest, plant here is the silver fern, *Gymnogramme calomelanos* Kaulf. Near the mountains the guts retain more moisture and harbor many of the plants common to their tributaries higher up the mountain ravines.

The mountains, which begin their usually abrupt ascent at an altitude of 1,000 to 1,200 feet, support a luxuriant and constantly increasing vegetation, except on wind-swept exposures. This consists of a variety of hard-wood trees, among them Spanish cedar, *Cedrela odorata* L., snake wood, *Ormosia dasycarpa* Jacq., "Spanish oak," *Inga laurina* Willd., galba, *Calophyllum Calaba* L., "locust," *Hymenaea Courbaril* L., two kinds of burwood, *Sloanea*, bayberry, *Amomis caryophyllata* (Jacq.) Krug. & Urb., and a great variety of shrubs, among them many kinds of *Melastomaceae*, a *Podocarpus* and *Weinmannia pinnata* L. A tall tree fern, *Cyathea arborea* Swartz, often 25 feet high, is very abundant and frequently forms dense, almost pure, forests up to 2,000 feet, where it is replaced by the mountain cabbage palm, *Euterpe oleracea* Mart., which also forms almost pure growths extending to the highest summits. Throughout all this range there is a great variety of smaller flowering plants both terrestrial and epiphytic representing many genera, such as *Begonia*, *Piper*, *Peperonia*, *Marcgraavia*, *Heliconia*, *Philodendrum*, and *Carludovica*, together with orchids, bromeliads and ferns in great profusion.

Three very small bodies of fresh water, all that I could hear of, were visited, the highest in elevation being Chance's pond, situated at an altitude of about 2,800 and at a short distance from the top on the eastern side of the mountain of that name. This pond was very disappointing, as it contained no characteristic aquatic plants of interest, neither did its margins support a flora differing materially from that on the surrounding mountain sides. Two ponds in the northern end of the island harbored a few plants each of the water lettuce *Pistia stratiotes* L., while the larger one, on Silver Hill at an elevation of about 1,100 feet, also contained two or three plants of the white water lily, *Castalia ampla* Salisb.

The Soufrières, of which there are three, are not, as usually supposed, situated on the mountain tops, but in deep ravines at an altitude of about 1,300 feet. They consist of numerous fissures containing boiling water and emitting steam and sulphurous vapors, surrounded by deposits of sulphur, white, yellow and red earth and rocks strewn with charred wood, parched grass, and an occasional dead tree or fern trunk still standing. The vegetation nearest to them consists of mosses and slime-like algae within and bordering the streamlets of hot water, the higher plants thriving nearest being a large bluish *Cyperus*, a low tree-like *Lycopodium* called hartshorn, two or three species of ferns belonging to the genus *Dicranopteris*, and a bromeliad with brilliant scarlet inflorescence.

Botanically this island is scarcely known, the only collections of plants made thereon, that we have any knowledge of, having been collected about 1802 by a Dr. John Ryan. I was unable to obtain any information about Dr. Ryan during my visit, and there are no white men of that name on the island now.

Economically, Montserrat has been in an unenviable position for sometime past, owing to the visitation of serious earthquakes, floods and hurricanes in rapid succession during the last twenty years, which, added to the depression already caused by the constantly declining price of sugar has reduced the white population to less than 100 persons among a total of nearly 14,000 inhabitants. It is distressing to look upon the great piles of stone, the ruins of once stately plantation buildings and spacious mansions and see near by the cheaply constructed makeshifts that have taken their place. On the other hand, the negroes seem to have profited to some extent, as these conditions have made it possible in many cases to acquire small areas of land, so that several of the larger estates are also held by them.

Sugar, formerly the staple product, has become unprofitable, chiefly owing to the fact that the primitive process of extraction, in which scarcely half of the saccharine contents of the sugar cane is secured and that of an inferior quality, is still in vogue. If a central factory were established on a modern basis, the industry would no doubt still be remunerative, but the transportation of the bulky cane over such a rough territory would make the project seem impractical even if sufficient capital to establish the factory were forthcoming.

Although Montserrat is known to the public almost wholly on account of its lime juice, this fruit and its products are produced on a commercial scale only by one concern, the Montserrat Company, a British corporation which owns many of the best estates and has hundreds of acres planted with limes. The output of fresh juice, however, is contracted for by another British company in such a way as to give them a complete monopoly of this product. Although considerable more juice is extracted than this concern handles, it is quite impossible to obtain it for shipment into the United States; the surplus is concentrated to about 12 per cent. of its bulk or neutralized with a calcium salt, forming citrate of calcium, both products being commercial sources of citric acid. Considerable volatile oil of limes is also produced.

Arrow-root, the starch obtained from the tubers of *Maranta arundinacea* L., is produced in large quantities and of very superior quality. Papain, a digestive substance similar to pepsin, obtained from the milky juice of the "papaw," *Carica Papaya* L., was formerly produced in considerable quantities and constituted an important industry, but competition from Asiatic countries, it is said, has reduced the price so that it is no longer profitable. The large green fruits are scraped and the juice which flows for a few minutes is collected in a small vessel, this operation being repeated a number of times until the fruit begins to ripen. The fresh juice is brought to persons who prepare the papain, and is paid for by volume. This industry formerly furnished an income for a great many persons without capital, for the plant is very abundantly spontaneous in many places.

Cacao, the seeds of *Theobroma Cacao* L., is being successfully grown in the central mountains, especially by the Montserrat Company, which also has experimental plantations of vanilla, pepper, pimento and nutmegs.

Bay oil, the volatile oil obtained from the leaves of *Amomus caryophyllata* (Jacq.) Krug. & Urb., a tree common in some of the mountains, is also produced in considerable quantities. It is the basis of the popular toilet article known as bay rum.

Vegetables in great variety are grown, mostly by the peasants in their "provision lands," which are usually situated in a fertile spot on the side of a mountain, at from 1,000 to 2,000 feet altitude. These are often so steep that the soil must be held up in step-like fashion by logs, usually the slender trunks of a tree fern, kept in position by several stakes driven below them. Here are grown in promiscuous confusion sweet potatoes, yams, tanyas, arrow-root, okra, tomatoes, egg-plant, peppers, squashes, beans, etc. Bananas and plantains are also grown here. The peasants also grow with less success such products of temperate gardens as potatoes and cabbage, but these are usually a failure during the summer months.

The cultivation of Sea Island cotton has been carried on very successfully and on a considerable scale for several years, and the product from this island has been bringing excellent prices in England. It is to be hoped that this will continue and that the practical results will equal the not too modest expectation of those who advocate the planting of "cotton, cotton and more cotton." If it will do for the whole island what it is reported to have already done for one or two estates, it will deserve to replace the ancient emblem of salvation now prominently displayed on the coat-of-arms of the island.

This report would be incomplete if I failed to mention my obligations to His Honor, Lt. Col. W. B. Davidson-Houston, Commissioner of Montserrat, for the gracious interest he displayed in our work; to Mr. Fred. W. Driver for favors already mentioned; to Mr. W. Robson, curator of the botanical station, for his per-

sonal interest and enthusiasm constantly displayed, and for the sacrifices and discomforts endured on my behalf in the ascent of Chance's Mountain and other excursions; to Mr. Dudley Johnson, my host, and to Mr. E. Gilks, his manager at Roches, for facilities afforded while in that most interesting but inaccessible region; to Miss H. Kirwan for the gracious manner in which she dismissed the charges of trespass so seriously filed against me by an over-zealous servant while collecting on Fergus Mountain, on one of her estates; to Mr. J. T. Allen, editor of the Montserrat Herald, for his personal guidance through the higher mountain ravines of his remarkable estate; and to Mr. Jackson, curator, and to Mr. Thibou, foreman of the botanical station at Antigua, for aid and facilities afforded me at that institution.

Respectfully,

J. A. SHAFER,
Museum Custodian.

SPRING LECTURES, 1907.

To be delivered in the lecture hall of the museum building of the garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

April 27. "The Life Story of a Tree," by Dr. C. Stuart Gager.

May 4. "The Flowers of Trees and Shrubs Growing Wild near New York City," by Dr. N. L. Britton.

May 11. "Jamaica: Its Flora, Scenery, and Recent Disaster," by Dr. M. A. Howe.

May 18. "Water Lilies and other Aquatic Plants; their Relation to Horticulture," by Mr. G. V. Nash.

May 25. "The Influence of Vegetation in the Formation of Recent and Ancient Swamps," by Dr. Arthur Hollick.

June 1. "Some Little Known Edible Fruits of the United States," by Dr. H. H. Rusby.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5.34 train from the Botanical Garden railway station, arriving at Grand Central Station at 6.05 P.M.

The museum building is reached by the Harlem Division of the New York Central and Hudson River Railway to the Botanical Garden Station, by trolley cars to Bedford Park, or by the Third Avenue Elevated Railway to Botanical Garden, Bronx Park.

NOTES, NEWS AND COMMENT.

Dr. E. B. Copeland, of the Bureau of Education of the Philippine Islands, called at the Garden on April 1.

Dr. Kristine Bonnevie, Konservator at the University of Kristiania, visited the garden on March 29.

Professor A. W. Evans spent a few days at the Garden during the last week in March, consulting the Mitten collection of mosses, recently acquired by the Garden Herbarium.

Professor Edward A. White, of the Department of Botany, Forestry, and Landscape Architecture of the Connecticut Agricultural College, Storrs, Conn., was at the Garden on March 29, consulting the Herbarium. Professor White removes to the Massachusetts Agricultural College on July 1, where he has been appointed to the newly established professorship of floriculture.

Dr. Melville T. Cook, who has been pursuing investigations in the laboratories of the garden during the preceding three months, has received an appointment, under the Adams act, as Plant Pathologist at the Delaware Agricultural Experiment Station, Newark. The appointment took effect on April 1. Dr. Cook will at once enter upon a study of fruit diseases, giving special attention to the crown-gall affecting the genus *Rubus.*

The New York Academy of Sciences will commemorate on May 23, the two hundredth anniversary of the birth of Linnaeus. In the morning of that day there will be addresses at the American Museum of Natural History and an exhibition of animals, minerals, and rocks known at the time of Linnaeus; in the afternoon, in Bronx Park, there will be addresses and exhibits at the Botanical Garden and the Zoölogical Park and the dedication of the Linnaean Bridge; in the evening, there will be simultaneous exercises at the Museum of the Brooklyn Institute and at the New York Aquarium.

Construction work during the winter has been mainly restricted to the excavation of stone from the ledges in the rear of the Museum building, a small force of men and carts having been used continuously, the stone taken out being used for the telford foundation of roads and paths and deposited on grades prepared during the autumn. The foundations for all the paths on the Fruticetum have now been laid, and the driveway along the east side of the Bronx River, from the Long Bridge north to Newell avenue, is nearly all paved. As soon as a supply of broken traprock and screenings can be obtained, these paths and roads may be completed.

Dr. and Mrs. N. L. Britton and Dr. C. F. Millspaugh returned during the last week in March from a successful botanical survey of some of the outer islands of the Bahamian archipelago. Visits were made to Eleuthera, Little San Salvador, Cat, Conception, Watlings and Long Islands. This was the fourth in the series of expeditions made by Dr. Britton to the Bahamas, and the third by Dr. Millspaugh. The large amount of material thus brought together, supplemented by collections made for the New York Botanical Garden by Nash and Taylor and by Brace, and the earlier collections of the Northrops, of Hitchcock, and of Coker, will serve as a tolerably satisfactory basis for a descriptive treatment of the interesting flora of these islands.

The Garden recently purchased from Mr. Charles H. Sternberg, of Lawrence, Kansas, a choice collection of 44 selected specimens of Cretaceous (Dakota Group) fossil leaves, which includes one of *Liquidambar integrifolia* Lesq., the ancestor of our sweet gum, about 8 inches in length by 11 inches broad; a branch of *Andromeda Pfaffiana* Heer, with six leaves attached; two specimens — counterparts — of the fruit of *Ficus neurocarpa* Hollick, first described in the Bulletin of the Torrey Botanical Club for February, 1903, and seven other leaves which apparently represent undescribed species. The two species last mentioned are of special interest for the reason that fossil leaves are seldom found attached to the parent stem and the fruit of figs are exceedingly rare as fossils.

Professor Theodore D. A. Cockerell, of Boulder, Colorado, recently transmitted to Dr. Hollick a collection of undescribed fossil plant remains from the Tertiary beds of Florissant in that state, with the request that he examine and describe them. Among them are several beautifully preserved flowers and fruits and a moss with fruiting capsules. The matrix is a fine shale in which the impressions of the outlines and even the delicate tissues of the anthers and petals of one of the flowers are clearly defined. An illustrated description of the moss by Dr. Hollick and Mrs. Britton is now in press for the Bulletin of the Torrey Botanical Club and the other remains are being critically examined and will be figured and described in the near future.

The total precipitation recorded for the month of March was 2.31 inches. Of this amount 7 inches fell as snow. Maximum temperatures were recorded of 50.5° on the 2d; 50° on the 9th; 61° on the 17th; 77° on the 23d; and 75° on the 29th; also minimum temperatures of 9.5° on the 7th; 9° on the 12th; 26° on the 21st; and 28.5° on the 26th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM FEBRUARY 1 TO APRIL 15.

ALYON, PIERRE PHILIPPE. *Cours de botanique pour servir à l'èducation des enfans de S. A. le Duc d'Orléans.* Paris, 1787–88.

ASCHERSON, P. & OTHERS. *Botanik von Ost-Afrika.* Leipzig, 1879.

AUTRAN, E. & DURAND, F. *Hortus Boissierianus.* Genève, 1896.

BEIJERINCK, M. W. *Beobachtungen und Betrachtungen über Wurzelknospen und Nebenwurzeln.* Amsterdam, 1886.

Bergen's Elements of Botany. Key and flora, Southern States edition by S. M. Tracy. Boston, 1899. (Given by Dr. L. M. Underwood.)

Botanical Letters. 109 letters from botanists from the collection of Mr. J. J. Crooke. (Given by Miss Vail.)

BROCKMANN-JEROSCH, H. *Die Pflanzengesellschaften der Schweizeralpen.* I Teil. Die Flora des Pushlav. Leipzig, 1907.

ČELAKOVSKÝ, LADISLAV. *Beiträge zur Fortpflanzungsphysiologie der Pilze.* Prag, 1906.

CIRILLO, DOMENICO. *Plantarum rariorum regni Neapolitani.* Neapoli, 1788. (Given by Miss Vail.)

CORRENS, C. *Gregor Mendels Briefe an Carl Nägeli 1866–1873.* Leipzig, 1905.

COUTINHO, A. X. L. *Curso de silvicultura.* Lisboa, 1886. 2 vols.

DETMER, W. *Botanische und Landwirkschaftliche Studien auf Java.* Jena, 1907.

DIELS, L. *Jugendformen und Blütenreife im Pflanzenreich.* Berlin, 1906.

FITTING, HANS. *Die Reizleitungsvorgänge bei den Pflanzen.* Wiesbaden, 1907.

FRÉMONT, JOHN CHARLES. *Geographical memoir upon Upper California.* Washington, 1848. (By exchange with the Library of Congress.)

GAUTIER, JOSEPH. *Traité de la taille des grands arbres d'agrément.* Paris, no date.

GOLDSMITH, SOPHIE. *Beiträge zur Entwickelungsgeschichte der Fibrovasalmassen im Stengel und in der Hauptwurzel der Dicotyledonen.* Zürich, 1876.

GUBERNATIS, ANGELO. *La mythologie des plantes.* Paris, 1878–82. 2 vols.

HANSEN, ADOLPH. *Vergleichende Untersuchungen ueber Adventivbildungen bei den Pflanzen.* Frankfurt a.M., 1881.

HENRY, AUGUSTINE. *A list of plants from Formosa.* Tokyo, 1900.

HOLTERMANN, CARL. *Der Einfluss des Klimas auf den Bau der Pflanzengewebe.* Leipzig, 1907.

KNOX, JOHN P. *A historical account of St. Thomas, W. I.* New York, 1852.

LANÉSSAN, J. L. DE. *Mémoire sur le genre Garcinia.* Paris, 1872.

LINNAEUS. *Systema vegetabilium.* Editio decima tertia adornata a Joanne Andrea Murray. Gottingae et Gothae, 1774.

LOTSY, J. P. *Vorträge über botanische Stammesgeschichte,* Vol. 1. Jena, 1907.

Lower California: Its geography and characteristics. New York, 1868. (By exchange with the Librarian of Congress.)

MIEHE, HUGO. *Die Selbsterhitzung des Heus.* Jena, 1907.

MURILLO, ADOLPH. *Plantes médicinales du Chili.* Paris, 1889.

OSORIO, NICOLAS. *Estudio sobre las quinas de los Estados Unidos de Colombia.* Bogotá, 1874.

PELLETIER & CAVENTOU. *Analyse chimique des quinquina.* Paris, 1821.

PERSOON, C. H. *Tentamen dispositionis methodicae fungorum.* Lipsiae, 1797.

PIERROT, EDOUARD. *Culture du caféier.* Paris, 1906.

PRAIN, DAVID. *Memoirs and memoranda, chiefly botanical.* Calcutta, 1894.

REGEL, E. VON. *Index plantarum.* Petropoli, 1824.

REGEL, E. VON, & TILING, H. *Florula Ajanensis.* Moscou, 1859.

SCHÖNFELDT, HILMAR VON. *Diatomaceen Germaniae.* Berlin, 1907.

SUDRE, H. *Les rubus de l'Herbier Boreau.* Angers, 1902.

SYDOW, P. *Deutscher Botaniker-Kalender für 1899.* Berlin, 1898.

TRINIUS, C. B. *Panicearum genera.* St. Petersburg, 1834.

VANDERCOLME, ED. *Histoire botanique des salsapareilles.* Paris, 1870.

VRIES, HUGO DE. *Arten und Varietäten und ihre Entstehung durch Mutation.* Berlin, 1906.

WALSH, JAMES J. *Catholic churchmen in science.* Philadelphia, 1906. (Given by Dr. N. L. Britton.)

WENDLAND, HERMANN. *Index palmarum.* Hannoverae, 1854.

WIESNER, JULIUS. *Die elementar Structur und das Wachsthum der lebenden Substanz.* Wien, 1892.

WINT, PAUL DE. *Essais historiques sur les jardins.* Paris, 1855.

PICTURE COLLECTION.

398 reproductions of botanists' portraits. (Given by Dr. D. T. MacDougal.)

24 pictures of trees from various sources.

24 portraits of botanists from the Torrey collection.

79 pictures from various sources.

2 portraits of Mr. C. G. Lloyd. (Given by Dr. L. M. Underwood.)

22 plates from the "Botanical Magazine." (Given by the Royal Gardens, Kew.)

1 framed colored print: portrait of Gérard. (Given by Charles F. Cox, Esq.)

1 framed colored print: portrait of Bernard de Jussieu. (Given by Charles F. Cox, Esq.)

107 plates from Jaume St. Hilaire, Plantes de France. (Given by Miss Vail.)

7 illustrations in the greenhouses of the New York Botanical Garden.

6 photographs of a sugar mill in Cuba. (Given by Dr. L. M. Underwood.)

1 photograph of Dr. Charles E. Bessey. (Given by Dr. Charles E. Bessey.)

MUSEUMS AND HERBARIUM.

73 specimens of flowering plants from British America. (By exchange with the Geological and Natural History Survey of Canada.)

6 specimens from Colorado. (By exchange with Professor T. D. A. Cockerell.)

2 specimens of *Crataegus* from Vermont. (Given by President E. Brainerd.)

50 specimens "Phycotheca Boreali-Americana," Fascicle 27, for the Columbia Herbarium. (Distributed by Messrs. Collins, Holden and Setchell.)

15 specimens of *Crataegus* from Rochester, N. Y. (Given by Mr. J. Dunbar.)

31 specimens of *Crataegus* from Missouri. (By exchange with Mr. E. J. Palmer.)

25 specimens of flowering plants from the eastern United States. (Given by Mr. K. K. MacKenzie.)

18 specimens of *Crataegus* from New York. (Given by Mr. W. W. Eggleston.)

747 specimens of flowering plants from Montana. (By exchange with Professor L. M. Umbach.)

9 specimens of *Crataegus* from the vicinity of Philadelphia. (By exchange with Mr. B. H. Smith.)

2 specimens of *Crataegus* from Rochester, N. Y. (Given by Mr. M. S. Baxter.)

7 specimens of flowering plants from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

1 specimen of *Crataegus* from Indiana. (Given by Mr. F. D. Kern.)

50 specimens "Musci Frond. Archipelagi Indici et Polynesiaci." (Distributed by Prof. Max Fleischer.)

PLANTS AND SEEDS.

27 plants for the conservatories from Montserrat. (Collected by Dr. J. A. Shafer.)

1 plant of bamboo for the conservatories from China. (By exchange with Buffalo Botanic Garden.)

300 packets of seeds. (By exchange with the Botanical Garden, Bonn, Germany.)

80 packets of seeds. (By exchange with the Warley Place Garden, Great Warley, England.)

7 packets of seeds. (By exchange with the Botanical Garden, Lund, Sweden.)

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18 packets of seeds. (By exchange with the Botanical Garden, Mt. Holyoke College, South Hadley, Mass.)

12 packets of seeds. (By exchange with the Botanical Garden, University of Catania, Italy.)

4 packets of seeds from the Platte River, Nebraska. (By exchange with Prof. C. E. Bessey.)

10 packets of seeds from Costa Rica. (Given by Mr. C. Wercklé.)

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PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Vol. I, 1900, viii + 213 pp. Vol. II, 1901, viii + 204 pp. Vol. III, 1902, viii + 244 pp. Vol. IV, 1903, viii + 238 pp. Vol. V, 1904, viii+242 pp. Vol. VI, 1905, viii+224 pp. Vol. VII, 1906, viii + 300 pp.

Bulletin of the New York Botanical Garden, containing the annual reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations carried out in the Garden. Free to all members of the Garden; to others, $3.00 per volume. Vol. I, Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Vol. II, Nos. 6–8, 518 pp., 30 plates, 1901–1903. Vol. III, Nos. 9–11, 463 pp., 37 plates, 1903–1905. Vol. IV, No. 12, 113 pp.; No. 13, 193 pp., 12 plates; No. 14, in press. Vol. V, No. 15, 105 pp., 1906; No. 16, 88 pp., 17 plates, 1906; No. 17, 115 pp., 1907.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies and Central America. Planned to be completed in thirty volumes. Roy. 8vo. Each volume to consist of four or more parts. Subscription price $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Vol. 22, part 1, issued May 22, 1905, contains descriptions of the order Rosales by Dr. J. K. Small, and of the families Podostemonaceae by Mr. Geo. V. Nash, Crassulaceae by Dr. N. L. Britton and Dr. J. N. Rose, Penthoraceae and Parnassiaceae by Dr. P. A. Rydberg.

Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

Vol. 7, part 1, issued Oct. 4, 1906, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by Professor G. P. Clinton.

Vol. 7, part 2, issued March 6, 1907, contains descriptions of the families Coleosporiaceae, Uredinaceae and Aecidiaceae (pars), by Professor J. C. Arthur.

Memoirs of the New York Botanical Garden. Price to members of the Garden, $1.00 per volume. To others, $2.00. [Not offered in exchange.]

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Dr. Per Axel Rydberg, assistant curator of the museums. An arrangement and critical discussion of the Pteridophytes and Phanerogams of the region with notes from the author's field book, including descriptions of 163 new species. ix + 492 pp. Roy. 8vo, with detailed map.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by Dr. D. T. MacDougal, assistant director. An account of the author's researches with a general consideration of the relation of light to plants. The principal morphological features are illustrated. xvi + 320 pp. Roy. 8vo, with 176 figures.

Contributions from the New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume.

Vol. I. Nos. 1–25, vi + 400 pp. 35 figures and 34 plates.
Vol. II. Nos. 26–50, vi + 340 pp. 55 figures in the text and 18 plates.
Vol. III. Nos. 51–75, vi + 398 pp. 26 figures in the text and 21 plates.

RECENT NUMBERS 25 CENTS EACH.

87. Studies on the Rocky Mountain Flora—XVII, by Per Axel Rydberg.
88. Jane Colden, an early New York Botanist, by Anna Murray Vail.
89. Two new species of Aytonia from Jamaica, by Caroline Coventry Haynes.
90. Studies in North American Peronosporales—I. The Genus Albugo, by Guy West Wilson.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII MAY, 1907 No. 89

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

CONTENTS

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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PLATE XXXVIII.

Photographed by Mr. F. C. Berte.

MEMBERS OF THE BOTANICAL SOCIETY OF AMERICA AND THEIR GUESTS AT THE NEW YORK BOTANICAL GARDEN, DECEMBER 29, 1906.

JOURNAL

OF

The New York Botanical Garden

VOL. VIII. May, 1907. No. 89.

NEED OF ADDITIONAL FUNDS.

(Statement authorized by Board of Managers May 9, 1907.)

As the development of the Garden as a great educational institution proceeds, the need of additional funds to supplement its ordinary income in order to properly expand its work becomes apparent. The Board of Managers now hold three such funds, as follows:

1. A bequest of the late Ex-Chief Justice Charles P. Daly, in memory of Mrs. Daly's grandfather, David Lydig, known as the David Lydig Fund, amounting to $34,149.86, and yielding about $1,365 annual income. By resolution of the Board this annual income is devoted to publication and is of great assistance and value.

2. A gift by the Misses Olivia E. and Caroline Phelps Stokes of $3,000, as a fund for the preservation of native plants, yielding $120 annual income, which is devoted to lectures and literature, advocating the purposes for which the Fund was established.

3. Fees paid to the Garden by students registering for special privileges are credited to the Students' Research Fund, which now amounts to about $2,700, and yields about $108 annual income, grants from which are made to aid the investigations of especially meritorious students when required.

Foundations for other objects are greatly desired, and it is believed they would add much to knowledge. They may bear, in general, such personal designations as donors may desire to indicate.

1. *Exploration Fund.* The obtaining of plants and of specimens of their products from distant regions little known botanically for public display and for expert study, is one of the most important duties of the Garden; a fund not less than $250,000, yielding $10,000 or $12,000 annually, is needed.

2. *Horticultural Fund.*—In order to develop horticultural work, to promptly secure and exhibit all horticultural novelties, to investigate horticultural problems, to establish and maintain decorative plantations, a fund not less than $100,000 is needed to yield at least $4,000 or $5,000 annually.

3. *Library Fund.* The Library has been built up by gifts from friends of the Garden and is now a noteworthy collection of botanical and horticultural literature. To render it more complete and to permit the purchase of all books published on botany and horticulture, a fund of $50,000, yielding about $2,000 a year, is required.

4. *Conservatory Fund.* For the purchase of rare, large, or otherwise interesting and valuable plants for the public conservatories whenever offered by dealers or collectors,a fund of $50,000 is required, to yield about $2,000 annually.

5. *Herbarium Fund.* The herbarium is the most important of the permanent scientific collections of the Garden, because it provides the necessary means for determining the names, features and relationships of plants. It should be continually increased by the purchase of specimens from collectors all over the world, and a fund of $50,000, to yield about $2,000 a year, should be provided for this purpose.

6. *The Lecture Fund.* Public lectures on botanical and horticultural topics are important educational factors, and the lecture hall in the Museum Building is provided for this purpose. Money for the preparation of illustrations and the payment of lecturers additional to members of the curatorial staff of the Garden is needed, in order that at least one public lecture a week throughout the year may be delivered. A fund of $25,000, to yield about $1,000 a year, would accomplish this.

7. *Illustration of the "North American Flora."* It is very desirable that illustrations in color of native North American plants

accompanied by descriptive letter press should be published, and the collections at the Garden furnish the specimens needed. The preparation of drawings, their reproduction, and the printing and editing of such a work would need a fund of about $30,000, to yield $1,200 to $1,500 annually. The total cost of issuing sixty to seventy-five plates a year would be about $4,000, but more than half of this cost would be met by subscriptions to the work, and in time they might defray the entire cost.

8. *Scholarship Funds.* For the support of trained deserving students while investigating botanical and horticultural problems. Several such funds from $10,000 to $25,000, yielding $400 to $1,200 annually, could be operated with signal advantage to science.

9. *Laboratory Fund.* For the purchase of apparatus and other materials for the laboratories provided in the Museum Building. The laboratories are most important adjuncts to investigation and they should be well supplied with all necessary equipment; a fund of $20,000 to yield $800 to $1,000 a year is needed.

10. *Fund for Horticultural Prizes.* In order to stimulate the production and exhibition of horticultural novelties, it is desirable that the Garden have a fund of $10,000, to yield $400 or $500 a year for the recognition of such work by experimenters in any part of the world, the prizes to be in money or as medals.

11. *Fund for Botanical Prizes.* In order to stimulate scientific botanical discovery, the power to recognize original observations and other noteworthy contributions to botanical knowledge, by prizes, either in money or as medals, a fund of $10,000 should be provided to yield $400 to $500 annually.

12. *Research Funds.* Several funds from $5,000 to $50,000 yielding from $200 to $2,500 annual income are desired, to be devoted to the solution of unsolved botanical or horticultural problems.

It is also very desirable that the general Endowment Fund of the Garden be increased. The present endowment has been contributed as follows:

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Smaller contributions	160.00
Life Membership Fees	18,750.00
Total	$300,660.00

In preparing a habitation for the Botanical Garden, the city has expended over $1,250,000 upon its buildings, grounds, and roads, and it contributes also to their maintenance as a part of the park system, for the health, instruction and enjoyment of the people; but for support of the life and soul of the Garden, as a valuable and progressive scientific institution, we must look mainly to the public-spirited citizens of New York. Much has been already done, as a glance at its work will show. The Directors have expended nearly $300,000 of privately contributed funds and have invested a fund of about $335,000, similarly derived as already stated; and in gifts of plants, books, apparatus and the deposit of collections, have received about $225,000 more, making a total of about $860,000 contributed by individuals.

The Garden has won an honored and a world-wide name for what it has so far done, but it must have means for progress.

Will you not help in this endowment for educational and scientific work? Remittances may be made to either of the undersigned.

C. F. Cox, *Treasurer*, Grand Central Station.

N. L. Britton, *Director-in-Chief*, N. Y. Botanical Garden.

In behalf of the Board of Managers of the New York Botanical Garden,

Addison Brown,
Chairman of the Executive Committee.

EARLY EUROPEAN BOTANISTS IN JAPAN.

For our first knowledge of the rich botanical treasures of Japan, we are indebted to commerce and the Dutch East India Company. With the exception of a few years (1613–1623) in the early part of the seventeenth century when the English had a small trading-post in Japan, the country was closed to all foreign nations except the Portuguese, the Dutch and the Chinese. In 1640 the Portuguese were expelled and until the middle of the last century, entrance was denied to all except the Dutch and the Chinese.

Three illustrious names, Kaempfer, Thunberg and Siebold, head the list of European workers upon the flora of Japan. It is interesting to note that each of these men went out in the employ of the Dutch East India Company; that each made the difficult journey from Desima to Yedo in order to accompany the Dutch Ambassador on his annual visit to the Court of the Emperor; that the vocation of each was that of the physician while botany was but an avocation. Each on his return to his native land wrote long and informally of his impressions of Japan, and these works are invaluable in that they picture the conditions that obtained in Japan before her ports were opened to the nations; each also produced a botanical work of permanent value — works that persist as corner-stones in the foundations of Japanese botany.

Engelbert Kaempfer (1651–1716) was a native of Lemgow in Westphalia and was educated at the universities of Cracow in Poland and Königsberg in Prussia. He spent much time in the study of "Physick and the Natural Sciences" and so paved the way for the useful observations and discoveries which he afterwards made in his travels. From Prussia he went to Sweden, where his scholarly attainments brought him into great repute at the University of Upsala and advantageous offers were made to him. This was a score of years before the birth of Linnaeus. There is a tendency to forget that botany did not begin with Linnaeus, who is often called the "father of modern botany." He may be the "father," but if the ancestry should be followed up, the grandfathers and great-grandfathers of modern botany would form a most respectable family-tree.

Kaempfer, however, preferred foreign travel and accepted an appointment as secretary of the embassy which the Court of Sweden was then sending to Persia. Three years later, the negotiations with the Persian Court were concluded and Dr. Kaempfer entered the service of the Dutch East India Company as Chief Surgeon to the Fleet. After touching at various points on the shores of Persia and Arabia, the coasts of Malabar, the islands of Ceylon, Sumatra and Java, he arrived in Japan in the autumn of the year 1690. His experiences in that country are most delightfully told in the thousand pages of his *History* [redacted] *Japan.* In these volumes there is the fascination that comes from telling a thing for the first time when every detail is new, and there is the added charm of the beautiful country with its conservative and art-loving people.

The first settlement of the Dutch had been on the Island of Firando, but in the year 1638 they were commanded by the Emperor to demolish their factory and warehouse, and this for no other reason, says Kaempfer, than that "they were of hewn stones handsomer than the buildings of the country and because the year of our blessed Saviour's nativity was engraved in the front." With this unexpected order they were obliged to comply, "not only without showing the least mark of dislike but even with seeming satisfaction"! Soon after the expulsion of the Portuguese, the Dutch were ordered to their abandoned site on the little island of Desima in the harbor of Nagasaki. Kaempfer gives a lucid description of this island or "prison" as he calls it. "In shape it nearly resembles a fan without a handle, being of an oblong square figure, the two longer sides whereof are the segments of a circle. It is joined to the town by a small stone bridge at the end whereof is a strong guard-house where there are soldiers constantly upon duty. Just before the bridge towards the town is a place built of square stones where they put up the Imperial Mandates and Proclamations and the Orders of the Governors. Two orders of the Governors are continually to be seen there on so many boards; one of these relates to the regulation of the Guard, and the other is directed to the street-officers of Desima, and to all persons who have any business there and are on this account obliged to go in or out."

Once a year the Dutch ships put into harbor and the men were allowed to remain on the island for the two or three months of their stay. Then the director with a small number of men, only seven in the time of Kaempfer, remained on the island, where at all times they were watched by guards and inspectors. That there might be no occasion for the Dutch to acquire the Japanese language, the government insisted upon a body of one hundred and fifty interpreters.

Once or twice a year, the few Dutchmen who remained were permitted to take a walk into the adjacent country, particularly to view the temples. This privilege was more frequently granted to physicians and surgeons under pretense of going to search for medicinal plants. But it was a somewhat expensive luxury as a great retinue must accompany all such expeditions and be treated to a dinner, and one must "see his purse strongly squeezed for the most common civilities."

After the departure of the ships, the director of the company with a numerous suite set out on a journey to the court of the Emperor to make the usual yearly presents. This was a great undertaking, for the way was long and tedious, "three hundred and twenty-three Japanese leagues of different lengths," nearly a thousand miles by land and sea. Kaempfer says that upon the journey they were "allowed no more liberty than even close prisoners could reasonably claim. We were not suffered to speak to anybody, not even without special leave to the domesticks and servants of the inns we lodged at. As soon as we came to an inn, we were without delay carried upstairs, if possible, or into the back apartments which have no other view but into the yard which for a still greater security is immediately shut and nailed up."

One wonders how with so many restrictions Kaempfer was able to botanize by the way. But he says that in addition to the various things that travelers usually carry along on their journeys, he had for his own use a large Javan box in which he "privately kept a mariner's compass, in order to measure the directions of the roads, mountains and coasts; but openly and exposed to everybody's view was an ink-horn, and I usually filled it with plants, flowers and branches of trees, which I figured and described. Doing this, as I did it free and unhindered to everybody's knowledge, I should be wrongly accused to have done anything which might have proved disadvantageous to the Company's trade, or to have thrown any ill-suspicion upon our conduct from so jealous and circumspect a nation. Nay, far from it, I must own that from the very first day of our setting out till our return to Nagasaki, all the Japanese companions of our voyage and particularly the Commander-in-chief were extreamly forward to communicate to me what uncommon plants they met with, together with their true names, characters and uses which they diligently inquired into among the natives. The Japanese, a very reasonable and sensible people, and themselves great lovers of plants, look upon Botany as a study both useful and innocent, which pursuant to the very dictates of reason and the laws of Nature, ought to be encouraged by everybody." Still Kaempfer confesses that at the very beginning of the journey he took whatever means he could to secure the friendship and assistance of his fellow-travelers "obliging some with a submissive humble conduct and ready assistance as to physic and physical advice; others with secret rewards for the very meanest services and favors received from them."

Had it not been for this adroitness and tact and skill in overcoming the prejudice of the Japanese, it is doubtful if much could have been accomplished. The pioneer botanist in Japan must needs be a diplomatist as well as a botanist. Many of the interesting facts thus obtained are embodied in a chapter of his history under the heading "Plants of the Country." This relates more particularly to those of agricultural or economic value while the *Amoenitates Exoticae* contains a catalogue of all plants noted in his travels with "descriptions more accurate and botanical."

He tells us of the kus or "Camphire-tree" and the preparation of "camphire"; of the urusi or "Varnish-tree which affords a milky juice, which the Japanese make use of to varnish, or as we call it, to japan all their household goods, dishes and plates of wood, and this from the Emperor down to the meanest peasant"; of the "Tsianoki or Tea-shrub which is allowed no other room but round the borders of Rice and Corn-fields, and in other barren places unfit for the culture of other things; the common drink of the Japanese is brewed from the larger leaves of this shrub; but the young and tender leaves dried, powdered and mixed in a cup of hot water into a sort of Soup are drank in houses of people of quality."

He says that "Japan may vie with most, if not all, known countries for the great variety of beautiful Plants and Flowers wherewith kind Nature hath most liberally and curiously adorned its hills, fields, woods and forests. Some of these the Japanese have transplanted into gardens and improved by assiduity and culture to the utmost, and indeed to a surprising degree of perfection. . . . There are numberless varieties of Feverfews and

Lillies growing in this country. The first are the chief ornament of the houses and gardens, the others of desert and uncultivated places. Nor hath Nature been less kind with regard to the Narcissus, Flowers de Lys, Clove-Gilli-Flowers and the like. But these several flowers fall as short as others of their kind, growing in other countries, in strength and agreeableness of smell, as they exceed them in the beauty of their colors. The same holds true with regard to most fruits of Japan which are far from coming up to the pleasant aromatic tastes of those which grow in China and the Eastern countries. . . . Numberless plants grow in the fields, upon hills and mountains, in woods and forests, in morassy grounds, in barren and uncultivated places, along the Sea-coasts and in short, everywhere. Of all these, there are but few but what afford their roots, leaves, flowers and fruits for the sustenance of the people. . . . There is a great variety of mushrooms, most of which are eat. . . . Of all the soft submarine plants, there is hardly one but what the Natives eat. Fishermen's wives wash and sell them and are very dextrous in diving them up from the bottom of the sea in twenty to forty fathom depth."

In the appendix, there are some delightful papers on "The Natural History of the Japanese Tea-plant," "The Making of Japanese Paper" and "An account of the Moxa, an excellent caustic, with a scheme showing what parts of the human body are to be burnt with that Plant in several Distempers."

After eight years abroad, Kaempfer returned to his native town intending to practice medicine and publish his travels and scientific observations at leisure, but his success as a physician so consumed his time and energy that only the *Amoenitates* was published in his lifetime. To Sir Hans Sloane, who purchased all his unpublished manuscripts, is due the publication of his "*History of Japan*," which was translated into English from the original High German by Scheuzer. From this English translation it was later rendered into French, then into Dutch and finally (1777) again into German.

We hear of no further botanical work in Japan until Linnaeus had nearly attained his allotted three score and ten years. Then it was that the young Swede, Carl Peter Thunberg (1743–1778), his pupil in botany and a graduate of the medical department of the University of Upsala, became interested in the botany of Japan. At Amsterdam he had repeatedly heard regret expressed by the professors and botanists of the botanical garden that so little was known of the rich flora of Japan. This suggested to him the idea of visiting that country. Through the instrumentality of influential friends he soon secured an appointment as surgeon on board a vessel of the Dutch East India Company and proceeded to Japan by way of the Cape of Good Hope and the island of Java. His *Voyages au Japon* published in French are as quaintly interesting as the "History" of Kaempfer, and his experiences were strangely similar. The condition of the Dutch settlement showed no change and restrictions were perhaps more severe than ever. We cannot improve on his own way of telling his own story :

"My first care on landing was to provide myself with interpreters and to secure the favor of the officers who frequented our little island (Desima). My knowledge of medicine gave me more than one opportunity to be of service to them as well as to their sick relatives and friends. In short my frank and open manners won their confidence. I was not likely to inspire with much uneasiness the inspectors of commerce who could very well see that all my attention was focussed on medicine and botany. . . .

"I was so fortunate as to discover in the wild plants of the country some valuable medicinal properties and took advantage of these discoveries for the purpose of obtaining a permit which had never been granted to any European, to explore the region about Nagasaki in order to collect plants and seeds. I succeeded beyond my expectations, but almost immediately the favor was recalled.

"Before granting the permit, the Governor, fearing some innovation, had caused search to be made throughout the records of the country to ascertain if such a concession had ever been made to a European surgeon. He discovered that at some time considerably remote, during an extremely fatal epidemic when the ship's remedies had become exhausted, that a Dutch surgeon had been allowed to land and search the environs of Nagasaki for medicinal herbs. This discovery had the effect of immediately raising all scruples. But unfortunately the Governor examined the case a second time and found that the Dutchman had been of the rank of Second Surgeon while I was a First Surgeon. Therefore was I in no way entitled to the same privilege and it was promptly withdrawn !

"A circumstance of this kind is of tremendous importance in the eyes of the Japanese who are conservative to an inconceivable degree. They pride themselves upon the strict execution of the wishes of their sovereign without troubling themselves to interpret them or to make the slightest concession to circumstances. As for myself, while I was in no way regardless of the counter-order, still I was more determined than ever. I attempted to convince the superior officer that there was really no marked difference between a First and a Second Surgeon ; that the First Surgeon had passed through the lower rank of the Second, and that the Second had the right to aspire to the rank of the First! These observations so wise met with approval and were sufficient to raise the last scruple of the Governor who once more rendered me the permit, but so late that I was unable to profit by it before the month of February. It was with great regret that I had spent the entire autumn waiting for that miserable revocation."

In the meanwhile, however, Thunberg's ingenuity had helped him out. He goes on to tell us that "Fortunately several of the interpreters had become my pupils in medicine and surgery. Under my supervision, they treated the sick of the village. As remuneration for my lessons, I demanded of them all the plants, flowers and seeds which they could collect in the neighborhood of Nagasaki."

On the fifteenth of August, they landed the animals from the ship. Cows, calves, sheep, pigs and deer were brought every year from Batavia, not only for the consumption of the Europeans at the factory, but also for the provision of the vessel on its return voyage. These animals were kept in a stable upon the island and during the winter fed upon rice, rice-straw and the young branches of trees; at other seasons on such leaves and herbage as the native servants were able to gather from the neighboring mainland. " Never once," says Thunberg, " did I forget to examine the fodder which was brought regularly twice a day, and thus it was that I found some very rare plants, some of which I judged worthy to figure in the herbaria of Europe." Then he adds plaintively, " These discoveries only served to render more exasperating the species of captivity which bound all Europeans to the narrow and desolate island of Desima."

On the seventh of February, after the final grant of the long-delayed permit, Thunberg made his first botanical excursion into the environs of Nagasaki. To the modern botanist who clambers about with only his tin box for company, this seems like a formal and imposing occasion. He was obliged to take a numerous retinue of interpreters first, and interpreters second, of *banjos* of different grades, of *compradores*, and a multitude of *employes*. This numerous suite was as hungry as in the days of Kaempfer and " occasioned considerable expense in the way of refreshment whenever the route led by an inn." " Yet," Thunberg adds, " I had not the *complaisance* to limit them, and it was necessary that they should accompany me over the hills and through the mountains."

These excursions were made once and sometimes twice a week until the time of the departure of the Dutch Ambassador whom Thunberg accompanied to the court of the Emperor. This journey was a repetition of those of Kaempfer's experience, and although Thunberg does not tell us how he did his botanizing, we know from his *Flora Japonica* that it was not neglected. The mountains of Fakonia and other places along the route and Yedo are constantly quoted as the localities of plants which he describes. This work published in 1784 contains descriptions of about one thousand species, and is marvellously accurate and complete when one considers the circumstances under which the material for it was collected. On his return to Sweden, Thunberg was made Demonstrator of Botany at the University of Upsala, and in 1784 was appointed Professor of Botany and occupied the chair left vacant by Linnaeus until his death (1828).

He published several important works and numerous memoirs in the transactions of many Swedish and foreign societies, in fifty-six of which he held an honorary membership. Fifteen years before his death, he received the title of Commander of the Order of Wasa, and one likes to think of him as Sir Carl Peter Thunberg, distinguished botanist, traveler, gentleman, a man "sweet and amiable and who enjoyed general esteem."

Philip Franz von Siebold was the last of the great European botanists to visit Japan in the days before the awakening. He was a member of an illustrious German family celebrated for its learning and scientific knowledge. His grandfather was an eminent physician ; his younger brother Carl Theodor Ernst has been called the "Nestor of German Zoology." With a view to improving the trading relations of the Dutch, he was sent out by the East India Company. He went out not only to act as their physician and to plan improvements in the sanitary conditions of their island prison, but also as a man of science with a determination to further its progress in every possible way.

Well equipped with scientific apparatus he arrived in Desima in 1822 and for six years made the island his headquarters. Already conditions for scientific work had improved to a considerable degree and he had comparatively free access to the country, while his reputation as a physician and scholar, brought him many visitors from all parts of Japan. Some of these became his ardent students. His valuable stores of information were constantly increased by trained natives whom he sent to collect for him in the interior. In 1826 he accompanied the Dutch Ambassador to Yedo and was allowed to remain behind, the only foreigner in the city. Unfortunately, however, his zeal in scientific pursuits outran his discretion, and for getting possession of a native map of the country, he was imprisoned and finally compelled to leave Japan.

On his return to Germany, he published not only those works on the fauna and flora and natural history of Japan that for a half-century made him the first authority on those subjects, but he wrote also upon the history, language and literature of the country. His most important work from the latter standpoint is

Nippon: Archiv zur Beschriebung von Japan, which first appeared in five quarto volumes of text and six folio volumes of atlas and engravings. In 1897 his illustrious son, the Baron Alexander von Siebold, revised this work, the edition appearing in two large attractive volumes with many illustrations and printed in German. As we have already noted the corresponding work of Kaempfer is available in the quaint English of the early eighteenth

FIG. 15. Monument to Kaempfer and Thunberg erected by Siebold on the island of Desima.

century, while that of the Swedish Thunberg is in French. The scientific descriptions of all are in Latin.

In 1859 Siebold undertook a second journey to Japan and was invited by the Emperor to his Court. With the consent of his own government, he entered the Japanese service as negotiator between Japan and the powers of Europe, but his services were of short duration, for various intrigues combined to compel him to retire from his post and ultimately from the country. To his son, Baron Alexander, fell the honor of moving in those ever-widening diplomatic circles that were instrumental in rendering Japan accessible to the ideas of the West.

The name of Siebold is connected with the introduction of many rare and beautiful plants into the Gardens of Europe, more particularly, Japanese lilies, camellias, and chrysanthemums. His herbarium of the plants of Japan contained about two thousand species and twelve thousand numbers. The types of the *Flora Japonica* are now in the Herbarium of the Imperial Academy of St. Petersburg: Thunberg's Japanese types are in the Delessert Collection at Geneva; Kaempfer's plants of Japan and his manuscripts are preserved in the British Museum.

Siebold's *Flora Japonica* consists of three large folios containing colored plates of numerous rare and curious plants. On the title-page we find a tangible record, here reproduced, of the monument to Kaempfer and Thunberg which, at his own expense, Siebold erected to their memory on the island of Desima. In the *Leben und Wirken von Philip Franz Siebold* by his son, it is with singular satisfaction that we read that his surviving students and the nobles and statesmen of Japan have erected a monument in Nagasaki in honor of the man who, according to the closing lines of the inscription, deserves the first place among the men, "welche Kenner und Vertreter der europäischen Wissenschaft waren; folglich ruht der Ruhm der grossen That, der Einfuhrung der Civilisation im heutigen Japan, auf Siebold, dessen Andenken dieser Stein gewidmet ist."

MARY PERLE ANDERSON.

WHY IS A SUBSTANCE POISON?

The study of poisons and their influence upon living organisms has always been prominent in animal and plant physiology. The reason for this is, that since poisons more or less disturb the so-called vital processes and tend to change the behavior of an organism, the belief has prevailed that the study of poisons and of poisoning will bring us nearer to a solution of the mystery of life itself.

The word poison ordinarily suggests "skull and cross-bones," but the term is rather elastic in meaning so that it is possible for the same substance to be a food in some cases and a fatal poison in others according to the concentration and conditions. A poison may accelerate the vital processes, may retard them, or it may stop them.

It is now firmly believed that the so-called vital processes are chemical reactions largely. The digestion of starch to sugar which occurs in plants and animals is a chemical reaction. Each advance in chemistry and physics offers a new basis for an advance in physiology so that now considerable attention is being paid to the separate vital processes as chemical reactions rather than to the activity of the organism as a whole, which is of course much more complicated. Gradually more and more of the vital processes can be carried on in test tubes, so to speak, and the real nature of poisoning will probably be discovered by an understanding of the conditions prevailing when a poison affects a single chemical reaction. Thus the effect of poisons upon the digestion of starch and upon the digestion of protein have been studied.

We may think of a chemical reaction between two substances as a rearrangement of the matter composing those substances which results in the formation of a third substance different from the original ones. A poison, then, is a foreign body whose presence alters the rate of reaction between two others. Modern research has shown that any third substance more or less alters the rate of a given reaction. In this sense every substance may under some conditions be a poison. To understand why a substance is poison apparently involves a knowledge of why any third body has an influence, great or small as it may be. Any number of hypothetical questions might be asked here but it is evident that the fundamental nature of matter and the properties of its ultimate constituents are involved.

Before modern research had revealed the important part taken by electrical energy in chemical changes numerous attempts were made to correlate the poisoning capacity of the elements with their physical and chemical properties as then known. Thus compounds containing the heavy metals, mercury, copper, lead, etc., were found to be more poison than those containing the lighter metals such as sodium, calcium, etc. In all those efforts the exceptions encountered were so numerous as to make a satisfactory explanation impossible.

According to the modern view chemical action is largely an affair between small particles called ions. Each ion carries an electrical charge. Some ions carry a negative charge and others carry a positive one. Some ions hold their charges much more tenaciously than others. When an ion loses its charge or gains an additional one it suffers a change and likewise the ion from which it gained the charge or to which it lost one. Now we may think of a living organism as an association of ions between the members of which there is a constant interchange of electricity. This interchange is outwardly manifest as the so-called vital processes. As long as the interchange remains in natural equilibrium the organism lives, but when this equilibrium is disturbed the organism is poisoned and death is a matter of the degree of the disturbance. Suppose a foreign substance, an ion of mercury, for example, approaches this association of ions (our living organism) and comes within the sphere of influence. It is an experimental fact that the mercury ion does not hold its charge very firmly, so that some ion member of our association steals the charge carried by the mercury ion. The electrical equilibrium previously existing in the organism is thus disturbed by the additional charge and perhaps a total readjustment of the electrical relations occurs — the organism is poisoned. Now suppose some other ion instead of the mercury, for example a sodium ion, reaches the sphere of influence of our organism. Since the sodium ion holds its charge too firmly to lose it, the chemical relations of the organism remain undisturbed — the sodium is not poison. This is essentially the latest theory of the real nature of poisoning. Those substances are most poison which hold their charges least firmly. This theory was advanced in 1904 and has been supported by two subsequent investigations by different men.

During the past six months a test of the theory has been made in the laboratory of the Garden. The digestion of fat was selected as the chemical reaction upon which the effect of a series of poisonous metals was tried. This reaction had never been tested and it proved to be more favorable for the purpose than others so far tried because the sources of error are much less. The results invalidate the theory. The poisoning power of the metals tried did not bear a definite relation to the energy required to separate a charge from its ion. The results also strengthen the view that a general law formulating the particular nature of poisoning and applicable in all cases, cannot be found. It does seem probable, however, that an explanation can be had why of two substances affecting a reaction one is more potent than the other. This would be a forward step, and our results have suggested a promising clue.

RAYMOND H. POND.

SOME FEATURES OF THE MOUNTAIN FLORA OF THE PHILIPPINES.

When one thinks of the Philippines and their vegetation, the first idea is that of a purely tropical flora, and until comparatively recently there was nothing in botanical publications and there is to-day practically nothing in current literature to contradict such an impression. And yet, even had no direct evidence been obtained of the presence of a very different element, a little reflection should lead us to expect something of the kind. Between the extreme northern and southern islands there is a difference in latitude of over sixteen degrees, about the distance which separates New York from northern Labrador or from the central Bahama Islands; though as the Philippines are entirely within the tropics, the resulting changes there should be less pronounced than in regions farther from the equator. But there is another element of still greater importance to be considered, altitudinal variation. The Philippines contain a great many hills, although none are so high as some in Formosa on the north or Borneo on the southwest. The highest are in Mindanao, the most southerly of the large islands, but the greatest mass is in Luzon, at once the largest and the last island of importance to the north. Nearly its whole northern half is mountainous, and the conjunction of northern latitude and high elevation has permitted a very different flora from that of lower levels. The higher peaks farther to the south show the same tendency, but not so noticeably. Naturally, the lower-lying and therefore the warmer portions of the islands are the better known.

Until a generation ago, botanical information regarding the Philippines had been obtained either by expeditions which spent a comparatively short time in the islands, or by resident Spaniards, and much of the work of the latter was unreliable. Both explored the country around Manila, and most of the visitors penetrated at least as far into the country as the great lake of Laguna de Bay, and climbed some of the hills in its rear. Another somewhat frequent stop was at Zamboanga, in Mindanao; but attention was almost confined to Luzon. A much more strenuous collector was Hugh Cuming, who spent several years there gathering shells, plants and birds, and in so doing seems to have visited nearly all of the principal islands. There is strong internal evidence that he never reached very high levels on any of the mountains, and was not beyond the edge of the hills of northern Luzon. The difficulties were not all physical. The Spanish hold upon the wilder portions of the group was so slight that no collecting could be done in any such place until a comparatively short time ago.

About twenty years before the American occupation, Sebastian Vidal, director of the Forestry Bureau, took the initiative in the exploration of Benguet, which is the province forming the southwestern portion of the mountain region above mentioned, and more recently Loher penetrated into Lepanto-Bontoc, adjoining Benguet on the north.

A few of the species which to us most strongly suggest temperate conditions were known before their day. Oaks were described by Blanco in 1837, and several kinds are now known; the first pine was described in 1847, having been collected by Cuming a few years before. Some beautiful orchids sent to England by him had brought collectors representing many of the leading horticultural firms of Europe to the islands, and one of them, Wallis, discovered the beautiful white Philippine lily, *Lilium philippinense*, now frequently cultivated, which is very abundant in the pine forests of Benguet, the most southern home for any species of this genus.

It has remained for the new régime to disclose more fully the nature of this northern flora, and to greatly augment the number of species known from the Philippines by the exploration of many other districts as well, including the three highest mountains in the archipelago, Apo and Malindang in Mindanao, and Halcon in Mindoro. At least a thousand species new to science have been found, and already about three fourths of this number have been published.

Perhaps we can most vividly realize the character of much of this hill vegetation by glancing at the names of some of the plants which compose it, remembering that while many of them are found only at the highest altitudes, others occur lower down upon the slopes. There are several species of raspberries, blueberries, sedges, rhododendrons, and violets ; fewer species represent the rushes, everlastings, gentians, hollies, cresses, willow-herbs, loosestrifes, bayberries, wintergreens, barberries, clematis, and honeysuckles ; and there is probably only one kind each of buttercup, rose, meadow-rue, thistle, sow-thistle, St. John's-wort, anemone, chickweed, stone-crop, eyebright, bedstraw, lobelia, aster, wild lettuce, golden-rod, strawberry, ash, maple, and willow.

Even these familiar names show very inadequately how different is the general aspect of the highlands from that of the lowlands, which is undoubtedly tropical.

It is among such species that we find those that show the most important connecting links with the flora of other countries. Thus, *Boenninghausenia albiflora* Reichb. f., a plant closely related to the rue, and previously known from the Himalayas and the mountains of western China and Japan, has been collected in Benguet by Mr. Williams and others. *Thesium psilotoides* was originally described by Hance from a few specimens found near Canton, in China. Mr. Williams found it also in Benguet, and it has since been collected farther north by Mr. Merrill. *Anaphalis adnata* DC. and *A. contorta* Hook. f., natives of the mountains of India and southern China are now also known from Luzon.

Ten times as many similar cases might be quoted, and instances where the species are closely allied but not identical are still more numerous. These throw a great deal of light both upon the earlier geological history of the islands and the origin of their flora. It is evident from the foregoing that Luzon was connected with continental Asia since these species were evolved, but yet long enough ago to permit the differentiation that has taken place in a very large number of other cases.

Still more noteworthy, perhaps, is the presence of a distinct, though much smaller, Australian element, first noted over twenty years ago by Mr. Rolfe and recently emphasized by Mr. Merrill, and it is again significant that these species are mainly from the mountains.

The oddly-shaped island of Celebes, lying to the south of the Philippines, shows many points of floristic similarity with them, and especially with the nearest large island, Mindanao; but the cases known at present seem of less interest.

A Bornean element is also known to exist, but investigations in this direction are least developed. It is certain to be very pronounced, if for no other reason than that the geographical limit between the two areas is ill-defined. Important explorations have recently been carried on in the large connecting islands of Mindoro and Palawan, but the results are not yet available.

The indications are, however, that much the greatest number of connecting links will be found to be with Formosa, as would be expected from its geographical position and general resemblance to the northern Philippines. Its flora, as recently worked out by Professors Matsamura and Hayata, already makes this evident, and, as little collecting has yet been done at elevations above 2,000 feet, many discoveries of the greatest interest are still to be expected; it is among these that we would look for the greatest number of plants belonging also to other countries.

From another point of view, the climate indicated by this semi-temperate vegetation in the north of the islands suggests most important possibilities for their future. Advantage has already been taken of this more bracing temperature from the standpoint of health. Much of the land, in Benguet at least, is known to be very fertile, and is already under high cultivation, and the rapid improvement in conditions farther north and fuller investigations thus made possible will soon make known the agricultural capabilities of that part of the region as well.

C. B. ROBINSON.

THE ECONOMIC GARDEN.

Ever since the New York Botanical Garden was opened to the public, the need of an economic plot, where visitors, especially the younger and city-bred ones, might see the principal hardy useful plants in a growing state, has been keenly appreciated, but not until the present year have the conditions been favorable for its establishment. Late in the summer of last year, a plot of half an acre, lying just north of the Morphological Garden, was set apart for this purpose. This plot, to be known as the Economic Garden, occupies the upper or northern end of a valley which lies to the eastward of the large conservatories. The southern half of this valley is occupied by the Hardy Herbaceous Garden, the three gardens together rendering this valley one of the most beautiful and interesting horticultural sites in the vicinity of New York. The valley, at the site of the Economic Garden, is only about fifty yards wide. An old drain which ran through the center has been converted into a rivulet, connecting a chain of small pools, from which the meadow slopes up to a rocky ridge on either side. Both of these ridges are occupied by a sparse natural forest growth. The margins of the slopes have been planted with the more important useful trees and shrubs, foods being represented upon the western side, and medicines, tanning and dye products, etc., upon the eastern side. The open meadow is laid out in beds, planned upon the unit system, where herbaceous plants may be found, their separation corresponding with that of the woody plants. The units are classified, so far as practicable, upon an economic basis. The growing collections represent one or more varieties of many of the plants cultivated for their material uses which will endure our climate. Besides these, a large number of the plants used by the aborigines, especially food plants, are represented. In the rivulet and the pools, many aquatics and marsh plants, such as calamus, cat-tail, rice, both cultivated and wild, taro, and wappatoo have been planted.

It is expected that this garden will become a very popular feature in the grounds, after its plants have become well established. It is notoriously true that many of our city people, even adults, have no idea of the character and appearance of the plants from which our most important vegetable products are derived. Aside from this fact, people of much more pretentious knowledge will be likely to find here subjects of novelty and even of surprise. The economic garden, moreover, is expected to furnish much new or complementary material to the Economic Museum. It is planned to form an economic department in the new series of glass houses soon to be built, which will complete our present economic series of exhibits.

H. H. RUSBY.

A NEW FLOWER GARDEN ADJOINING THE CONSERVATORIES.

To the north of the Conservatories, between the terrace and the opposite ridge on which the pines are located, is a flat area lying between the paths, about five hundred and fifty feet long and fifty-six feet wide, divided into five rectangular plots. This tract has been retained in green sward until very recently, but it was decided this spring to plant the two largest of the five plots with flowers and shrubs.

Each of the two plots referred to is about one hundred and seventy-six feet long and fifty-six feet wide, making a total in the two plots of about 19,712 square feet. It seemed desirable to so arrange the planting as to make it attractive during both winter and summer. This was of easy accomplishment so far as the summer was concerned, and to insure this for the winter it was decided to plant large masses of conifers and broad-leaved evergreens in the center, allowing them to run out here and there in small masses. Between the irregular margin thus produced and the surrounding border, measuring ten and one half feet wide, have been planted deciduous shrubs in masses.

The entire central rectangular area, measuring about one hundred and fifty-five feet by thirty-five feet, is planted with evergreens and deciduous shrubs. This will give during the summer a solid effect of green, relieved by the masses of color produced by the flowers of the deciduous shrubs ; while during the winter the dark green of the evergreens will make a pleasing contrast with the surroundings. Of the border of ten and one half feet referred to, a band eight feet wide has been devoted to herbaceous plants, made up largely of perennials, with some annuals, among which will be found many old-time friends.

The remaining two feet and a half has been retained in grass, making a green frame to the whole planting. Suitable show labels, giving desirable information, will be placed in position shortly.

In the planting of these plots, about one thousand conifers and broad-leaved evergeens have been used, five hundred deciduous shrubs, and two thousand two hundred herbaceous plants. It is a pleasure to again refer to the generosity of Mr. Lowell M. Palmer, who has contributed the large number of conifers and broad-leaved evergreens necessary to make this planting effective.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT.

Under a Park Department contract with Kelly & Kelley, ground was broken on May 3 for the boiler house of the new public conservatories to be erected on the east side of the garden near the Bleecker Street entrance.

During the building of the masonry retaining walls at the driveway and path approaches to the Mosholu Parkway and the Woodlawn Road, it was of course necessary to break the border screen of trees and shrubs along the railway at those points. The gaps have been filled this Spring and the border screen is now intact from the Elevated Railway Station north to the Woodlawn Road. Considerable planting has also been done at the base of the retaining walls at both these driveway entrances.

Active work in the construction of the stone bridge to replace the old wooden "Blue Bridge" near the north end of the Hemlock Grove, has been in progress during the month of April under the Park Department contract with M. J. Leahy. The same underlying stratum of sand and gravel on which all the other bridges in the garden rest was found at this point and forms a footing for these structures which could not be better. This layer occupies a position about six feet below the average surface level of the river. As already described, this bridge is being built of boulders selected from old stone walls in the grounds and of others which grading operations have unearthed.

Much progress has been made in grading, sodding and sowing the banks about the lakes during the month of April and the telford foundation of the path system around the lakes is now very nearly complete, so that as soon as a supply of trap-rock screenings can be obtained they may be completed for the use of the public. It may be of interest to record that the price of broken trap-rock and trap-rock screenings has been greatly advanced since last year, competitive bidding last year bringing out a cost of $1.87 per cubic yard delivered at the garden, whereas the lowest bid obtainable this spring is $2.15 per cubic yard, and even at that figure it is difficult to obtain screenings free from a large amount of finely comminuted stone or sand.

Arbor Day exercises were held at the garden on May 2 and May 3 in connection with the nature-study lectures given to the children of the public schools of Manhattan and the Bronx. Remarks appropriate to the occasion were make by Dr. Britton and Dr. Murrill.

Dr. Hollick addressed the pupils of Curtis High School, New Brighton, Staten Island, giving an account of the origin and development of the movement and calling attention to the fact that the inauguration of Arbor Day in New York State was due to an act introduced in the State Assembly in 1888 by Assemblyman George Cromwell of Staten Island, now President of the Borough of Richmond.

The total precipitation recorded at the Garden for April was 4.93 inches. Maximum temperatures were recorded of 70° on the 5th, 56° on the 11th, 57° on the 21st, and 68° on the 25th;

also minimum temperatures of 26° on the 2d and 6th, 31° on the 11th, 29° on the 20th, and 37° on the 25th. The mean temperature was 48°, or 4.3° above the normal for April for New York State.

ACCESSIONS.

PLANTS AND SEEDS.

430 plants for the outside collections. (Purchased.)

26 plants for the outside collections. (Collected in the vicinity.)

64 plants from the Bahamas for the conservatories. (Collected by Dr. N. L. Britton.)

1 plant for the conservatories. (Given by Mr. Harding.)

1 plant for the fruticetum. (Given by Mrs. Dyer.)

1 plant for the nursery. (By exchange with the Bureau of Plant Industry.)

3 plants for the conservatories. (By exchange with Dr. I. D. Cardiff.)

24 plants for the conservatories from Cuba. (Collected by Mr. W. R. Maxon, by exchange with the United States National Museum.)

16 plants for the conservatories from the Bahamas. (Collected by Mr. L. J. K. Brace.)

1 plant for the conservatories. (Given by Mr. D. Griffiths.)

3 packets of seeds from Corea. (Given by Dr. R. T. Morris.)

89 packets of seeds from Siberia and Corea collected by Mr. T. N. Meyer. (By exchange with the Bureau of Plant Industry.)

19 packets of seeds. (By exchange with the United States National Museum through Dr. J. N. Rose.)

1 packet of seeds. (Given by Dr. H. H. Rusby.)

2 packets of seeds. (By exchange with the Royal Gardens, Kew, England.)

179 packets of seeds. (By exchange with the Botanical Garden at Leiden, Holland.)

18 packets of seeds. (By exchange with the Botanical Garden at Dublany Austria.)

18 packets of seeds. (By exchange with the Botanical Garden at Groningue, Holland.)

102 packets of seeds. (By exchange with the Botanical Garden at St. Petersburg, Russia.)

3 packets of seeds from Cuba. (Given by Prof. M. T. Cook.)

1 packet of seeds. (Given by Mr. R. C. Schneider.)

3 packets of seeds from Montserrat, W. I. (Collected by Dr. J. A. Shafer.)

130 packets of seeds. (Purchased.)

MUSEUMS AND HERBARIUM.

61 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

2 specimens of *Crataegus* from New Hampshire. (Given by Mr. Percy Wilson.)

100 specimens "Fungi Columbiana" Century XXIV. (Distributed by Mr. E. Bartholomew.)

2 specimens from Mexico. (Given by Mr. C. G. Pringle.)

1 specimen of *Nothoscordium* from Florida. (Given by Mr. S. Rapp.)

3,000 specimens from Montserrat and Antigua. (Collected by Dr. J. A. Shafer.)

2 specimens of *Crataegus* from eastern Pennsylvania. (Given by Professor C. L. Gruber.)

200 specimens "Cryptogamae Formationum Coloradensium." (Distributed by Professor F. E. Clements.)

20 specimens of *Crataegus* from Missouri. (By exchange with Professor William Trelease.)

2,000 specimens from the Bahamas. (Collected by Dr. and Mrs. N. L. Britton.)

10 specimens from California. (By exchange with the University of California.)

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Bulletin of the New York Botanical Garden, containing the annual reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations carried out in the Garden. Free to all members of the Garden; to others, $3.00 per volume. Vol. I, Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Vol. II, Nos. 6–8, 518 pp., 30 plates, 1901–1903. Vol. III, Nos. 9–11, 463 pp., 37 plates, 1903–1905. Vol. IV, No. 12, 113 pp.; No. 13, 193 pp., 12 plates; No. 14, in press. Vol. V, No. 15, 105 pp., 1906; No. 16, 88 pp., 17 plates, 1906; No. 17, 115 pp., 1907.

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

Vol. 7, part 1, issued Oct. 4, 1906, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by Professor G. P. Clinton.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII JUNE, 1907 No. 90

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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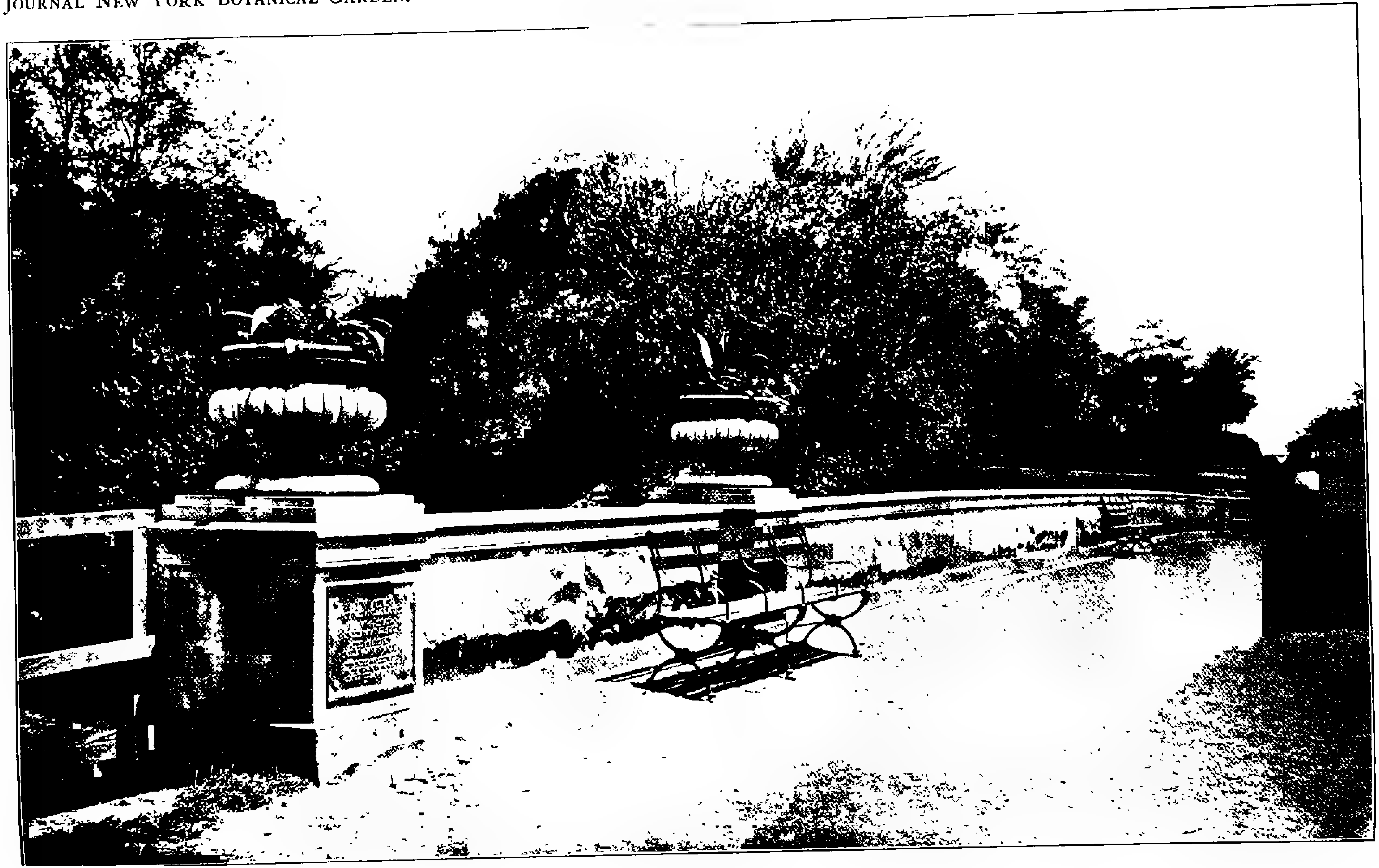

JOURNAL

OF

The New York Botanical Garden

Vol. VIII. June, 1907. No. 90.

EXERCISES COMMEMORATIVE OF THE TWO HUNDREDTH ANNIVERSARY OF THE BIRTH OF LINNAEUS.

Exercises commemorating the two hundredth anniversary of the birth of Linnaeus were held May 23, under the auspices of the New York Academy of Sciences, at the Museum of Natural History, the Botanical Garden, the Zoölogical Park, the Aquarium, and the Museum of the Brooklyn Institute.

In the forenoon, at the Museum of Natural History, American animals, shells, minerals and rocks known to Linnaeus were exhibited by a committee in charge, and letters and cablegrams from other societies appreciative of the work of Linnaeus were read by the Secretary of the Academy. Short addresses were also made by some of the representatives of these societies who were present. Then followed the main address of the morning by Mr. J. A. Allen on "Linnaeus and American Zoölogy."

Exhibition of American Plants Known to Linnaeus.

The exercises were continued in the afternoon at the Botanical Garden. Visitors were received under an arch bearing the name of Linnaeus decorated with flowers known to him and draped with the American and Swedish flags. After luncheon, an exhibition of American plants known to Linnaeus was held in the museum building. Nearly a thousand species of flowering plants, including potted plants and cut flowers, were shown, besides several species of ferns and a few of the lower cryptogams. The botanical writings and portraits of Linnaeus occupied a conspicuous place in this exhibition.

The following address was then delivered by Dr. P. A. Rydberg, Curator:

LINNAEUS AND AMERICAN BOTANY.*

Mr. Chairman, Ladies and Gentlemen:

I have been asked to make a short address to you on Linnaeus and his relation to North American botany. That the selection fell on me was not because I was the most able one to deliver such an address, for there are many abler men present, but simply because I was born in the same country as Linnaeus. In fact, my grandfather came from the same province of Smaland and

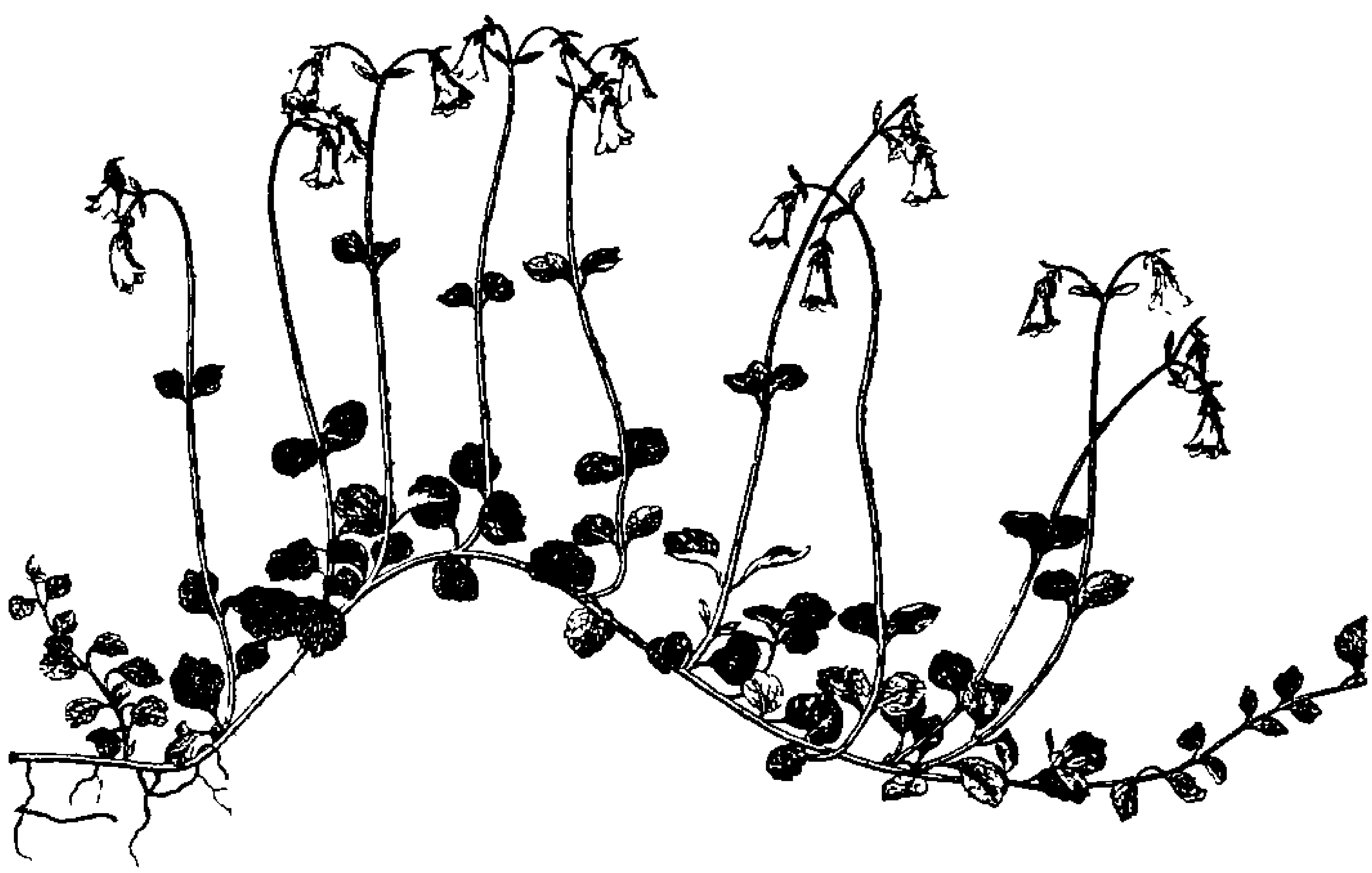

FIG. 16. The twin-flower, *Linnaea borealis*, a plant especially beloved by Linnaeus and dedicated to him by Gronovius.

even from a parish adjoining that of Stembrohult, in which my illustrious countryman was born.

In the early part of the seventeenth century there lived in Jonsboda, Smaland, Sweden, a farmer named Ingemar Svenson. He had three children, two sons and one daughter, the grand-

*Address delivered at the New York Botanical Garden, May 23, 1907, by Per Axel Rydberg, on the commemoration of the two hundredth anniversary of the birth of Linnaeus by the New York Academy of Sciences.

mother of Linnaeus. On the Jonsboda farm stood a very large linden tree, so old and with so many traditions that it was regarded by the people as a holy tree. Any damage done to this tree, it was claimed, would surely bring misfortune upon the head of the perpetrator. When the two sons began to study for the ministry, it was natural that they should think of this tree in selecting a family name. They called themselves Tiliander; *Tilia* is the Latin for the linden or basswood, and *andros* the Greek for man. It may not be amiss to state that at that time the common people of Sweden did not have any family names, and this is true to a certain extent even to-day. A man was known by his given name, the given name of his father with the word son appended, and the place where he lived. The farmer mentioned above was known as Ingemar Svenson from Jonsboda. His father's name was Sven Carlson and that of his grandfather, Carl Johnson. The names of his two sons would have been Carl and Sven Ingemarson had they remained in the peasant class, instead of Carl and Sven Tiliander.

The daughter married a farmer, Ingemar Bengtson, and her son's name was Nils Ingemarson, until he entered the "gymnasium." He was also born in Jonsboda and, when selecting a name, he naturally also turned to the same old linden tree as his maternal uncles had done. He called himself Linnaeus. It is remarkable that two of his father's maternal granduncles also bore another Latin form of the same name, viz., Lindelius. Some claim that even this name was derived from the same old linden tree, but this is scarcely in accordance with the facts. More likely it traces its origin from the Linden Farm in Dannäs Parish, where their ancestors lived.

But what has this genealogy to do with Linnaeus's relation to North American botany? Perhaps nothing directly, but indirectly a great deal; for the circumstances and surroundings under which a man is born and reared to a certain extent make the man. In his younger days, Sven Tiliander was the house-chaplain of Field-marshal and Admiral Viscount Henrik Horn, who was for many years Governor of Bremen and Verden, two cities with territory in Germany acquired by Sweden through the

Thirty-years War. During his stay in Germany, Tiliander learned to know and love botany and horticulture and established around Viscount Horn's residence in Bremen a garden which was remarkable for that period. When both returned to Sweden, Tiliander brought with him the choicest plants from this garden and planted them around the parsonage of Pjetteryd Parish, of which he had been appointed rector. Here at Pjetteryd, Nils Linnaeus spent most of his youth, studying in company with his uncle's sons. Later, both as curate at Rashult and as rector at Stenbrohult, he surrounded the parsonages with gardens, in which he grew many rare and interesting plants. In the midst of these, Carl Linnaeus, the famous botanist, was born and reared. Later, while a student at the university, he spent a summer vacation at home in 1732, and made a list of the plants in his father's garden. This list is still to be seen in the Academy of Sciences at Stockholm. Although defective, the first four classes being unrepresented, it enumerates 224 species. Of these, many were at that time very rare in cultivation. Professor Theodore Fries in his biography of Linnaeus enumerates 36 of the rarest of these. Among them we notice six American plants, viz., *Rhus Toxicodendron*, the poison oak, *Mirabilis Jalapa*, four-o-clock, *Asclepias syriaca*, milk-weed, *Phytolacca decandra*, poke-weed, *Antennaria* (now *Anaphalis*) *margaritacea*, pearly everlasting, and *Solanum tuberosum*, the potato. It may be remarked that the cultivation of potatoes was introduced into Sweden about twenty years later. We see from this that Linnaeus had learned to know some American plants even in his early childhood.

Carl Linnaeus was born the 13th of May (old style), 1707, at Rashult, an annex to the parish of Stenbrohult. His father was the curate there, but two years later, at the death of his father-in-law, Samuel Broderson, he became rector and moved to Stenbrohult. In the fall of 1714, Carl Linnaeus entered the school of Wexiö, and graduated from the "gymnasium" in 1727. His parents, especially his mother, wanted him to study for the ministry, but he had no love for theology, nor for metaphysics, nor the classics. He learned Latin tolerably, however, because that language helped him to study the natural sciences. He decided to study medicine and entered with that view the University of Lund, which was nearest his home, but remained there only one year, learning that there were better facilities at Upsala. At the latter place he soon became acquainted with Professors Rudbeck and Celsius, two of the most prominent scientists of that time,

FIG. 17. Linnaeus at the age of thirty, in Lapland dress.

and was allowed to use their libraries. The former, who had many duties to perform, soon asked Linnaeus to give for him the public lectures in Botany. The income from these gave Linnaeus means to support himself and linked him closer to his favorite study. He became acquainted with practically all the plants of the gardens and fields of the whole region around Upsala and learned all the scientific names given in the books at his disposal.

The latter was not an easy matter, when we take into consideration the form of scientific names at that period. For example, the most approved name of the common blue-grass that adorns our lawns was: "*Gramen pratense paniculatum majus, latiore folio, Poa Theophrasti.*" Other names of the same grass were: "*Gramen vulgo cognitum,*" "*Gramen pratense majus vulgatus,*" and "*Gramen alterum et vulgare.*" In the first publication by Linnaeus, it appears as "*Poa spiculis ovatis compressis muticis.*" I think that Linnaeus and his contemporaries had much more cause than we to exclaim: "Those horrible Latin names!" To us the same plant is known as *Poa pratensis* L., the name adopted by Linnaeus in his "Species Plantarum."

The lectures given by Linnaeus for Professor Rudbeck became very popular. This was especially the case after his return from his Lapland journey. Some persons, especially Dr. Nils Rosen, became jealous of his success and induced the University faculty to pass a resolution by which no one who had not taken the corresponding degree was permitted to give university lectures. Linnaeus had not yet received his doctor's degree, and hence was debarred. As Holland was offering at that time excellent facilities both in medicine and in botany, and as living expenses were lower than elsewhere, Linnaeus decided to visit that country and take his examinations there. He received his doctor's diploma at Harderwijk, and afterwards went to Leyden, where he became acquainted with three of the greatest botanists of the time, Boerhaave, Burmann and Gronovius. George Clifford, the wealthy burgomaster of Amsterdam and president of the East India Company, was a great lover of plants and had a splendid botanical garden at Hartecamp as well as a rich library and herbarium. On the recommendation of Boerhaave, Linnaeus became Clifford's physician and curator of his collections and garden. Here he lived in luxury, beloved as a son.

Clifford furnished Linnaeus with means to publish five of his first books, "Systema Naturae," "Fundamenta Botanica," "Bibliotheca Botanica," "Genera Plantarum" and "Flora Lapponica," the manuscript of which he had brought with him from Sweden. In the first of these, Linnaeus presents his system of classification. He divides Nature into three kingdoms, the mineral, vegetable and animal. In the vegetable kingdom, he brings out an altogether new classification, based upon the sexual organs of plants. He divides the kingdom into 24 classes, the first 23

FIG. 18. Linnaeus at the age of forty.

containing the phanerogams and the last the cryptogams. In the first 11 classes are included plants which have from 1 to 12 free and practically equal stamens; in the 12th and the 13th, plants with many stamens; in the 14th and 15th, plants with 4 and 6 stamens respectively, of which 2 are decidedly shorter; in the 16th, 17th and 18th classes the stamens are united by their filaments; in the 19th they are united by their anthers, and in the 20th they are adnate to the pistil; in the 21st and 22d the flowers are unisexual, *i. e.*, the stamens and pistils are in different flowers, on the same individual in the 21st and on different individuals in the 22d; and the plants of the 23d class have both unisexual and bisexual flowers. The classes were divided into orders. In the first 13 classes the orders were determined by the number of the pistils, in the 14th and 15th by the fruit; and in the 16th to 18th and 20th to 23d by the number and distinctness or union of the stamens. The classification of the 19th class is too complex to enter into here. The 24th class was divided into 4 orders: Filices, Musci, Algae and Fungi.

This system of classification is purely artificial. Linnaeus himself regarded it only as temporary, and expected that it would soon be supplanted by a more rational one, based on natural relationship. The Linnaean system served its purpose, however. It became a means by which it was possible to tabulate every known genus of plants. Before this time there had been no systems at all, or such crude ones as we find even to-day in some popular flower-books, where the plants are classified by the color of their flowers. If the natural systems of DeCandolle, Bentham and Hooker, and Engler and Prantl are too complicated for popular books, why not go back to the simple system of Linnaeus? It would at least give a good insight into the structure of the flower instead of the mere color.

In his "Genera Plantarum" Linnaeus applied this system to all known genera of plants and gave each of them a concise and plain description.

Clifford had many American plants in his garden, but he sent Linnaeus to England to visit Sir Hans Sloane, Professor Dillenius, and Philip Miller, in order to secure American plants grown by them. Both Sloane and Dillenius treated Linnaeus at first with coolness, because he "confounded" botany. On his farewell visit to Dillenius, Linnaeus politely asked him what he meant by "confounding botany." Dillenius took from the library the first few pages of Linnaeus's own "Genera Plantarum" and showed him where there was written at numerous places "NB." Dillenius stated that all the genera so marked were wrongly described. The first example he pointed out, if I am not mistaken, was *Canna*, placed by Linnaeus in his first class, which contains plants with but one stamen. Botanists before this time had described it as having three stamens. To settle the dispute they went out into the garden and the living plant showed that Linnaeus was correct. Dillenius then retained Linnaeus for several days and found that the older botanists in most cases were at fault and the young Swede correct. From being an opponent, he became a friend of Linnaeus and let him have all the plants he wanted.

After his return to Holland Linnaeus continued his work in Clifford's garden with renewed zeal; and completed his "Hortus Cliffortianus," a large folio, in which are enumerated and described all the plants found in Clifford's collections, together with synonyms and citations of nearly all botanical works then in existence. In preparing this work he became thoroughly acquainted with almost all the literature referring to American botany, such as Morison's "Plantarum Historia," Plukenett's "Almagestrum Botanicum" and "Phytographia," Petiver's "Gazophylacium," Sloane's "Jamaica," Plumier's "Plantarum Americanarum Genera," "Plantarum Americanarum Fasciculus Primus" and "Filicetum Americanum," Catesby's "Historia Naturalis," and, later, Cornuti's "Canadensium Plantarum Historia."

After completing the "Hortus Cliffortianus," Linnaeus returned to Leyden, where he spent some time helping Gronovius with the editing of his "Flora Virginica," based on a large collection of plants collected by Clayton. Here again he came in contact with American plants.

Linnaeus then returned to Sweden and became a practicing physician. He was soon appointed Professor of Medicine at Upsala, but by common agreement he exchanged chairs with Rosen, who held the professorship of Botany. He now began work upon the most important book of his life, his "Species Plantarum." In this he tried to include a short description of every known species of plant, together with the most important synonyms and citations. In this book the Linnaean binomial system of nomenclature was used for the first time. Linnaeus was not the first to give plants names; nor was he the first to name genera. Many Latin plant-names had come down from antiquity, while others had been proposed by his predecessors. Men like Tournefort and Micheli had in some cases clearer ideas of genera than Linnaeus himself. Neither was Linnaeus the first one to use binomials. In Cornuti's work on Canadian plants, for example, we find almost as many binomials as polynomials; but it is doubtful if Linnaeus had seen Cornuti's book when he first wrote his "Species Plantarum." He does not cite it in the first edition, but does so in the second. Linnaeus was, however, the first one to use binomials systematically and consistently. Before his time botanists had recognized genera and applied to them Latin nouns as names. In order to designate species, they added to these nouns adjective descriptive phrases. These consisted sometimes of a single adjective, as in *Quercus alba*, the white oak, but more often of a long string of adjectives and adjective modifiers, as in the case of the blue-grass mentioned above. The specific name had hitherto been merely a description modifying the generic name; from this time it became really a name, although a single adjective in form. An illustration of the pre-Linnaean form of plant-names might be had if, instead of "Grace Darling," one should say, "Mr. Darling's beautiful, slender, graceful, blue-eyed girl with long golden curls and rosy cheeks." "Grace" is just as descriptive of the girl as this whole string of adjectives. It may be that "Grace" is not always applicable to the person to whom the name is applied; but this is also often the case with many specific plant-names. *Asclepias syriaca* and *Rumex Brittanica* are American plants, and *Rubus deliciosus* is one of the least delicious of the raspberry tribe. This invention and strict application of binomial names could not but cause a revolution in Botany. Since the appearance of "Species Plantarum" in 1753 it has been possible to pigeon-hole not only genera, but also species of plants.

Before this useful book was printed, Linnaeus had become better acquainted with North American plants, and in another way. Baron Bjelke, the vice-president of the Court of Appeals of Finland, had proposed to the Royal Academy of Sciences at Stockholm to send an able man to Iceland and Siberia, countries partly in the same latitude as Sweden, "to make observations and such collections of seeds and plants as would improve the Swedish husbandry, gardening, manufactures, arts and sciences." Dr. Linnaeus suggested North America instead, and recommended one of his pupils, Professor Pehr Kalm, of Abo, for the proposed expedition. Kalm spent two years in North America, traveling through Pennsylvania, New Jersey, New York and Canada, and making large collections of seeds and plants, which were preserved as living or dried specimens or as alcoholic material. During his stay at Raccoon, New Jersey, he discovered our mountain laurel. The Swedes of Raccoon called it spoon-tree, because the Indians made spoons from its hard wood. Kalm adds in his journal about this tree: "The English call this tree a Laurel, because its leaves resemble those of the *Laurocerasus.* Linnaeus, conformably to the peculiar friendship and goodness which he has honored me with, has pleased to call this tree *Kalmia foliis ovalis*, *corymbis terminalibus*, or *Kalmia latifolia.*" Here Linnaeus himself gave an illustration of both the pre-Linnaean and the post-Linnaean nomenclature. Kalm became acquainted with several of the naturalists of this country, C. Colden and his daughter Jane, Bartram and Clayton, and through Kalm a correspondence was established between them and Linnaeus. Linnaeus also corresponded with John Ellis, who resided in the West Indies, and Dr. Gardiner, who botanized in Carolina and Florida. Later he bought a set of plants collected by Patrick Browne in Jamaica, and received a part of the collections made by Jacquin in the West Indies.

When the second edition of the "Species Plantarum" appeared, in 1762, Linnaeus knew and had described nearly 1,000 plants indigenous to the United States and Canada. Besides these, he described about 1,000 more, natives of the West Indies, Mexico and Central America, and 400 or 500 South American plants. His knowledge of American plants was small compared with what he knew of plants of the Old World. "Codex Linnaeanus," which enumerates all plants named by Linnaeus, contains not fewer than 8,551 species.

Linnaeus died January 10, 1778, honored and esteemed by all. Some of his work will doubtless live as long as Botany is studied by man.

We see from the preceding account that we may consider Linnaeus one of our American botanists. Even the little plant

FIG. 19. Hammarby, the country home of Linnaeus near Upsala, Sweden. From a recent photograph by W. A. Murrill.

which Gronovius dedicated to the Father of Botany, the twin-flower of our woods, with its exquisite perfume and its dainty pink flowers, belongs to a genus essentially North American. The genus *Linnaea* contains four forms, all closely related. One of these, the original *Linnaea borealis*, is confined to the mountain regions of northern and central Europe. Linnaeus discovered it on his Lapland journey and it was then considered a very rare plant. Now it seems to be more widely distributed than it was at the time of Linnaeus. Perhaps it is of American origin and has become modified since it transplanted itself on the other side of the ocean. The other three forms are North American. *Linnaea americana* Forbes, which has usually been confounded with its European cousin, is common in the woods from Labrador to Alaska, and extends in the Rocky Mountains as far south as New Mexico. *L. longiflora* (Torr.) Howell, is found in the mountains from Northern California to Alaska. The fourth form is, as far as I know, undescribed and unnamed. It is with great pleasure that I here propose the following name and description for this species:

Linnaea serpyllifolia sp. nov.

A delicate plant with long creeping stems, 1–4 dm. long, sparingly hirsute; petioles 2–3 mm. long, ciliate; blades broadly oval or round-ovate, 5–8 mm. long, minutely crenulate, obtuse, sparingly hirsute, more or less coriaceous and shining, slightly paler beneath; peduncles 3–5 cm. long, sparingly pubescent and more or less glandular above, 2-flowered; bracts 2–3 mm. long, linear or lance-linear, obtuse; pedicels 5–8 mm. long, glandular-pubescent; hypanthium subglobose, in flower slightly over 1 mm. long, glandular-puberulent, purplish; calyx-lobes 2–2.5 mm. long, linear-subulate; corolla pink, open-funnelform with a very short tube, decidedly oblique, about 6 mm. long and 5 mm. wide.

This species differs from *L. borealis* and *L. americana* in the very narrow and almost glabrous calyx-lobes. In this respect, it agrees with *L. longiflora*: but it is distinguished from that species by the differently shaped corolla and by the leaves, which are broadest at or below the middle, instead of above it. It differs from all three in the smaller size of the flower and of the leaves, and in the indistinct toothing of the latter.

Alaska: Cape Nome, 1900, *F. E. Blaisdell* (Type in herb. N. Y. Bot. Gard.); Kotzebue Sound, *Arnott.*

Apparently the same plant has also been collected on the island of Sachalin by F. Schmidt, but his specimens lack flowers.

Exhibition of Lantern Slides of American Flowers Known to Linnaeus.

Dr. H. H. Rusby then showed selected colored lantern slides of the flowers of the following North American plants known to Linnaeus; early blue violet, hardhack, partridge pea, purple flowering raspberry, dwarf cornel, jack-in-the-pulpit, harebell, alum-root, meadow beauty, ground-nut, button-snakeroot, wake-robin, swamp rose-mallow, marsh-marigold, skunk cabbage, water hemlock, cardinal-flower, large blue flag, butterfly-weed, pickerel-weed, sea-side goldenrod, five-finger, large blue gerardia, black-eyed susan; sweet elder, swamp honeysuckle, witch-hazel, rhododendron; laurel magnolia, flowering dogwood, sweet-gum, locust-tree, black birch, fringe-tree, tulip-tree, and American linden.

American Trees Known to Linnaeus.

At the conclusion of the exhibition of lantern slides, Dr. W. A. Murrill led the way through the grounds of the Garden from the museum building to the Linnaeus Bridge and pointed out certain species of American trees known to Linnaeus. The following trees were observed, in the order given, and some of their characteristics briefly mentioned; tulip-tree, sweet-gum, red maple, red cedar, sweet birch, white pine, white ash, sugarberry, flowering dogwood, sassafras, buttonwood, butternut, white elm, red oak, white oak, hemlock, chestnut-oak, and American linden.

Dedication of the Linnaeus Bridge.

A handsome new bridge over the Bronx River on Pelham Parkway, between the Botanical Garden and the Zoölogical Park, was then dedicated by the unveiling of a bronze tablet commemorative of Linnaeus placed thereon by the Academy of Sciences. Dr. N. L. Britton, Director of the Garden and President of the Academy, made the following address:

Address by the President of the Academy.*

The recognition of the work of famous men is one of the happiest duties of mankind. It stimulates our endeavors and encourages us to make efforts which we would probably not make without their examples before us.

To-day we do homage to a distinguished man of science, and

* Delivered at the dedication to Linnaeus of the Pelham Parkway bridge over the Bronx River, by Nathaniel Lord Britton, President of the New York Academy of Sciences, May 23, 1907.

the unanimity with which the scientific societies and institutions of the City of New York join in this tribute is in itself evidence of the value which is placed upon his contributious to natural history.

Science has made great progress during the two centuries which have elapsed since the birth of Linnaeus. Theories have in large part given place to ascertained facts or have been replaced by other theories based on more accurate knowledge of natural objects and of natural phenomena. The contributions of science to the welfare, comfort and happiness of mankind have made present human life widely different from that of two hundred years ago, and this amelioration of our condition, and the more general diffusion of knowledge has been accompanied by a vast improvement in morality.

The ceremonies of to-day are worthy of the great naturalist whose birth they commemorate. Societies and institutions all over the world join with us in honoring him, and are represented here by delegates or have transmitted documents expressing their appreciation of his life and labors. The public natural science institutions of New York have come to take leading parts in the subjects they teach and illustrate. Public and private philanthropy have developed them with a rapidity almost phenomenal, for they are all yet in their infancy, and on a scale commensurate with the dignity of the metropolis of America. The cordial cooperation of a municipality with public-spirited citizens to build and maintain such institutions for the welfare of the people and of science, finds here, in New York, its maximum evolution, which has as yet, however, by no means reached its complete development nor its maximum usefulness. What shall be said of their position and importance when after fifty years the New York Historical Society opens the tablet which we now place upon this bridge? And, what discoveries will Science have made for the benefit of the human race during these next fifty years?

The selection of this bridge recently constructed by the Park Department, as a permanent memorial of Linnaeus, is most appropriate. It is situated just outside the New York Zoölogical Park, with the New York Botanical Garden a short distance to the north, being thus between the two institutions which teach the subjects on which the fame of Linnaeus chiefly rests. The suggestion that it be known hereafter as the Linnaeus Bridge came from the Director of the American Museum of Natural History.

On behalf of the New York Academy of Sciences I now unveil this tablet and present it to the City of New York, there having been placed in it copies of to-day's program and other documents befitting the occasion.

The tablet was then unveiled by Dr. N. L. Britton and accepted for the City by the Hon. Joseph I. Berry, Commissioner of Parks

FIG. 20. Tablet placed on the Linnaeus Bridge by the New York Academy of Sciences.

of the Borough of the Bronx. Its location is shown in the frontispiece, and its wording in the accompanying photograph.

The key of the tablet was accepted by the New York Historical Society for safe keeping until May 23, 1957. Addresses were made by Mr. G. F. Kunz, President of the American Scenic and Historic Preservation Society, and Mr. Emil F. Johnson

President of the United Swedish Societies of New York. Appropriate music was furnished by the American Union of Swedish Singers.

From the Linnaeus Bridge, the party entered the grounds of the Zoölogical Park and, under the guidance of Dr. W. T. Hornaday, the Director, and several members of his staff, examined the zoölogical collections with special reference to animals known to Linnaeus.

The exercises were continued in the evening at the Museum of the Brooklyn Institute with addresses by Messrs. F. A. Lucas and E. L. Morris, with an exhibition of lantern slides, and musical numbers by the Glee Club of the United Swedish Societies.

A reception at the Aquarium given by the New York Zoölogical Society to the New York Academy of Sciences and Guests, about five hundred people in all, closed the exercises of the day. Features of marine life known to Linnaeus were then demonstrated, and the first view was had of the Aquarium collections under illumination by night. The centennial of the Aquarium building was commemorated at the same time.

W. A. MURRILL.

NOTES, NEWS AND COMMENT.

Miss Anna Murray Vail, Librarian, is at present in France, where she intends to remain during the summer.

The seventh annual meeting and exhibition of the Horticultural Society of New York was held at the Garden on Wednesday and Thursday, May 8 and 9. The seventh summer exhibition was held June 12 and 13.

Dr. Per Axel Rydberg, Curator, delivered an address at Augustana College, Rock Island, Illinois, on May 13, in connection with exercises commemorative of the two hundreth anniversary of the birth of Linnaeus.

The exercises at the Garden in honor of Linnaeus were attended by the Swedish Minister, from Washington, and by the Swedish Consul, Vice-Consul, and President of the United Swedish Societies, from New York.

Mr. Wladimir H. Lipsky, the well-known Russian botanist and botanical explorer, recently spent several days at the Garden examining the library and collections.

The nature-study lectures and demonstrations for the benefit of pupils of the public schools in the borough of the Bronx and a portion of Manhattan closed for the spring term on June 4, to be continued in the autumn.

A collection of fossil gums containing some very rare and choice specimens has just been presented to the Garden by Messrs. G. W. S. Patterson & Co. of this city. A description of this collection will be published at an early date.

The total precipitation recorded for May, 1907, was 4.05 inches. Maximum temperatures were recorded of 72° on the 10th, 83° on the 14th, 70° on the 24th, and 71° on the 30th; also minimum temperatures of 34° on the 5th, 30° on the 12th, 44° on the 18th, 37° on the 22d, and 41° on the 28th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM APRIL 15 TO JUNE 1.

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ZEILLER, R. *Etudes sur la flore fossile du Bassin Houiller et permien de Blanzy et du Creusot.* Paris, 1906. 2 vols. (Given by Dr. Arthur Hollick.)

MUSEUMS AND HERBARIUM.

4 mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

287 specimens of *Rubus* from eastern North America. (Collected by Mr. W. H. Blanchard.)

300 specimens of marine algae from the Barbados. (Collected by Miss Annie L. Henderson.)

1 specimen of *Polyporus anceps* from Massachusetts. (Given by Professor E. A. Burt.)

30 specimens for the economic museum from Montserrat, W. I. (Collected by Dr. J. A. Shafer.)

1 bowl made of a redwood burl from California. (Given by Mr. Rodney Burns.)

6 specimens of cassava starch and products from Montserrat, W. I. (Given by Mr. A. S. Weeks.)

539 specimens from Central America. (Collected by Mr. H. Pittier.)

1 specimen of *Claytonia multicaulis* from Iowa. (By exchange with Mr. M. P. Somes.)

1 specimen of *Puccinia melothriae* from North Carolina. (Given by Dr. F. L. Stevens.)

1 specimen of *Pterospora Andromedea* from California. (Given by Mrs. H. L. Britton.)

490 specimens from Mexico. (Collected by Dr. C. A. Purpus.)

PLANTS AND SEEDS.

55 plants for woody collections. (Purchased.)

1 plant for herbaceous garden. (Given by Mr. E. S. Steele.)

19 plants for conservatories. (Purchased.)

1 plant for herbaceous garden. (Given by Dr. L. R. Abrams.)

6 plants for herbaceous garden. (Given by Miss D. W. Marble.)

1 plant for herbaceous garden. (Collected by Dr. J. A. Shafer.)

520 conifers for nurseries. (Given by Messrs. I. Hicks and Son.)

1 plant for herbaceous garden. (Given by Mr. E. N. Howell.)

51 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

2 plants for herbaceous garden. (Given by Dr. D. T. MacDougal.)

1 plant for herbaceous garden. (Given by Dr. H. J. Banker.)

9 plants for conservatories. (Given by Messrs. Siebrecht and Sons.)

1 plant for herbaceous garden. (Collected by Dr. P. A. Rydberg.)

1 plant for conservatories. (By exchange with Mr. Oakes Ames.)

1,800 plants derived from seeds from various scources.

1,127 plants for woody collections. (Given by Mr. Lowell M. Palmer.)

24 plants for conservatories. (Given by Mr. Lowell M. Palmer.)

1 packet of seeds from the Bahamas. (Collected by Dr. N. L. Britton.)

1 packet of seeds from Colorado. (Given by Mr. D. M. Andrews.)

3 packets of seeds from California. (Given by Mr. S. B. Parish.)

1 packet of seeds from Mexico. (Given by Mr. J. T. Nagle.)

8 packets of seeds from California. (Given by Mrs. H. L. Britton.)

1 packet of seeds from Antigua. (Collected by Dr. J. A. Shafer.)

Members of the Corporation.

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PUBLICATIONS

OF

The New York Botanical Garden

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII JULY, 1907 No. 91

JOURNAL

OF

The New York Botanical Garden

EDITOR

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First Assistant

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Published for the Garden

At 41 North Queen Street, Lancaster, Pa.
by The New Era Printing Company

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JOURNAL

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Vol. VIII. July, 1907. No. 91.

THE BREATHING OF PLANTS.*

There is probably no scientific question concerning which erroneous notions are more wide spread than the one regarding the difference between animals and plants. Ask the "average man" what this difference is and he will tell you, in the first place, that animals have motion while plants have not; or, if he is especially conservative, that animals have locomotion while plants have not; and, second, that plant respiration is just the reverse of animal respiration. Animals, he says, "breathe-in oxygen and breathe-out carbon dioxide, while plants breathe-in carbon dioxide and breathe-out oxygen." It is with the latter of these "differences" that we are concerned in the following paragraphs.

By way of a gentle introduction it may be stated at once that plants breathe precisely as do animals, and, second, that they do not "breathe" at all. This seeming contradiction is explained when we remember that, as we think more accurately, our terms must be more carefully defined. In ordinary conversation "breathing" refers to the inspiration of fresh air into the lungs, and the expiration of the air that has been used. Obviously plants have no lungs. We cannot *see* them breathe.

But this exchange of fresh and foul air is only incidental to the real physiological process, properly termed respiration. Not all animals have lungs. Earthworms, insects, jelly-fish, and others may be mentioned as familiar examples of this fact. The

* From a lecture delivered at the New York Botanical Garden, October 27, 1906.

real process, to which the physiologist applies the term respiration, has to do with the use that is made of the inspired air. From the lungs this air, in man for example, is taken up by the blood. Part of it the blood uses in its own respiration, the remainder it carries to all the tissues of the body, and delivers it to the individual protoplasmic units or cells. These cells take up the oxygen according to their needs, use it in performing their work, and return to the blood the carbon dioxide that results. Carried by the blood back to the lungs, the carbon dioxide is given off to the air in expiration. All of this is common knowledge. Respiration refers to that part of this process which goes on in the individual cells, while the term breathing may be to advantage restricted to the work of the lungs. Respiration, then, is a cell-process, and every organism that is alive, and every living cell of that organism must respire. The cells of our fingers, our eyes, and our hearts respire, as well as do those of the lungs. All plants are built up of cells, some of which are alive and some not. All the living cells of plants respire, just as truly as do those of animals.

It is difficult to demonstrate the cell processes, but the outward manifestation of them — the absorption of oxygen and the evolution of carbon dioxide — is very easily shown.

Into each of six fruit jars place portions of the different parts of plants as follows: into the first fresh roots, into the second stems, into the third leaves, into the fourth flowers, into the fifth germinating seeds, and into the sixth nothing. A lighted candle will continue to burn when placed in any of the jars. Seal them all air tight. If, at the end of twelve hours, a lighted candle is thrust into each of the jars, it will be extinguished in each of the first five, but will continue to burn as usual in the sixth. This shows us that the air in the five jars has become poorer in oxygen, while that in the sixth jar is apparently unchanged. If now we pour clear lime-water into each of these jars, the water will become milky in each of the first five, but will remain clear in the sixth. This indicates that in the first five the amount of carbon dioxide has been increased, but not so in the sixth.

Since the only difference between the first five jars and the sixth is the presence, in the former, of parts of living plants, we must conclude that the change in the air is due to the vital activities of the roots, stems, leaves, flowers, and seeds. But an absorption of oxygen and an evolution of carbon dioxide, we have learned, is the outward indication of the cell-process called respiration. In this, and in many other ways, it may be shown that plants respire.

It will be seen here that plant respiration is not confined to the leaves. Nothing can be more misleading than to speak of leaves as the "lungs of plants." If any comparison at all is to be made they could better be called the stomachs of plants, for in them processes of digestion go on with as much, if not more, vigor than does respiration. Moreover many kinds of plants such as bacteria, algae, fungi, liverworts, and others, have no leaves, but respiration goes on in them notwithstanding, and trees in winter, after all the leaves have been dropped, continue still to respire.

No vital activity is as important as respiration. Food may be supplied, water and air may be abundant, but without respiration life is impossible. The power to respire marks the chief difference between the living and the non-living. In the realm of living things it is universal and incessant. It is always in all essentials, the same process, whether in plants or in animals. The failure to recognize this fact gave rise in the latter half of the last century to the doctrine of vital dualism. Because of the supposed difference between animal and plant respiration, it was argued that there were two kinds of life. A clearer understanding of the vital processes of animals and plants, however, has taught us that life is one. No clearly defined line can be drawn between the two kingdoms.

As great differences exist between certain animals, and between certain plants, as are found between animals and plants. But the process of respiration is everywhere the same. Even dry seeds, which certain German physiologists have considered as in a condition of "*Scheintodt*" (apparent death), are respiring. The boquets in our vases, the celery and lettuce on our tables, the potatoes and apples in our cellars, as well as the trees, shrubs and herbs, indoors and out, are constantly, day and night, taking in oxygen, exchanging it in the living cells for carbon dioxide, and returning the latter to the surrounding air.

Even in regard to the amount and rate of respiration the supposed difference between animals and plants breaks down. Under favorable conditions the process may be even more active in plants than in animals. In man the carbon dioxide produced in twenty-four hours equals about 1.2 per cent. of the body weight, but in some of the moulds the amount has been found to equal 6 per cent. of the dry weight of the plant. Bulk for bulk, very active bacteria may consume oxygen 200 times more rapidly than man. In both kingdoms respiration is accompanied by an evolution of heat.

In plants, as in animals, the rate of respiration varies with the age of the organism, and with external conditions. Breathing, which is the expression of respiration in man, is most rapid with infants, and decreases with the approach of old age. So it is with plants, for germinating seeds and young seedlings respire more rapidly than mature plants. Increase of work is accompanied with increase of respiration in animals: in trees, also, the process is more vigorous in the spring, during the work of bud-opening and the putting forth of new leaves and flowers. Under bodily pain or mental excitement we breathe more rapidly, so also does a plant that has been cut, or otherwise injured, or subjected to any stimulus, as, for example, violent shaking. A thermometer placed in a dish of cut onions, for example, will indicate the existence of a fever (due to the wounding of the tissue), just as surely as if placed in the mouth of a typhoid patient.

This question is far from having a merely academic interest, Practices that have been in vogue since man first began to till the soil, and that must be continued as long as agriculture is carried on, depend, in part, upon the respiratory function of plants. I refer to plowing the soil and hoeing the crops. It is not alone to get the soil into a suitable physical condition that it is broken up by the farmer. The roots and other underground parts must have air to respire, just as much as the parts above ground, but if the soil is hard and compact this need is but poorly met. The plow, the spade, and the hoe facilitate the thorough aëration of the ground. For the same reason it is desirable frequently to loosen the surface of the soil in flower pots, and this, in part, is why flower pots are made of porous material.

Emphasis has been laid upon the fact that only living things respire. While this is perfectly true of the physiological process, it is not true of the mechanical act which may be designated as breathing. The entire soil area of the globe is subject to great inspirations of atmospheric air, and expirations of the gases resulting from life processes underground. This process is necessary to the healthful respiration of soil-organisms, and of the underground portions of all land plants. Without it land vegetation would perish and the world would become a desert.

The "breathing" or aëration of the soil is accomplished in a variety of ways. In all regions where it has a depth of fifty feet or more, the ground at a certain distance below the surface is soaked with water, so that all the spaces between the soil particles are completely filled. The upper surface of this moisture is called the water-table, and above it the soil contains only capillary water. The interspaces between the soil particles are filled with air, and only the surfaces of the grains are wet. The level of water in a well marks the level of the water-table in the soil. In the spring, and in other wet seasons, this water-level stands at a greater height than in periods of dry weather, and, as it falls, air from above ground enters the soil. When the water-table rises, gases are forced out.

The gradual heating of the soil during the day causes the soil-air to flow out, while the nocturnal cooling is accompanied by a current in the opposite direction. Wind blowing over the surface causes an outflow, the calm that follows an inflow. Thus the great soil-breathing goes constantly on.

It is in this way that fresh air is continually supplied, not only to roots, but also to the soil-bacteria, some of which are able to convert the nitrogen of the air into a form available to other plants, others of which are able to convert the ammonium-compounds into nitrates and the nitrates into nitrites, in which form it may be utilized by higher plants. For we must remember that bacteria must respire as truly as ourselves.

The question as to what becomes of all the roots, and why the soil never becomes clogged, may possibly never have occurred to some of us. Several causes explain this, one of which is the process of putrefaction, which is explained by the respiration of a certain kind of microscopic plants. These plants are called *anaërobes*, because they normally respire anaërobically, that is, without the presence of free external oxygen. Some of them are unable to respire at all if free oxygen surrounds them. If, therefore, the aëration of the soil is interfered with, these plants find ideal conditions for their growth and activity, and the soil becomes "sour," and unfit for crops.

From the above considerations it becomes clear that agriculture, the most fundamental of all human industries, depends for its successful pursuit upon practices whose whyfore is found in the fact that plants respire.

But husbandry is not the only point where the respiration of plants touches our daily lives. Upon the respiration of the yeast-plant depends the enormous brewing industry of our own and other countries, and upon the respiration of another yeast-plant we are dependent for the lightness of our daily bread, for the fermentation involved in "raising" dough is a kind of respiration. The difference between a "good" and a "bad" cigar is partly attributable to a similar cause, for the difference is connected with the curing of the tobacco, and this process involves the respiration of bacteria. So, too, does the tanning of hides, and the separation of flax and hemp fibers from the plants that produce them.

Cold storage warehouses and refrigerator cars are made necessary, in part, because of the respiration and universal presence of myriads of microscopic plants that float in the air, for, whereas heat accelerates respiration, cold retards it. The turning rancid of butter, the souring of milk, the formation of vinegar from cider, are all dependent upon the same process. If plants did not respire canned fruits and meat would seldom spoil. That a hen's egg is a miniature botanical garden is a bit of that truth that is stranger than fiction. The ovophytic flora enters the egg in the body of the fowl, before the formation of the shell, and the respiration of the entombed plants is one reason why eggs will not always remain "strictly fresh," and why cold storage will prolong the period of their freshness.

The difference between green and black tea is largely owing to the fact that, in the case of the latter, microscopic plants have been allowed to respire among the moist leaves of the tea plant until a critical point is reached, when the plants are killed and the respiration stopped. A well regulated banquet must terminate with cheese and black coffee; but is the cheese Camembert, Roquefort, Neufchatel, Brie, or Schweitzer? That depends upon the kind of plants that respired within the cheese during the process of its ripening. Formerly it was not thought possible to produce a given kind of cheese except in a given native locality; but this is no longer so, for, since it has been known that the difference depends upon the activity of plants, these little organisms can be shipped to any locality where it is desired to manufacture a given kind of cheese.

The wide range of relationships indicated above depends upon the fact that carbon-dioxide and water are not the only by-products of respiration. Many other substances result, the discussion of which would lead us into technicalities beyond the scope of the present lecture.

But someone may be raising the question of the value of plants in the sick room. It is hardly necessary to more than mention the subject, for now that we know that plants are continually respiring, and in precisely the the same manner as are animals, it is at once recognized that they would have the same kind of an effect on the air of a room that a person or a burning gas jet would have, though possibly not to the same degree. If the plants were abundantly supplied with green leaves, and were well exposed, even to bright diffused sunlight, they would supply an insignificant amount of oxygen to the air. But at the same time they would be sources of carbon dioxide. And when we recall that the "plants" in a sick room are usually cut flowers, often not over fresh, and that flowers respire more vigorously than any other part of a plant except germinating seeds, we do not need to be further enlightened as to their power of purifying the air. Our scientific knowledge, however, should not, as it is often liable to do, get the better of our "sense uncommon, men call common sense," for the brightness and cheer that flowers bring to the sick need never be sacrificed for fear of their evil effects upon the air.

The discovery and elucidation of plant respiration was one of the most, if not the most, important contributions ever made to the science of plant physiology. It throws a flood of light upon metabolism, and in metabolism is locked up the secret of secrets, whose finding out is the ultimate problem of all biology, viz., the answer to the question, What is life? It is fitting, therefore, that we should know something of those masters of experimental investigation, to whose wonderful skill and untiring labors we are indebted for what is now known of the subject.

Since the process involves an understanding of the relation between plants and air, it is obvious that it could never be understood until the nature and properties of air were clearly comprehended. On this question we are all familiar with the fantastic notions of antiquity. Thales, of Miletus, had taught that all things were made from water, but Anaximenes, his fellow townsman, declared that everything is made of air. And, since it is the air that gives his life to man, it must be his very soul. From this it was justly inferred that the infinite air was God, and that it is the source of all the gods and goddesses.

Diogenes, of Apollonia, went a step farther, and said that the whole world is a living being. Air is not only the soul of man, but also the soul of the world. By an ingenious logic, he reasoned that air "knows much." "But that which has knowledge," said he, "is that which men call air; it is it that regulates and governs all, and hence it is the use of air to pervade all, and to dispose all, and to be in all, for there is nothing that has not part in it." * How surprised he would be to-day to find how near he came to expressing the truth! Since, said Diogenes, plants have no air cavities, and since they are wholly unintelligent, the intelligence of man is due to the flowing of air through his body in the blood.

* Draper, Intellect. Devel. Europe, p. 73. New York, 1870.

These early notions persisted for centuries and were slow to disappear, for when the early investigators discovered the component fluids of the air they called them ghosts. The term has persisted to this day, only we translate the German *Gahst* or *Geist*, by *gas*, and speak of the various *gases* of the air.

We are indebted to Van Helmont for the first experimental knowledge of the nature of air, and of the relation to it of plants He is one of the most peculiar figures which the history of science presents to us. Born (in 1577) in an epoch of transition, he formed, says Claude Bernard, the connecting link between the mystic savants of the middle ages and the modern experimentalists.

As many of his biographers recall, Van Helmont possessed concerning fire, air, gas, earth, and water knowledge well in advance of those of his time. He had a clear perception of aëriform fluids, and of their rôle in chemical phenomena. He first gave attention to organic chemistry, was the first to introduce the balance and computation into his researches, determined the nature of flame, and laid the foundation for the chemistry of air. It was he, moreover, who coined the word *gaz* or *gas*, and used it as it is understood to-day.

Chemistry and plant physiology are indebted to Van Helmont for an experiment that is very remarkable, considering the age in which it was made. This experiment consisted in effecting the combustion of 69 pounds of oak carbon. After the carbon had been consumed there remained only one pound of ashes. Van Helmont concluded that 68 pounds of carbon had been converted into an invisible air, which he called the *gas*, or spirit of the wood. It was he who discovered the property of this gas of turning lime-water milky. Subsequently he found it in fermentation vats, and in air that will not support respiration or combustion. It was the gas which to day we call carbon dioxide, the discovery of which is thus due to him. Van Helmont died in 1644. He was the last of the alchemists.

Notwithstanding the example of Van Helmont, the world was slow in adopting the experimental method. Scientists continued to discuss what they *thought* was so, or what ought to be so.

For this and other reasons we find scientific literature for the next hundred years, and even as late as the middle of the nineteenth century, burdened with a mass of misinformation, such as, for example, the notion that leaves are the lungs of plants, that they inhale by one surface and exhale by the other, that in breathing the inspiration was at night and the expiration at day.

One preconception that was a hindrance to progress was the idea that plants possessed a system of organs and functions analogous to those of animals. This thought is most fully elaborated in that strange poetical-scientific book, *The Botanic Garden*, published in 1791 by Erasmus Darwin, grandfather of the great evolutionist. "It is easy to conceive," says the author, how a peristaltic contraction produces the flow of sap in plants. "There is . . . a complete circulation in the leaf; a pulmonary vein receiving the blood from the extremities of each artery, on the upper side of the leaf, and joining again in the foot-stalk of the leaf, these veins produce so many arteries or aortas, which disperse the new blood over the new bark. . . . And I was induced to believe the existence of a venous system corresponding to the arterial one in the barks or roots of plants, as well as in their leaves and petals. . . . I think there can be no doubt that the leaves of trees are their lungs. . . . The circulation in the lungs or leaves of plants is very similar to that of fish."

So late as 1830 Brongniart described a circulation in plants analogous to that of the blood in animals.

It is easy enough for us to smile at these crude ideas, but I wonder what the scientific world will be saying of us one hundred years from now, or how broadly the audience will smile then as some lecturer quotes from the books we take so seriously, to emphasize how superior is the knowledge of his time over the hazy notions of 1906. The difference between the Darwin who died in 1802 and the one who was born in 1809, is not so much a difference of mental ability, as of mental inheritance. The pioneers of science have labored, we have reaped the benefits.

I must pass over the work of Black, who discovered that carbon dioxide is a constituent of the atmosphere, of Ray and Boyle, who discovered that seeds would not germinate in a vacuum, of

Saluce who "demonstrated" that air in which candles had burned out was vitiated by the heat, and could be restored by exposure to extreme cold, and of Hales, who, as late as 1769, taught that respired air was vitiated because it had lost its elasticity.

The scientific successor of Van Helmont was Joseph Priestley, preacher, historian, linguist, theologian, revolutionist, scientist. Born in 1773, he became pastor of the church at Needham at the age of twenty-five, but was forced to leave the place because of his Unitarian tendencies. He was versed, not only in Latin and Greek, but also in Hebrew, Arabic, Chaldee and Syriac. Among his writings one finds such titles as Theory of Languages, Oratory and Criticism, The Constitution and Laws of England, Matter and Spirit, Comparison of Heathen and Christian Philosophy, The Doctrine of Necessity, The French Revolution, On the American War. Laughed at in France for being a Christian, he was decried in his own country for being what many called an atheist. After being attacked by a mob which tore down his house in Birmingham, because of his sympathy with the French Revolution, he went to London, but could hardly secure lodgings there, as every one feared that the house in which he dwelt would be torn down. Shunned by members of the Royal Society, he took refuge in America, and made discoveries enough in science to make half a dozen men famous.

"The interrogation point," said DeCandolle, "is the key to all the sciences." With this key Priestley unlocked the door that led to the discovery which became the foundation of both chemistry and physiology, the discovery of oxygen gas. This discovery was celebrated at the grave of Priestley, in Northumberland, Pa., on August 1, 1875, as the starting point of modern chemistry. It was Priestley, also, who discovered the osmosis of gases through a bladder membrane. He rejected Van Helmont's term "gas," as being a needless introduction of a new term, and in its stead employed the word air in a generic sense.

The discovery of oxygen, in the year 1775, is described in his "Treatise on different kinds of air." Chemists in that day knew that the atmosphere contained "fixed air" (carbon dioxide), "phlogisticated air" (nitrogen), and "phlogiston," a term used then as many of our terms are used now, to cover up ignorance. Priestley furthermore recognized that all of these components were unfit to support respiration and combustion. They extinguished flame and life alike. What is it then, that makes burning and respiration possible?

He sought the answer to this question in nature herself. The method was that of experiment. In order to ascertain the effect of these different "airs," he placed in them small animals. He clearly showed that combustion, respiration, fermentation, and putrefaction all have a similar effect on the surrounding air. He became especially interested in trying to find out why the air never becomes permanently vitiated by respiration, and why animals do not suffocate, though a multitude of generations of living beings have worked for millions of years to vitiate the air by absorbing immense quantities of "dephlogisticated" air (oxygen), and returning oceans of "fixed air" (CO_2), and though the fixed air is continually supplied from flames, volcanoes, and other sources. The theory of Saluce, referred to above, was based upon the fact that cold prevents fermentation and putrefaction, while heat promotes them. Priestley resolved to test that theory by means of experiment. To that end he burned candles in an enclosed space, or let animals remain there until the air would no longer support combustion or respiration. This air was then exposed to the cold of a hard frost, but even then flames went out, and animals expired when placed in it. Thus the theory of Saluce was disproved, as well as another current theory that heat vitiated the air, for animals lived at ease in air that had been passed through hot tubes. What could the true explanation be? Again the question was put direct to nature. "It becomes," said Priestley, "a great object of philosophical inquiry, to ascertain what change is made in the constitution of the air by flames, and to discover what provision there is in nature for remedying the injury which the atmosphere receives by this means."

Priestley found that animals could not live in air in which a candle had burned out; he also demonstrated the converse, showing that a flame would not burn in air vitiated by the respiration of a mouse. We can hardly overestimate the importance of this experiment. It was the first experimental evidence of the similarity between combustion and respiration (confirmed later by Lavoisier), and marks the first step into the realm of physiological chemistry.

See now the unlocking power of the interrogation point. Do plants, said Priestley, behave as animals do? Can they live in an atmosphere where animals suffocate and flames go out? Then followed that famous experiment in which, after a mouse had suffocated under a bell-jar, and it was shown that another mouse expired instantly when introduced into the same jar, that a sprig of mint was placed in the same space. Not only did it not die, but it thrived with unusual vigor. Moreover the air after ten days, would enable a mouse to breathe with the greatest of ease. When later experiments of Priestley gave sometimes different results, and seemed to indicate that plants may also vitiate the air, he rejected these as "bad experiments," and accepted only the "good experiments."

See, in his own words, by how narrow a margin he missed the discovery of plant respiration. "I have found that a fresh cabbage leaf, put under a glass vessel filled with common air for the space of one night only, has so affected the air, that a candle would not burn in it the next morning, and yet the leaf had not acquired the smell of putrefaction." However he attributed the result to incipient putrefaction. It is a source of regret to us all to know that the discoverer of oxygen died in ignorance of the fact that it is concerned in plant respiration, or even that it had anything to do with combustion, for his last published writing was a lengthy and spirited defence of phlogiston, and a refutation of the theory that combustion is merely rapid oxidation.

Priestley is universally acknowledged as the discoverer of oxygen, but his claim rests partly upon priority of publication. Two years before the appearance of his treatise, the same discovery had been made in Germany by Karl Wilhelm Scheele, but no public announcement was made of it. Priestley had called oxygen dephlogisticated air; Scheele called it "fire air." He proceeded at once to find out all he could about it, and found, among other things, that germinating pea seeds convert it into what he called "aërial acid," his name for carbon dioxide. Thus, in a chemical laboratory, by a chemist, was made the discovery of plant respiration. These experiments were afterwards confirmed by Lavoisier, the father of modern chemistry.

In 1770, Jan Ingen-Housz, trying to straighten out the contradiction of Priestley's experiments, placed green plants in sunlight under water and showed that sunlight and leaf-green were both necessary for the evolution of oxygen, but he thought that the oxygen came from the water. Twelve years later Senebier proved that the oxygen came from the plant, and resulted from the carbon dioxide which the leaves had first taken from the water.

Finally, in 1821 and 1822, Théodore de Saussure established the fact that oxygen is indispensable to the life of the plant, and that all parts of the plant, in darkness as well as in light, take in oxygen and give off carbon dioxide.

The famous Liebig, in 1841, rejected the entire theory that plants respire, as based on "a weak and unstable foundation." He considered that the carbon dioxide given off at night was merely that taken in by the plant during the day, but not decomposed because of the absence of the sun's rays. To his great prominence and authority may doubtless be attributed the persistence, even to this day, of erroneous notions concerning plant respiration.

It was Garreau who, in 1851, insisted on the necessity of considering the two processes of respiration and photosynthesis separate and distinct, and this position was afterwards accepted by Sachs, and formulated into a general theory.

I have given only the barest outlines of this history. The battle raged long and fiercely over questions of fact and questions of priority. But, fortunately for the world, the settlement of scientific questions seldom, if ever, depends upon opinion or the majority vote. They are not matters of opinion, and not debatable, but must be settled by direct appeal to nature, through observation and experiment.

C. Stuart Gager.

LEAF BLIGHT OF THE PLANE-TREE.

The plane-trees in the Garden grounds have been seriously attacked this season by a fungous disease which causes the leaves and young twigs to die and change color as though scorched by fire. During the month of June the disease was at its height and the results most conspicuous. It is not confined to this locality, but occurs wherever the plane-tree grows, appearing each season about the time the first leaves are mature. Last year I observed it on the oriental plane in Italy, where the trees usually begin to recover from its attack about the middle of June. A late spring with damp weather is favorable to the growth of the fungus and induces an epidemic of the disease such as occurred here this season.

The fungus (*Gloeosporium nervisequum* Sacc.) was first described by Levéillé in 1848, but was not recognized in this country until nearly forty years afterwards. Three species of plane-tree are subject to its attack: *Platanus occidentalis* and *Platanus racemosa* of North America, and *Platanus orientalis* of the Old World. The active vegetative portion (mycelium) of the fungus lives within the leaves and twigs; the fruiting portion appears in brown patches on the twigs or veins of leaves that have been killed. If one of these brown patches is examined with a lens, a number of dark dots will be found; these dots are small pustules containing numerous minute, colorless, egg-shaped spores, which when mature are distributed broadcast by the wind and communicate the disease to other plane-trees.

The effects of the fungus are usually not lasting except in the case of trees already weakened by disease or starvation. The plane-trees are rendered unsightly for a few weeks, then new foliage appears, and by midsummer all traces of the disease have disappeared. It often happens, also, that many of the branches, especially those near the top of the tree, remain entirely untouched and are able to tide the tree over the period of attack with very little loss.

Not so, however, during a season like the present one, when every tree, in all its branches, appears to be infested with an exceedingly active form of the disease. Leaves, petioles and young twigs have rapidly succumbed to its attacks and young branches

FIG. 21. Western plane-tree, *Platanus occidentalis*, in the Garden ground attacked by leaf blight.

two or three feet long have been found entirely killed by girdling. The dormant buds that develop later will find little nourishment at hand and a short season for growth and preparation for another year; the number of branches already dead will doubtless be considerably increased by the ravages of the winter's cold among unseasoned twigs; and another spring will probably find the plane-trees much less able to cope with the fungus than they were this year. On the other hand, fortunately, the trees will probably have several years to recuperate before another epidemic appears like the present one.

No treatment of the disease can be suggested. Spraying is out of the question because of the immense size of the tree and because the fungus lives within the leaves and twigs and cannot be reached by the spraying solution. It is always desirable to see that the general health of the trees is good and that all dead wood that can be easily reached is removed.

The plane-tree is of little use except for shade. The wood is coarse-grained, difficult to smooth and cannot be split. Of the

FIG. 22. Twigs from the tree shown in Fig. 21. Most of the leaves are attacked.

three North American species, *Platanus occidentalis* is by far the best known. It is one of our very largest trees, occurring in river-bottoms as far north as Massachusetts, and often growing to the height of 100 feet. The oriental plane-tree, *Platanus orien-*

talis, is often met with in cultivation, especially in cities. It differs from our native species chiefly in having smaller and more deeply cut leaves and usually somewhat clustered fruit. It is a native of western Asia and was brought to Europe by the Romans, who, with the Persians and the Greeks, held it in great veneration, planting groves of it and using it for shade about their homes and shrines. The Persian fire-worshippers often held their feasts beneath this tree, as the Druids were accustomed to do beneath the oaks in the forests of northern Europe.

The plane-tree is an excellent shade producer, the leaves appearing at the proper time in this latitude and remaining on the tree as long as could be desired, when they give place to the persistent and graceful fruit. With a little protection it passes the northern winters uninjured and develops rapidly into a splendid and shapely tree large enough for the widest avenues or capable of being adapted by pruning, to which it most readily submits, to very narrow streets. Such is the activity of its young wood and bark that the stem is at times completely girdled without appreciable injury, and the outer layers of its cortex are annually sloughed off during late summer and autumn, leaving the new layers beneath entirely free from soot and dirt accumulated during the summer. It is partly due to this, perhaps, that it enjoys with the *Ailanthus* the distinction of being best adapted to parts of cities where smoke and dust abound.

Plane-trees are comparatively free from either insect or fungous pests, with the exception of the leaf blight. The annual sloughing of the bark is considered by some a drawback to its use on city streets; its foliage is rather late for southern latitudes, but often persists in a healthy condition after that of other trees has succumbed to heat and dust. In some cities of southern Europe complaint is made of the thick hairy covering which becomes detached from the young leaves and twigs and gets into the nose and mouth, producing an inflammation known as "Platanus cough." This tree is, however, most widely and abundantly planted in the cities of India, Persia and Europe, while in America it is deservedly growing more popular as a street tree every year. In London it is considered by many to be the only tree that will thrive in the dirt and smoke of so large a city.

Of the two common species of plane-tree, the eastern is smaller and of closer growth than our native species, though less hardy and less beautiful in form. It was for some time thought, also, that the eastern species was less subject to attack by the leaf blight, but this is probably not the case. In this country the oriental plane-tree is usually preferred, while in Paris the western species is used exclusively, since it seems to conform better to the style of pruning adopted in that city.

W. A. MURRILL.

AN ATTRACTIVE PHILIPPINE SHRUB IN FLOWER.

The shrub from which the accompanying illustration was made has been referred to before in the pages of this Journal. Always beautiful at its flowering period, it has surpassed its former efforts in the magnificence of its display for the past few weeks. This

FIG. 23. An attractive Philippine shrub, *Medinilla magnifica*, in flower in the conservatories of the Garden. This specimen has a spread of twelve feet and a height of seven feet.

shrub, *Medinilla magnifica*, may be seen in the conservatories on the north side of house no. 4, not far from the large plant of *Anthurium Veitchii*. It was originally secured as a small plant through an exchange with Fairmount Park, Philadelphia, in 1900.

The accompanying illustration, in which over fifty flower clusters may be counted, gives no idea of its rich coloring. The leaves are of a deep green, which color serves to intensify the bright pink of the flower clusters, which are sometimes a foot and a half long. Not only the flowers themselves are pink, but the rachis of the cluster and the large bracts are of the same color. It is frequently found in cultivation, but is not often seen so large as this. The plant is well worth a place in any collection, for it is not difficult to grow and flowers often when only two or three feet tall, although to see it in its greatest beauty it should have attained something like the dimensions of this specimen at the garden, which has a spread of about twelve feet and a height of seven feet.

This species was first brought to the attention of horticulturists by the Messrs. Veitch, a famous English firm. It was exhibited by them at the spring meeting of the Royal Horticultural Society in 1850, where it was awarded a large medal, under the name of *M. bracteata*, a Javan species, an error which perhaps gave rise to the statement made in the original publication that the plant was a native of Java. This was later corrected by Hooker, who gave the correct locality as Manila, where it was discovered about 1847 by Mr. Thomas Lobb, a collector sent out by the Messrs. Veitch.

Mr. R. S. Williams, who has spent considerable time in the Philippines collecting plants for the Garden, says that he found it occurring not infrequently in north central Luzon, especially in the neighborhood of Baguio, province of Benguet, where it thrives on the sides of moist shady ravines at an elevation of about 5,000 feet. He describes the shrub as of a straggling habit, broader than high, with a diameter sometimes of twenty feet and a height of eight to ten feet. The specimen in the conservatories, although not so large as this, fits well the above general description, so it may be taken as a characteristic example

of this showy shrub in its native home. Mr. Williams secured no specimens of this plant except at Baguio. It has, however, been found by other collectors in the vicinity of the Baco River, in the northern end of the island of Mindoro, about three hundred miles to the south. Its present known range may therefore be taken as indicated above. Data would seem to indicate that in its southern station it grows at a lower elevation than in its more northern home.
GEORGE V. NASH.

A COLLECTION OF FOSSIL GUMS.

The Garden has recently acquired an interesting and valuable collection of fossil gums or resins, donated by the firm of G. W.

FIG 24 A mass of yellow Kauri, from New Zealand, 17 in. in diameter and weighing 29 lbs.

S. Patterson & Co., 81 Pine St., New York. The specimens include a number of large single masses and several boxes of smaller fragments, all of them representing material utilized in the manufacture of varnish. The largest single piece, weighing about twenty-nine pounds, is shown in Fig. 24, and smaller pieces in Fig. 25.

Such gums are generally known under the rather loosely applied trade names of gum Animé, Copal, Dammar resin and Kauri or Cowrie. They are all natural products of species of trees now living, but the only material used in making varnish is obtained from the ground, in a semi-fossilized condition at the bases of the trees, or in localities where the trees are now extinct.[1]

The Kauries are derived from species of the coniferous genus *Dammara* or *Agathis*; the Copals are for the most part products of leguminous species belonging to the genera *Trachylobium* and

FIG. 25. On the left, a mass of brown Manila copal from Borneo, 8 in. high; in the center, yellow Kauri from New Zealand, 10 in. in diameter; on the right, black Kauri from New Zealand, 8 in. high.

Hymenaea, while the so-called "black-dammar resin" is derived from the burseraceous species *Canarium strictum* Roxb., and the "white dammar" from the dipterocarpaceous species *Vateria Indica* L.

Among the varieties represented in the collection are yellow

[1] A discussion of this subject from a commercial standpoint may be found in the National Standard Dispensatory, pp. 1306–1308. 1905.

and brown Kauri from New Zealand (*Dammara* (*Agathis*) *australis* Salisb.), Dammar resin from Java (*D. orientalis* Lamb.), Copal or gum Animé from Zanzibar (*Trachylobium Hornemannianum* Hayne), white dammar or Manila copal from Borneo (*Vateria Indica* L.), and Brazilian Copal (*Hymenaea Courbaril* L.).

None of the living trees produces such quantities of gum as are frequently represented in these fossil masses and the reason for this extraordinary production in the past has never been satisfactorily explained. Apparently certain conditions favoring the secretion of gum must have prevailed which were different from those of more recent and modern times.

ARTHUR HOLLICK.

NOTES, NEWS AND COMMENT.

Dr. J. A. Shafer and Dr. M. A. Howe represented the Garden at the second annual meeting of the American Association of Museums held at Pittsburg, June 4 to 6.

Dr. W. C. Coker, Associate Professor of Botany at the University of North Carolina, was engaged in cytological research at the Garden during the greater part of July.

Dr. J. E. Kirkwood has recently been promoted to a professorship of botany in Syracuse University, and the botanical work there is now recognized as an independent department of the university instruction.

Dr. M. A. Howe attended the summer meeting of the Vermont Botanical Club at Pownal, Vermont, July 2 and 3. Pownal is in the extreme southwestern part of the state and is celebrated as a botanical collecting ground.

Professor F. S. Earle, formerly in charge of the mycological collections at the Garden and later director of the Cuban Agricultural Experiment Station, is spending several weeks here, continuing his investigations of the gill-fungi.

Dr. N. L. Britton represented the Garden at the fourth annual field Botanical Symposium, held at Newton, New Jersey, July 1 to 8. The region about Swartswood Lake is of great interest botanically and was formerly one of Dr. Britton's favorite collecting grounds.

Dr. Arthur Hollick, Curator, delivered an address at the opening exercises of the St. George branch of the New York public library at Central avenue and Hyatt street, Staten Island, June 26. He also participated in the commencement exercises of Curtis High School on June 27.

Mr. Guy West Wilson (M. S., Purdue University, 1906), who during the past year has been engaged in mycological studies at the Garden, has been appointed professor of biology in the Upper Iowa University at Fayette, Iowa, and expects to begin work there next autumn.

Mr. Fred J. Seaver, university fellow in botany in Columbia University during 1906–'07, has been appointed assistant professor of botany in the North Dakota Agricultural College and assistant botanist of the agricultural experiment station at Fargo, North Dakota.

Miss Winifred Josephine Robinson, Instructor in Biology at Vassar College, has been granted a leave of absence for one year. During this time Miss Robinson will act as Laboratory Assistant at the Garden, and continue her investigations on the taxonomy of the ferns of the Sandwich Islands, the life history of the filmy ferns, and the nutrition of the pitcher-plants (*Sarracenia*).

Professor M. A. Barber, of the University of Kansas, Professor W. L. Bray, of the University of Texas, Professor F. E. Lloyd, of the Arizona Agricultural Experiment Station, Professor F. L. Stevens, of the North Carolina Agricultural and Mechanical College, and Messrs. Hermann Schmidt and Louis Weiss, explorers of the valley of the Amazon, were among recent visitors at the Garden.

Meteorology for June. — The total precipitation recorded for

June was 3.85 inches. The heaviest rainfall (1.88 in.) occurred on June 29–30. Maximum temperatures were recorded of 76° on the 9th; 87° on the 16th; 90° on the 22d; and 91.5° on the 26th; also minimum temperatures of 42° on the 1st and 13th; 44° on the 4th; 59° on the 20th; and 57° on the 28th. The mean temperature for the month was 66.75°.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

8 specimens of mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

15 museum specimens from Montserrat. (Collected by Dr. J. A. Shafer.)

25 specimens of marine algae from the East Indies. (By exchange with Mrs. A. Weber-van Bosse.)

25 specimens of fleshy fungi from Vermont. (Collected by Miss Gertrude S. Burlingham.)

3 herbarium specimens from Canada. (Given by Brother Louis Arsene.)

520 specimens from Egypt. (By exchange with the Botanical Garden, Zurich, Switzerland.)

300 specimens "Plantae Mexicanae." (Collected by Mr. C. G. Pringle.)

10 museum specimens of fossil Kauri, Copal, and Dammar. (Given by Messrs. G. W. Patterson & Company.)

2 specimens of mosses from Massachusetts. (Given by Miss Cora H. Clarke.)

25 specimens, "Ustilagineae" Fascicle 8. (Distributed by H. and P. Sydow.)

4 specimens of *Pinus* from Miami, Florida. (By exchange with the Subtropical Laboratory, Miami, Fla.)

1,667 specimens from the Philippines. (By exchange with the Bureau of Science, Manila.)

1,854 specimens from Colombia. (Collected by Consul Lehmann.)

49 specimens of lichens from Jamaica. (Collected by Professor Duncan S. Johnson.)

PLANTS AND SEEDS.

3 plants for nursery. (Given by Dr. A. Endy.)

1 plant for conservatories. (By exchange with Mr. F. Weinberg.)

88 plants from Panama for conservatories. (Purchased from Mr. Otto Munch.)

1 plant for herbaceous garden. (Collected by Dr. J. A. Shafer.)

30 plants for nursery. (Given by Mrs. Dyer.)

9 plants for conservatories. (By exchange with the U. S. National Museum, through Dr. J N. Rose.)

5 plants for nursery. (Given by Mr. O. E. Jennings.)

4 plants for herbaceous garden. (Given by Mr. Quercus Shafer.)

1 plant for herbaceous garden. (Collected by Mr. R. C. Benedict.)

49 plants derived from seed from various scources.

23 plants for herbaceous garden. (Collected by Mr. Norman Taylor.)

2 plants for herbaceous garden. (Given by Miss D. W. Marble.)

6 plants for conservatories. (By exchange with Subtropical Laboratory, Miami, Florida.)

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Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

Vol. 7, part 1, issued Oct. 4, 1906, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by Professor G. P. Clinton.

Vol. 7, part 2, issued March 6, 1907, contains descriptions of the families Coleosporiaceae, Uredinaceae and Aecidiaceae (pars), by Professor J. C. Arthur.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII AUGUST, 1907 No. 92

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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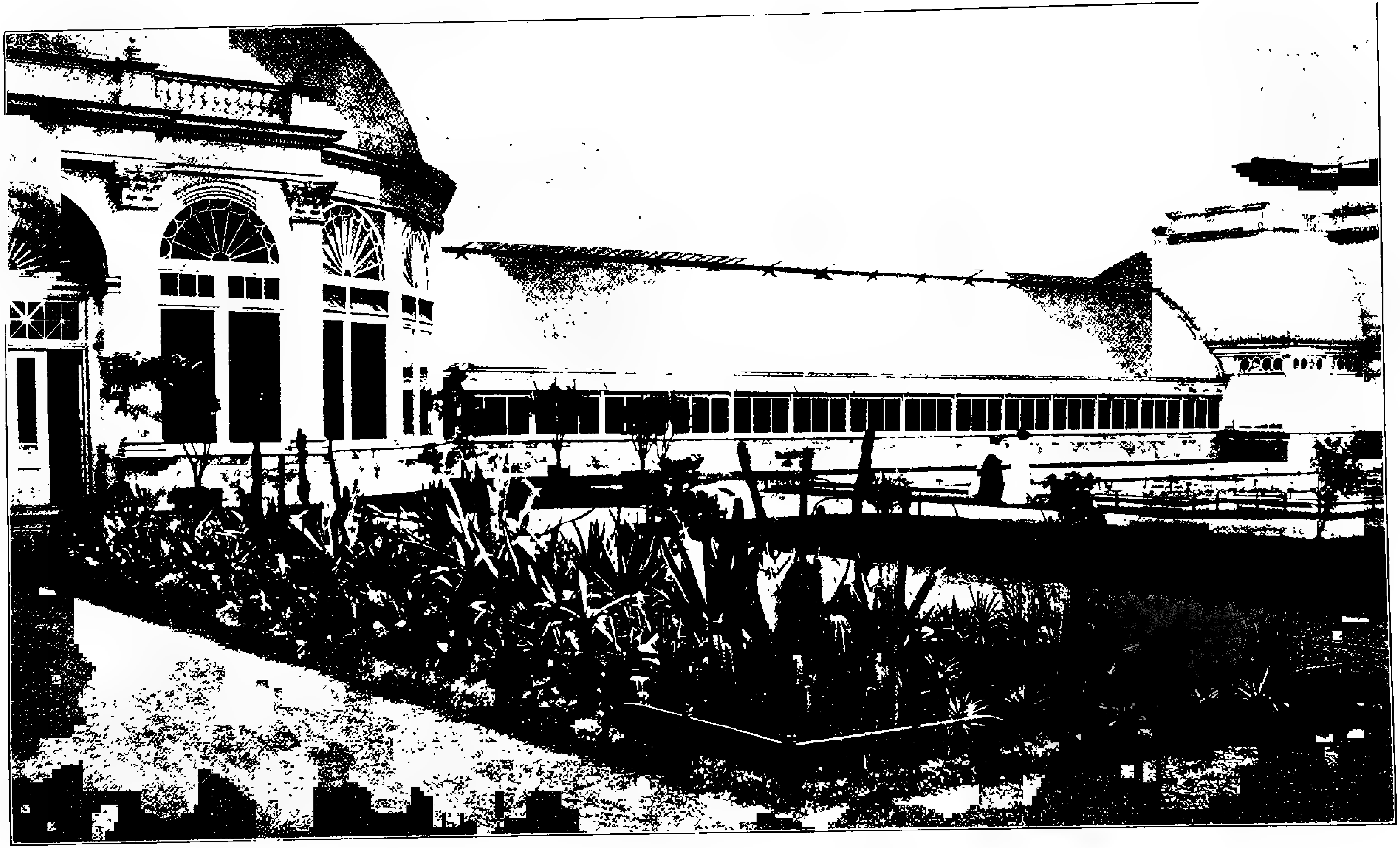


AMERICAN DESERT PLANTS IN THE CONSERVATORY COURT.

JOURNAL

OF

The New York Botanical Garden

Vol. VIII. August, 1907. No. 92.

A COLLECTION OF AMERICAN DESERT PLANTS.

In many parts of the world, wherever local conditions are such as to result in a small precipitation, dry arid regions, known as deserts, occur. In America there are many of these. One of them extends from our own southwestern country down through parts of Central America, including the vast region of Lower California. Many of the islands of the Bahamas, as well as many parts of the West Indies, are of this desert character. In South America large desert areas occur on the western slopes of the Andes.

It has been our aim in the past few years to bring together here at the Garden as large a collection as possible of living plants from these arid areas, especially from those of North America. The result has been a collection of desert plants second to none in the country — a collection especially rich in the cactus and orpine families — and it is from this collection that the plants have been selected which fill the large bed in the court of the conservatories. These form only a portion of the entire collection. Many other plants will be found in houses no. 5 and 6 in the conservatories, and a large study collection is grouped in the propagating houses. Many other desert plants from other parts of the world may also be seen in the conservatory houses referred to above. In the court of the conservatories, however, only such plants are to be seen as have originated in the American deserts.

Deserts, or regions subject to long periods of drought and at the best having but a small rainfall, have a vegetation all their own, and the plants which go to make this up are provided with various means by which they can live through these long dry spells. Plants as ordinarily constructed could not survive the extreme conditions which the desert plant is called upon to meet. The perpetuity of such species is insured in a number of ways. In the first place, a great many of the desert plants are annuals, that is, the plant dies, root and stem, after completing its life cycle, depending for the continuance of its kind upon seeds, which it usually makes in great abundance. These seeds lie dormant in the ground until favorable seasons of moisture arrive, when they germinate and make the desert look like a flower garden. This method, of course, is not peculiar to desert plants, but it is one means by which they are perpetuated.

It is, however, among the perennial plants, those which live for several years, that the adaptive methods which make up the characteristics of the desert plants and give to many of them their odd and queer forms are most conspicuous. A glance at this collection of plants in the conservatory court will show how different from most plants they appear. Various methods are resorted to in order to accomplish the same essential end, the storage of nutriment and water to carry them over the drought. Some have the stem much enlarged at the base, as in the huariqui, *Ibervillea Sonorae*, of Sonora. A specimen of this queer member of the watermelon family will be found in house no. 6 of the conservatories. These large bodies lie around in the desert like large knots of wood, with apparently no life in them, but when the rains come they start into growth and send up long green stems which blossom and bear fruit. When the fruit is mature, the stems die down and the plant assumes its dormant condition until the next rainy season. In some cases, as in certain cacti, tubers are made in the ground, which serve the same purpose. In others, the stems and branches, or both, are enlarged and fleshy, and serve as storage organs. This latter condition is found largely in the cactus family. In the hedgehog cactus, *Echinocactus*, it is the stem that is greatly enlarged, often forming globose or cylindric bodies, a foot or more through and several feet high. The capacity of such plants to store water is often taken advantage of by the Indians who inhabit the region where these plants grow. Selecting a large-sized specimen, the thirsty Indian cuts off the top, macerates the pulp within, and squeezes it and drinks the water which it contains. In other plants of the cactus family the stems and branches are composed of flat or cylindric joints, which serve the same purpose. This is especially the case in the genus *Opuntia*, to which the prickly pears belong. Here the large flat joints are often referred to as leaves. This is not true, however, the real leaves being usually very small and inconspicuous. They are to be found on the young shoots only and soon drop away. The stems and branches in these plants act not only as storage organs but also perform the functions of leaves.

In the century plants, which belong to the genus *Agave*, of which many representatives will be found in the center of the bed, the leaves become thick and fleshy and serve as storage organs. This sometimes leads to the plant's own undoing, as man, taking advantage of this storing capacity of the plant, deprives it of its sap, which he manufactures into an intoxicating drink. This is particularly true in Mexico, where century plants are very common; several species are used by the Mexicans in the manufacture of "pulque." Some of the century plants also yield a fiber which is of great value. Sisal hemp, an example of this, is manufactured from the fiber of the sisal plant, *Agave rigida*, which is cultivated in many tropical regions for this purpose. In the orpine family, also, it is the leaves which act as storage organs. A number of species of *Echeveria* and related genera will be found in the bed. In the genera *Dasylirion* and *Beaucarnea* it is the much-enlarged base of the plant which acts as a storage organ.

In all of these plants which have a perennial stem, whether it be the leaves or the stems which are of primary importance to the plant, it will be noted that the epidermis, or outer layer, is so constructed as to prevent the free transpiration of water, thus protecting the plant from the extreme evaporation which would result in the hot sun of the desert — a drain which the plant could not supply from its scanty water supply.

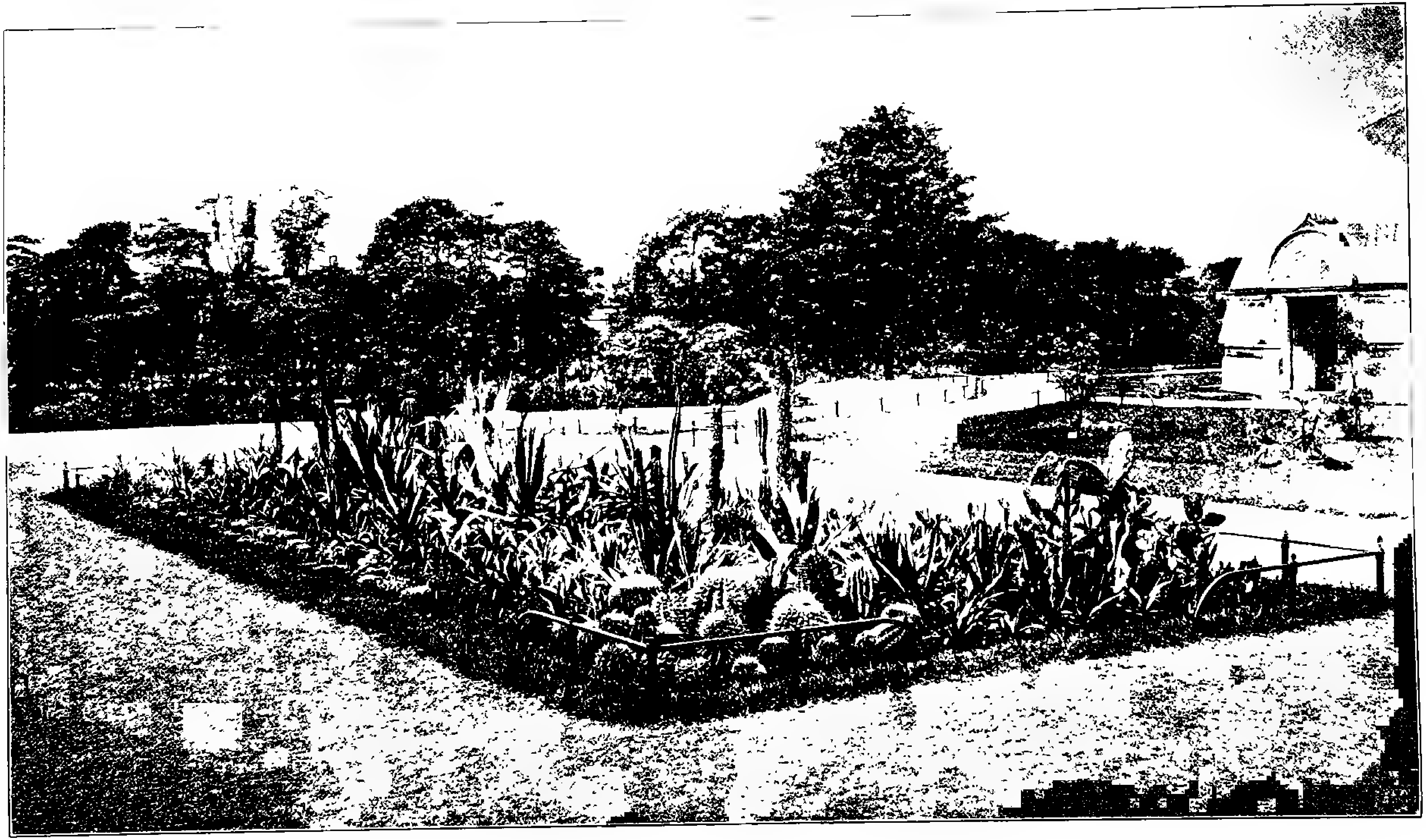


FIG. 26. A collection of American desert plants.

The bed containing this collection of American desert plants is fifty-nine feet long and eighteen feet six inches wide. It contains about five hundred and sixty plants, representing seven families and about two hundred species. The families are arranged as follows: the amaryllis family, to which belong the century plants and furcraeas, is confined mainly to the center of the bed, the furcraeas running out to the border on the northern end. In the center of the bed are a few of the tall columnar cactuses, represented by the genus *Cereus*. A group of these, as well as some species of the genus *Pilocereus*, a closely related group, will be found in the southwestern corner. Conspicuous among these are the saguaro, *Cereus giganteus*, and the rare *Cereus Pringlei*. The western side of the bed is devoted to a group of the prickly pears, the genus *Opuntia*, in both the cylindric and flat-stemmed types. In the northwestern corner are a number of plants of the hedge-hog cactus, *Echinocactus*, already referred to. Here also will be found plants of the turk's-head cactus, *Melocactus*, on two of which will be found the dark-red spiny cap, which gives to the plant its popular name. It is from this portion of the plant that the flowers and fruits appear. On the eastern side of the bed are the members of the orpine family. In the southeastern corner are the members of the lily family, represented by the genera *Yucca*, the Spanish bayonet, *Dasylirion*, *Beaucarnea* and *Hesperaloe*. Near by, in the southern end, will be found a single large plant of the genus *Fouquieria*, which contains five or six species, all American. A small specimen of the desert palm, *Neowashingtonia filifera*, also finds a place here. Two much larger specimens of the same genus, *Neowashingtonia robusta*, will be found in house no. 13, on the north side. The pine-apple family is represented by a plant of the genus *Dyckia*.

GEORGE V. NASH.

AN OLD LOCUST POST.

Not far from the eastern boundary of the Garden there is a neglected family burying-ground about one hundred and fifty years old, formerly enclosed by a fence, the posts of which were made of black locust. A single post about four inches thick and a yard high is all that now remains of the fence, and this doubtless owes its preservation to a wild black cherry tree with a forked trunk which has grown from a seed dropped at its base by a passing bird and has for some years enclosed the post and effectually protected it from mechanical injury. This tree is now fifteen feet in circumference at the base and the larger fork is nearly three feet thick, indicating an age of from sixty to a hundred years. During all these years the post has been exposed to the elements, but is still fairly well preserved and will probably last for many years to come.

The black locust, *Robinia Pseudacacia* L., grows naturally from Georgia north to Pennsylvania and west to Iowa, and has been extensively planted and naturalized far beyond its original boundaries. It is abundant about New York City, some of the trees being very old. Early in the seventeenth century it was introduced into Paris by Jean Robin, herbalist of the King, from seeds gathered in Virginia; and in 1636 Vespasien Robin planted a single specimen of it in the Jardin du Roi, which is still alive. In 1753 Linnaeus assigned to this tree the name *Robinia*, in honor of Jean Robin and his son.

There are four species of *Robinia* in the United States, three of which are trees and one a shrub. They are all ornamental, being cultivated for their foliage and flowers. *Robinia Pseudacacia*, the most abundant and best known species, has probably been planted more extensively both in this country and in Europe than any other North American tree. Its foliage is light and graceful, and its conspicuous clusters of flowers, which appear in May and June, are both showy and fragrant. Over thirty ornamental varieties are known.

This species also furnishes an exceeding valuable wood, which is hard, heavy, close-grained, and very durable. It is used for posts, treenails, clubs, bows, fuel, the construction of houses, shipbuilding, street-paving, etc. The durability of its wood is remarkable. The post mentioned above is a proof of this, and many other similar cases might be cited. It is said on good authority that the locust posts used by the early Virginia colonists in the construction of their first rude huts were still standing in a fair degree of preservation a hundred years after they were placed in the ground.

As a shade tree, the black locust is successfully cultivated on the streets of Paris, where the top is kept small and spherical and the branches thickly clustered; in this country, however, it cannot be recommended for shade. It is a rapid grower, hardy, easily propagated and transplanted, and does well in poor soil; but is angular and scraggly in form, with brittle branches, short-lived foliage, unsightly pods, and troublesome sprouting roots; and, moreover, it is often seriously attacked by insects and fungous pests.

The chief enemy of the locust is the locust borer, *Cyllene Robiniae* Forster. This insect riddles the trunk and not only kills the tree but renders the wood unfit for use except for fuel. Another enemy of the black locust is a bracket-fungus, *Pyropolyporus Robiniae* Murrill, the large brown fruit-bodies of which may often be seen in great numbers on the trunks of old locust trees throughout the southern states and as far north as Connecticut. Several insects and fungi attack the foliage of the locust, but the damage they do is usually insignificant compared with that done by the borer and the bracket-fungus mentioned.

W. A. MURRILL.

SOME LITTLE KNOWN EDIBLE NATIVE FRUITS OF THE UNITED STATES.*

There is probably no other center of population in the world where the variety and abundance of fruit is so great as in New York, nor where the supply represents such an elaborate series of systems of production, transportation, storage, and wondrous horticultural arts by which our new varieties are originated and developed. Our citizens may be regarded as epicures in these products. Not only have we at all seasons a liberal variety of fruits to select from, but we have learned to be content with nothing less than the choicest varieties of each.

It is somewhat difficult for such people to even imagine conditions which are easily recalled by those of us who are able to

* From a lecture delivered at the New York Botanical Garden, June 1, 1907.

FIG. 27. An old locust post in the center of a large wild black cherry tree.

look back to a childhood of half a century or so ago, when many of our staple fruits were absolutely unknown in the markets, and when the varieties of those then staple were few and so poor that the best of them would now scarcely find a sale. There were seasons when such common things as apples, oranges and lemons were absolutely unobtainable. The banana came occasionally, to the extent of a few bunches, and might be had at the rate of ten or fifteen cents each, and its tropical associates, now so common, were known only through the accounts of travellers. Many of our present small fruits were either known only in the wild state, or were cultivated merely for a domestic supply. There was no regular trade in them, though the accidental surplus was often marketed, yet as often allowed to go to waste. When we endeavor to picture these conditions to our pampered children, we find it like trying to picture hunger and thirst to one who never experienced them.

It is almost equally difficult for us to realize the relatively worse conditions which faced our early settlers and constituted the *status naturae* of the aborigines. They knew practically nothing of improvements under cultivation, and but little of preserving methods, yet they depended upon the fruit supply, not for their luxuries merely, but to eke out the quantity of food necessary for actual existence. We can, however, readily understand that it would be necessary for a people so circumstanced to eat many things which we would, at first thought, regard as unfit for human food. It is of this class of fruits, particularly, that I wish to speak to-day. The subject is perhaps of more than mere historical interest. Some of these fruits have been pronounced by expert and learned judges to be worthy of a place among our modern supplies, and amenable to great improvement by modern methods of treatment.

We shall first consider a group of fruits of a peculiarly acid character, giving them a semi-medicinal value as antiscorbutics or correctives in addition to that of ordinary fruits. The type of this class is the cranberry, the cultivation of which, scarcely known in my boyhood, is now one of our important agricultural industries. The small cranberry (*Oxycoccus Oxycoccus*) is but little known in this locality, being a plant of northern bogs. The slender stems run through the sphagnum, and the berries, about half as large as those of the cultivated species, lie, usually singly, partly concealed in the moss. These berries are largely collected by the Indians, and are marketed by them in many northern towns. They are very sour, but are preferred by some persons to the common cranberry.

Two fruits are commonly known as "mountain cranberry," one in the southern Alleghenies, the other in nearly all far northern localities and southward in high mountains. Both grow on small erect shrubs instead of on creeping stems like our cranberries. The former is, however, classed as a cranberry (*O. erythrocarpus*). Small is probably correct in maintaining it as a distinct genus, under the name *Hugeria*. Its fruit is small, red to purple, and sour, and is not largely eaten. The other is the well-known mountain cranberry of Europe (*Vaccinium Vitis-Idaea*). It is very largely used, and is a commercial article. It is classed with the blueberries. Its fruits resemble those of the smaller cranberry in size, but are of a deeper red. When fresh they are slightly bitter, but lose this flavor when properly cooked.

Although the discussion of such well-known fruits as blueberries and huckleberries is out of place in this lecture, two members of the group call for special mention. Every berry-gatherer is familiar with a fruit known to country-people as "poison huckleberry," or "green huckleberry." In the books it is mostly called deerberry. We used to know the plant as *Vaccinium stamineum*, but it is now quite properly kept apart from that genus as a *Polycodium*. Contrary to popular belief, there is nothing poisonous about these fruits, which were very generally used by the aborigines. They are not palatable like the blueberry, being sour and slightly bitter, but may be cooked like the mountain cranberry. The other is the so-called southern or mountain gooseberry, of the southern Alleghenies. It is described as especially valuable for cooking and more ought to be known concerning it. Even its botanical identity is in question, though it is probably *Polycodium melanocarpum*.

The two remaining fruits of the cranberry group are not even distantly related botanically with the preceding species. The high bush cranberry (*Viburnum Opulus*) is a close relative of the black haw or nannyberry (*V. prunifolium* and *V. Lentago*). The latter are also sometimes eaten, but are dry, of weak flavor, and palatable only after the action of severe frosts ; while the former, the cultivated form of which is our snow-ball shrub, is juicy and acid, and a fair substitute for the cranberry. It inhabits the northern part of the north temperate zone, the world around. Not only was it an article of the aboriginal cuisine but it is still eaten by country-people in northern North America and even gets occasionally into their markets. The fruit of *V. alnifolium* is of very similar appearance but I cannot be certain that it is eaten.

To our ancestors the barberry was the ante-type of our present cranberry, being largely cultivated for its fruit, strongly acid, and of a peculiar flavor, which the cranberry, good as it is, cannot approach. It is probably due to its smaller size and "seedy" character that its use has been so largely abandoned. Nevertheless it has not yet altogether lost caste. Only very recently an old-fashioned friend has informed me that she never fails to procure a supply of this fruit for making a winter preserve that she and her favored acquaintances regard as unequalled.

Very similar to the cranberries, in nature and value, were the native crabapples of this country. The cultivated crabs, though sour enough in the unripe state, have had their acidity much mitigated by cultivation. In their natural condition they were extremely acid, but were stewed and used, not only by the Indians but by generations of settlers, as we use cranberries and pie-plant, as much for their wholesomeness as for their palatability. One of the most valuable properties of this fruit was its permanence after being cooked when unripe, without the addition of sugar. In the northern parts of our southern states these trees were very abundant, often forming dense thickets, like the wild plum. Four native species of this genus (*Malus*) are recognized.

In the arid regions of the west and especially in the far northwest, a substitute for the crabapple is found in the large fruits of some species of rose, notably *R. Nutkaensis.* These fruits are far less acid and more sugary than the crabs, and the "apple" sauce and pies made from them are of the utmost importance to the Alaskans. It is a long step, both botanically and geographically from these to the "apple pies" of the far southwest, made from the Mexican banana, the fruit of the Spanish bayonet (*Yucca baccata*), a plant of the lily family. It is not difficult for any of you to picture this plant in your imagination. Think of the common Yucca of our gardens twice enlarged and much stouter, with leaves ending in spines so stout and sharp that a falling horseman may be impaled upon them, and bearing upon its flower stalk several fruits much resembling in form a stout banana. Between the inner seed capsule and the skin there is a pulp from a quarter to a half inch thick which, when sliced off, may be made into a pie resembling an apple pie of rather weak flavor.

Not all of the fruits used under the name crabapple pertain to the genus *Malus.* The thorn-apple, produced by the enormous genus *Crataegus*, has probably been much more largely used than is known. These fruits are very inferior to the crabs, being dry and of a weak flavor, with a slightly mucilaginous consistency. Nevertheless, the best of them occasionally find their way into the market, and several species have been considerably improved by cultivation. One species is the commonly cultivated "crab-apple" of the city of Mexico and its environs.

The gooseberries and currants, of similar nature to the fruits already considered, can scarcely be classed as little known, yet it will surprise most persons to learn that we have some sixty species of these plants growing wild in the United States, and that in many localities they occur in masses, producing large quantities of delicious fruit. Of the currants, probably the most used sort is the yellow-flowered, tall species, eight to twelve feet high (*Ribes tenuiflorum*), of the southwest. Its fruit is said to be equal to the currants of cultivation. In the northwest occurs a species that produces heavy fruit-racemes six inches or more in length. Of gooseberries, we have two series, one with smooth, the other with prickly fruit. In general, the latter are of richer flavor and would be preferred but for their forbidding exterior and their very thick skins. Like the currants, they are of various shades of green, yellow and red. It may be remarked that several species of the Rocky Mountains (*R. cereum*, *R. inebrians*, etc.) are narcotic poisons.

One of the least known, yet, to the taste of the speaker at least, one of the most delicious of our native small fruits, is the Buffalo berry (*Lepargyraea argentea*). The plant, in many parts of the northwest, and fortunately in partially arid regions, covers square miles of ground, to the exclusion of most else. It produces its one-seeded oblong berries, as large as huckleberries, greenish or pinkish with purple blotches, in the densest profusion. The Indians spread skins beneath the bushes and shake the fruits off by the bushel. During the season they almost live upon them, and they dry great quantities for winter use. The flesh is juicy, sweet and acid, and its flavor may be compared with that of a rich and sweet lemonade. They are prepared in many ways, some of which involve the crushing up of the seed with the pulp. The seed is soft, of not unpleasant flavor, and apparently fatty and nutritious. There are many species of this genus in the northern hemisphere, and a number, even of those cultivated as ornamental shrubs, are delicious. They exhibit a considerable variety of acidity, sweetness and flavor. A related and similar, though larger, fruit is the silverberry (*Eleagnus argentea*), which extends farther north.

Closely related to the crabapples and thorn-apples, but of totally different character from any of the fruits so far considered, are the service-berries, also called June-berries, sugar-berries, shad-berries, and by various other local names. They pertain to the genus *Amelanchier*, now recognized as containing about twenty species. These fruits have the structure of the apple and pear, but the core is thin and soft, so that the entire fruit can be eaten, like a blueberry. The specific determinations of these plants are so obscure that one hesitates to use their botanical names. The one most largely used is the Canadian service-berry (*Amelanchier Canadensis* and probably one or more closely related species). It is a large shrub, and often becomes a small tree. Its fruits are eaten in almost every conceivable form. One of their most important uses is that of being pounded up with chopped meat and the mass frozen for winter use, the "Pemmican" of the Canadians. In the northwest occurs a similar group (*A. alnifolius*, *A. Cusickii*, etc.), regarded as the best and most important fruit of the region. The Canadian Amelanchier is common about New York, where it is known as shad-bush, but it rarely fruits so far south. We have, however, several small shrubby species, like blue-berries, which produce delicious sugary black fruits.

Of our blackberries, raspberries, grapes and plums, I shall not speak, since all are well-known and have contributed important cultivated forms, but there are some important facts concerning aboriginal uses of our native cherries which are not generally known. It may be mentioned in passing that the wild red cherry (*Prunus Pennsylvanica*) so very abundant everywhere to the northward, is far from worthless when well-grown and perfectly ripe. It is rather sour, but yet contains much sugar and is decidedly rich in flavor. Its chief defect is the small amount of flesh in comparison with the large stones. Our common wild black cherry (*Prunus serotina*, but more appropriately separated in the genus *Padus*) has well-known uses in wine making. It is represented in the arid western regions by others with larger fruits, but these consist almost wholly of the large stone, the flesh being so slight in amount and of such poor quality that their use on its account is out of the question. These fruits are largely used by the Indians for the sake of the seeds contained within the stones. To understand this subject, we must recall well-known facts regarding our sweet and bitter almonds. The former is well regarded as one of the most nutritious, wholesome and delicious of our table delicacies. The latter possesses the same constituents, but associates with them substances which, as soon as brought into contact with water, develop prussic acid, not only poisonous, but intensely bitter. The cherries are close relatives of the almond, and agree with the bitter almond in these particulars. The western Indians have learned that water will remove the objectionable substances and leave a very useful food substance; so they pound up these fruits in great quantity, pulp and seeds together, and subject them to an ingenious leaching process, forming the residue into durable cakes for use in time of need.

A far more important cake-making fruit is what might be appropriately called the black checkerberry or wintergreen of the northwest. The limited use of our common red checkerberry (*Gaultheria procumbens*) in the northeast is well-known, the fruit even finding its way, in small quantity, into the New York market. The use of these fruits is very healthful, and mixed with sugar, or even eaten plain, they are quite palatable; yet they are dry and rather insipid. The black one (*G. Shallon*), on the contrary, is sweet, somewhat juicy and of excellent mild flavor. It grows on the northern Pacific coast and adjacent islands, on a bush three or four feet high. These shrubs cover large areas, as do our huckleberry bushes, and produce their fruit in great profusion. It is a staple article of food with the Indians during its season, and the cakes made by pounding it up constitute in some sections almost the sole vegetable food of the winter season. Related to these fruits, and of similar flavor to that of our checker-berry, is the little white teaberry (*Chiogenes hispidula*) of northern regions. It grows on a creeping, matted plant, amidst the moss. The fruit is unimportant, yet constitutes an item in the aboriginal bill of fare. The same may be said of the little partridge berry (*Mitchella*), the special value of which consists in the fact that it can be collected in early spring, upon the melting of the snow. Even the fruit of the little *Moneses* or one-flowered pyrola, is collected by these hard-pressed natives. This is known to us as a very rare and beautiful little bog-plant, but far to the northward it grows freely among the wet sphagnums, and yields sufficient fruit to be worthy of collection.

In the same class of products belongs the little bunch-berry (*Cornus Canadensis*), which can be collected in great quantity in all our northern districts, where the plants grow in great beds. The fruit is a dry, mucilaginous and weakly-flavored drupe, but is not devoid of nutriment.

Let us pass from the consideration of these very small and relatively unimportant fruits to two very large ones, the largest of our wild edible fruits. Their very similar names, papaw and paw-paw, have caused them to be not a little confused in the popular mind. The papaw (*Carica Papaya*) is a distinctly tropical fruit, but has been introduced into southern Florida, where it makes a scanty growth and produces fruit of fair quality. It is a peculiar soft-wooded tree, bearing at the summit an umbrella-shaped crown of huge leaves. At two or three years of age it begins to fruit, and thenceforward produces fruit freely during its life, of from seven to ten years. The fruit has the form and size of a musk-melon, though somewhat pointed. Its pulp is similar and the cavity is thickly covered with rounded black seeds resembling swan shot. The pulp is of peculiar flavor and one must learn to like it, but it is sweet and agreeable. It might be compared in flavor and consistency to an over-ripe and inferior musk-melon. Its great value lies in its high percentage of nutriment and in its power to aid in the digestion of other food eaten with it. When unripe it is irritant and even somewhat poisonous, owing to its milky juice.

The paw-paw is probably to be considered as our richest and most delicious native fruit. Indeed, people are not wanting who esteem it the most delicious of all fruits produced in this country. It is a close relative of the sour-sop, sweet-sop, custard-apple and chirimoya, queen of American tropical fruits. The small tree is abundant in the southern United States, from Arkansas east, and produces its fruits in late summer. Those who know them best say that they should not be eaten until dead-ripe and touched by frost. The fruit resembles a small short and stout banana, but is one-sided and slightly curved. Its seeds, as large as marbles, make bulging points upon its outline, and between them lies the rich, creamy, deliciously sweet pulp. It passes in ripening through the same color changes as a yellow banana. It is common in western and southern markets, and there is a no more needed and promising field for experimentation in horticulture than this remarkable fruit offers.

The fruits thus far considered are mostly of very considerable importance, and not very "little-known." Let us now pass on to consider some which are rather in the nature of curiosities to us, yet important products to those whose general supplies are scanty and poor.

The shallon, which I have described as a very important small fruit of the northwestern tribes, is represented southward by a most distinctly related one, of very inferior quality, yet considerably used for the simple reason that little else is offered over most of the districts where it grows. It is the manzanita (meaning little apple), produced by several species of *Arctostophylos*, especially by *A. pungens*. They are very interesting and beautiful shrubs, with pale-green or glaucous evergreen leaves and terminal clusters of reddish-yellow fruits. The latter are apple-shaped, but scarcely exceed a half inch in breadth, and are usually more or less grooved from base to summit. They are rather dry and sour, and quite astringent, but cooking renders them sufficiently palatable to the Indian. They are also pounded up with other substances to form cakes for preserving.

The apple family itself supplies a similarly used fruit, the California holly (*Heteromeles arbutifolia*), in southern California and adjacent Mexico. It is closely related to our mountain ash (*Sorbus*), and is a very handsome plant. The shrubs grow thickly and exhibit dense masses of dark and glossy foliage, against which lie the large clusters of rich crimson fruit. The latter is not very astringent, but bitterish, and it would be difficult for any of us to class it as edible, yet its use is not unimportant to those impoverished people. The closely related choke-berry or choke-pear (*Aronia arbutifolia*) performs a very similar rôle for the eastern tribes. This small and more slender erect shrub is everywhere common along the Atlantic and very abundant in many sandy salt-marshes, and all berry-pickers are familiar with it. The fruits are of a rich glossy purple-black and much resemble our large black huckleberry. They look very tempting, but are found to be flat and puckery in taste.

The very puckery properties of the unripe persimmon, and its sweet and edible properties when thoroughly ripe, are too well-known to require more than mention, but reference may be made to the extensive use of another very astringent fruit, the sumac-berry, produced by various species of *Rhus*. Its use for the preparation of an acid, refrigerant drink, when nothing else is obtainable for the purpose, has been handed down to the present day. The Indians also pound it up into cakes, for use as a food. It is not unlikely that the nutrition of the contained seeds has much to do with this use.

An even stranger fact is the use by the northern Indians of cakes made by pounding up soap-berry (*Sapindus*). This fruit, as large as a marble, consists of a thin, translucent, gummy, wrinkled pericarp, of red or orange color, loosely enclosing a single large hard seed. The pulp is not only acrid, soapy and unpalatable, but contains considerable saponin, a distinctly poisonous constituent, and one can but wonder at its use. Quite a number of vegetable substances containing saponin are used as Indian foods, but always after some leaching process for the removal of this constituent.

A fruit that reminds us much of the soap-berry in its appearance is the saw-palmetto of our southeastern coast region, where it is produced in prodigious quantity. Its properties are, however, very different. Although it leaves an acrid taste after free eating, it is sugary and nutritious. It is used in large quantities for fattening hogs and chickens, and it was formerly eaten to a considerable extent by the natives.

A northern visitor to our south Atlantic resorts looks with curiosity upon the use of the fruits of the passion-flower, known as may-pops, but people from the tropics are familiar with the use of a number of related species, some of almost sickish sweetness, others as acid as the lemon. This fruit is elliptical and as large as an egg. It has a crustaceous rind, like a mock-orange gourd, which, when stepped upon, emits a popping sound, whence the common name. The interior is a mass of translucent, slippery pulp, clinging tenaciously to a large number of small seeds. It is commonly eaten by swallowing the mass entire, like an oyster.

Unfortunate is the modern lover of fruits who has not access to a supply of our native eastern black mulberry (*Morus rubra*), one of the most highly esteemed, and justly so, of aboriginal fruits. This tree, when well grown in an open space, is widely spreading and thickly clothed with large leaves, making it an admirable shade tree. In early July it is loaded with deep purple-black fruits nearly an inch in length and about as thick as the little finger, full of rich purple juice, and so tender and soft as to be scarcely marketable. They are highly esteemed by most persons, though of too heavy a flavor for some. The European mulberry, much cultivated, is not to be compared with this. Southwestward we have several smaller, less juicy, and in every way inferior species.

A group of fruits not nearly as well known as they should be are those produced by many of our southwestern *Cactaceae*. Some of these are very small, no larger than the sharpened end of a lead pencil, and of similar form. It is probably for this reason that they are not better known, for some of them are really excellent. Many, even among those of larger size, are sour, slimy or "flat," and would not commend themselves to the civilized taste; but a few are large, well-flavored and highly nutritious, and are not only among the most important of Indian foods, but have been highly valued by all travelers who have become familiar with them. The most important of them is the pitahaya of the Apaches, produced by a large columnar cactus, *Cereus Thurberi*, of Arizona and northern Mexico. The fruit is of the form and size of an orange, green externally, containing a rich crimson-scarlet pulp with innumerable small, imbedded seeds. This pulp is sugary, juicy, rich and well-flavored and is the cream of Indian existence during the late summer, when they subsist almost entirely upon it. While the pulp is the flavored portion, the seeds are more important, owing to their highly nutritive qualities. This fruit is cooked and preserved in many ways, and from it are made both syrup and alcoholic beverages. The famous giant cactus of Arizona (*C. giganteus*) produces the saguaro, a fruit similarly used. It is elliptical in form, and the pulp is of a deeper crimson. The facts stated suggest the use of the fruits of the common prickly pear cactus of the Atlantic coast. These small, yellowish, shriveled fruits, about as large as plums, are rather dry, mucilaginous and insipid, except for their mild acidity, and we do not find them palatable. Nevertheless, history records their use, by both aborigines and settlers. They were usually stewed and strained into a mass much resembling apple-sauce.

A fruit much more agreeable to the civilized palate, though of a peculiar flavor that is as objectionable to some as it is esteemed by others, is the ground-cherry, husk-tomato, or cherry-tomato, produced by various species of *Physalis*, in the tomato family. There is a wide variation in sweetness and flavor among the several species. The best is produced by the very sticky plant that we know botanically as *P. viscosa*. The plant grows in sandy soil near the coast, rarely reaching a foot in height, but spreading out to twice that breadth. It bears an ovoid, pointed husk an inch or more long, inside of which is a yellow, sticky, sweet berry. It is ripe in the late blackberrying season, when it is much sought by children, and is relished by adults. It reminds us slightly in its flavor of the much larger berry of the mandrake, or may-apple, a rather well-known fruit also often eaten, though scarcely to be called good.

The elderberries are also fruits of a peculiar strong flavor, objectionable to many people. Their use for making wine is very familiar, and this wine is a very superior article. Their use in pie-making is also quite well known, but their former very extensive use as a food among the savages is a historical fact not commonly recognized. There are quite a number of species in America, black, red and even blue in color, and all seem to have been employed. A fact more difficult for us to realize is the use, apparently never extensive, of the wax-berries (*Symphoricarpos*), and the fruits of various species of honeysuckle, both reputed as somewhat poisonous.

My lecture should include an account of a number of interesting semi-tropical fruits growing along our southern borders, from Texas eastward, including the sea-grape (*Coccoloba*), the cocoa-plum (*Chrysobalanus*), the downward plum (*Bumelia*), and fruits of the genera *Condalia*, *Zizyphus*, *Forestiera*, *Cordia*, *Ehrectia* and *Celtis*. The qualities and uses of most of these fruits are, however, very little known as yet and I will content myself with having exhibited these pictures and made reference to them.

H. H. Rusby.

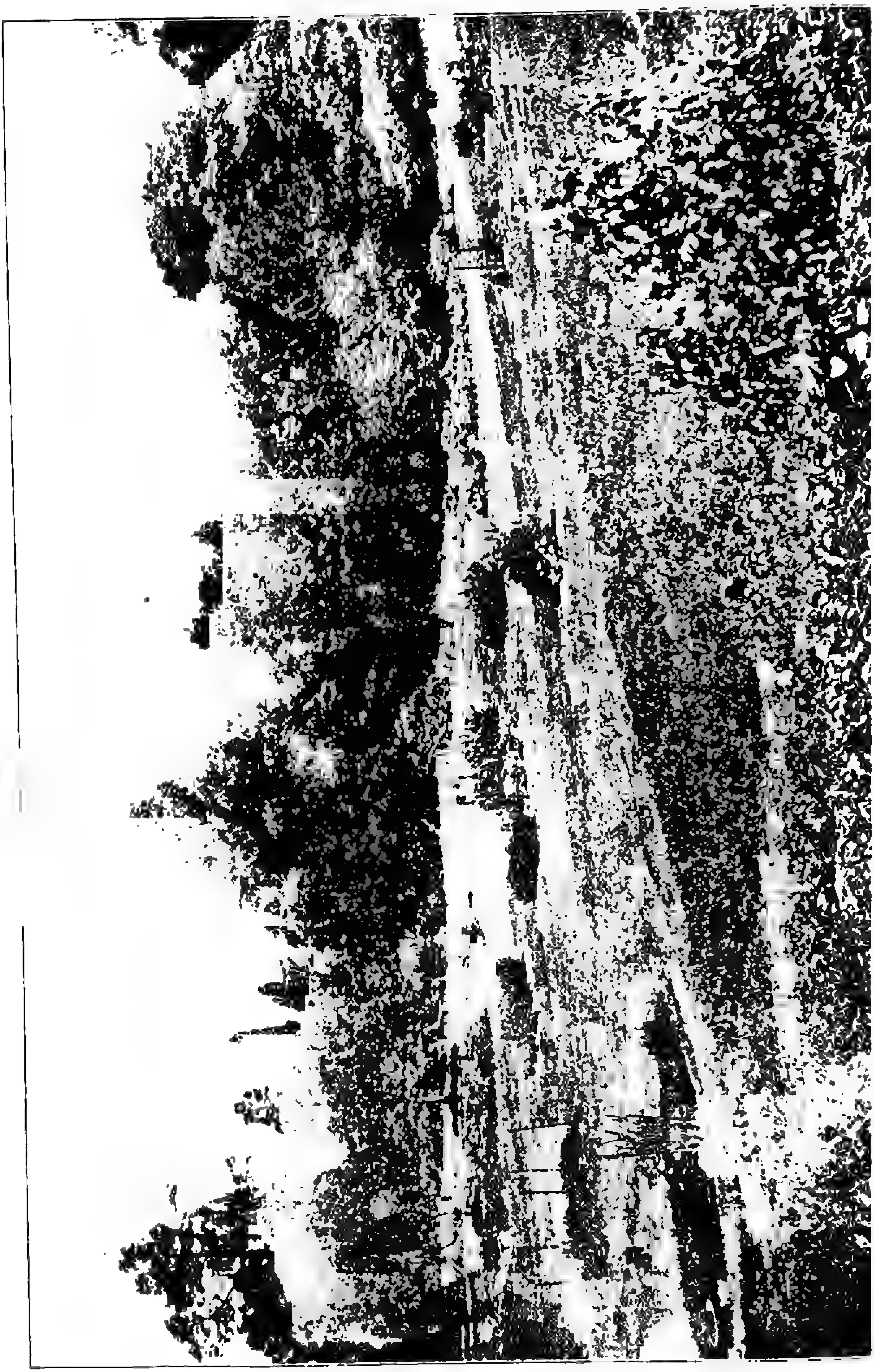
THE ECONOMIC GARDEN.

In the May Journal reference was made to the new Economic Garden then in process of installation. Since that time much has been done in the development of this feature. Many of the more common economic plants are now represented, and the collection has been labeled. Each bed is furnished with a large sign indicating the general nature of the contents, and each plant in the bed is supplied with a smaller individual label giving useful information in regard to that particular plant.

Through the center of the tract devoted to this garden is a broad aisle of sod about thirty-two feet wide, at the southern end of which is a pool; from this pool flows a narrow brook running the length of the valley to the southern end of the Herbaceous Grounds, with several widenings here and there in the shape of small pools.

To the east of this aisle are the beds containing the plants from which are derived fibers, medicines, condiments and relishes. The bed containing the fibers is the most southern one, and is not far distant from the pool referred to above. Here will be found some of the plants which furnish important fibers, such as cotton, linen, ramie, and jute. Following this are several beds devoted to medicinal plants. In these will be found, among others: foxglove and aconite, both valuable remedies in heart troubles; rhubarb; belladonna; licorice; tobacco; dulcamara; castor-oil plants, from the seeds of which is extracted the well-known castor-oil; coltsfoot; wormwood, which is used in the manufacture of absinthe; horehound; stramonium, with its poisonous leaves and seeds, which is known under a variety of common names, such as devil's apple, mad apple, apple of Peru, devil's trumpet, and Jamestown weed, from which last has arisen the corruption Jimson weed; catnip; pennyroyal, from the leaves and flower-tops of which is obtained the oil of pennyroyal; tansy; eupatorium, or boneset; valerian; and conium, or poison hemlock.

Among the shrubs lining the woodland border will be found a number of medicinal plants familiar to many. Among these are: *Hamamelis Virginiana*, from which is obtained the common and



popular remedy known as witch hazel or Pond's extract; prickly ash, *Xanthoxylum Americanum*, also known as the toothache-tree and Angelica-tree; *Rhamnus Frangula;* ceanothus, belonging to the same family as the *Rhamnus*, and sometimes known as New Jersey tea and red-root; hydrangea; and the shrubby yellow-root. Along the brook referred to above will be found additional medicinal plants, such as sweet flag and magnolia, placed there on account of the moisture which they require.

At the extreme northern end of the series is a bed devoted to condiments and relishes. Here will be found such old and well-known plants as lovage, fennel, lavender, thyme, sage, spearmint, nasturtium, mustard, horse-radish, anise, marjoram, savory, balm, and caraway. In the brook will be found the common water cress, *Roripa Nasturtium.*

To the west of the grass aisle are the food plants. Here are plants which furnish some of our most well-known foods. These have been grouped according to the part of the plant which is used. Three of the beds are devoted to such plants as furnish roots, tubers, corms or bulbs for food, or, in general, those in which the underground parts are used. Among these may be mentioned the potato, onion, leek, yam, oyster-plant, beet, carrot, radish, turnip, parsnip, sweet potato, and Jerusalem artichoke. To plants in which the stems or leaf-stalks are used a single bed is allotted. Here will be found such common food plants as asparagus, celery, rhubarb, kohl-rabi, and sea kale. The leaves of many plants are used for food; to such plants two beds are devoted. Some of the commonest vegetables belong here, such as cabbage, kale, Brussels sprouts, parsley, lettuce, spinach, dandelion, and chicory. A small bed is devoted to such plants as furnish edible flowers, represented here by broccoli, globe-artichoke, and cauliflower. To such plants as produce fruits, eleven beds are allotted. Here many of our commonest foods will be found, such as the egg-plant, tomato, okra or gumbo, peppers, squash, pumpkin, cucumber, muskmelon, citron, and watermelon. Some of these, as for example the tomato and egg-plant, may not be popularly known as fruits, but they are strictly so, for a fruit is a product derived directly by growth from the flower. These are usually classed among the vegetables, a term of broader scope than the term fruit.

To grains and seeds are given four beds. Some of the common cereals are planted here, including wheat, rye, and barley. Among other well-known plants in which the seeds are used for food are buckwheat, beans, lentils, peas, sweet corn, pop corn, and peanuts. To fodder plants, in which the herbage is used, are given two beds. Here will be found such well-known plants as white clover, red clover, crimson clover, alfalfa, spring vetch, winter vetch, timothy, red-top, Kentucky blue grass, and field corn.

In the collection of shrubs between the beds and the westerly path are a number of plants which produce foods of various kinds. Here will be found, among the nuts, the chinquapin, the filbert and the American hazel-nut. Among the berries will be found the currant, both red and white, the huckleberry, and the blueberry. There are other kinds of fruits which are popularly called berries, but which are not. To this class belong the strawberry, the blackberry, and the raspberry, all of which are represented here. A fruit of this kind is known as a compound fruit, for it is made up of several smaller fruits, each the product of a developed ovary in the flower. In the strawberry it is the receptacle on which these ovaries are placed which enlarges and furnishes the luscious flesh of that fruit, the seeds appearing as the small yellowish objects on or near the surface. In the blackberry each of these seeds is enclosed in a juicy covering, a collection of these forming the so-called berry. The receptacle in the best blackberries is also enlarged, so that there are two elements of food in such fruits. In the raspberry, as is well known, the receptacle remains on the bush when the fruit is picked, so that only the seeds surrounded by the juicy coverings are used.

Some of the food plants will be found along the brook. The taro, *Colocasia esculenta*, is one of these. It is a member of the family to which our common jack-in-the-pulpit belongs, and like it has a corm. It is this part which is edible and is used in tropical regions, including the West Indies, very much as the potato is used in temperate regions. Rice, *Oryza sativa*, will be found growing in the small pool referred to above. This is largely grown in our own southern states, and also in immense quantities in Asiatic countries, where it is the staple article of food. Near this is a clump of the wild or Indian rice, a native of North America. It grows in swamps, and in some places covers large areas. It is of frequent occurrence on the Hackensack marshes in the neighborhood of New York City, and in other places of similar nature. It was largely used by the Indians for food.

There are at present in the Economic Garden thirty-one beds. In these, and along the brook and in the shrub borders, are contained about two hundred and thirty different kinds of economic plants, classified as follows: food plants, one hundred and forty; fibers, six; medicinal, sixty-five; condiments and relishes, eighteen.

GEORGE V. NASH.

REPORT OF LECTURES ON THE PRESERVATION OF WILD FLOWERS.

NEW BRIGHTON, NEW YORK CITY,
August 2, 1907.

DR. N. L. BRITTON,
Director-in-chief, New York Botanical Garden.

Dear Sir: Upon receipt of your letter of May 9 last, authorizing a grant to me of $200 from the Stokes' Fund to be used in defraying the expenses of a lecture tour in aid of the cause of plant protection, I proceeded to New York, and, after making a selection at the Garden of about fifty colored lantern slides from the Van Brunt collection, continued to Summit, New Jersey, from which place an invitation to lecture had been several times extended me by Mrs. Georgiana K. Holmes, founder and secretary of the Nature Study League. Bad weather and a local Board of Trade dinner on May 10, the evening of the lecture, interfered somewhat with the attendance, but the interest displayed by the school children, many of whom spoke to me after the lecture, was very gratifying.

On May 11, I went to Nantucket, where a day was spent walking about the island and observing the interesting flora of the sandy prairies and scrub pine groves. The mayflower is here the most abundant of spring wild flowers, carpeting the moors on the south side of the island and lending a rich, spicy fragrance to the ocean breezes that sweep over these exposed tracts. It is in less danger from picking than from the surface fires which are of common occurrence in spring. These fires, kindled chiefly through carelessness or accident, run rapidly over the dry vegetation of the moorlands, but fortunately do no lasting damage. The later blooming wild flowers suffer more or less at the hands of summer tourists, but I was glad to observe that the residents of Nantucket as a whole are keenly alive to the importance of preserving the natural beauties of the island, and carefully guard the localities for many rare plants, especially the Scotch heather and the two European heaths (*Erica cinerea* and *E. tetralix*) which occur there. I lectured May 13 in the historic old Unitarian church to a large and appreciative audience, every possible courtesy being extended by the pastor, Rev. Edward Day, and by Principal B. D. May of the High school.

The following day I left for Boston, lecturing there in the rooms of the Boston Society of Natural History under the auspices of the Society for the Protection of Native Plants by invitation of its president, Professor Robert T. Jackson of Harvard University. The talk there was rather in the nature of a comparison of the work of the two Societies, the relations between which have always been of the most cordial nature. There can be no doubt that the large population of Boston and its environs has been greatly enlightened on the subject of plant protection by the many excellent leaflets distributed by our sister organization.

I then went to Springfield, where several days were spent visiting friends, resuming my tour May 22 with a lecture at Brattleboro, Vermont, in the Baptist church, under the auspices of the Young People's Society. On May 23 I addressed a large audience in the music hall at Woodstock, where the preliminary arrangements had been kindly made by Mr. and Mrs. Franklin S. Billings. On May 24 I spoke in St. Johnsbury in the attractive Fairbanks Museum, whose curator, Miss Delia Griffin, is keenly alive to the importance of plant protection, and is doing an excellent work among the school children. May 25 I reached Burlington, where Professor L. R. Jones of the University of Vermont, one of our own members, had made all arrangements for the lecture in the science hall of the university. The attendance here was one of the largest that the hall has contained, and several new members were enrolled. I remained three days in Burlington as the guest of Professor Jones, visiting points of botanical interest, and on May 29, at the invitation of President Brainerd, spoke in the chapel of Middlebury College at Middlebury, enjoying afterwards the privilege of inspecting his wonderful violet garden.

May 30 I left for Ottawa, where I was hospitably received by Mr. J. M. Macoun, of the Geological Survey, and entertained that evening by the Ottawa Naturalists' Field Club, under whose auspices the lecture was given the following evening in the Normal School, with a large attendance. June 1 I spoke at the University of Toronto, in Toronto, through the courtesy of Professor R. Ramsay Wright, enrolling more new members for the Wild Flower Preservation Society here than in any other place. Indeed, my experience in Ottawa and Toronto indicates that the people of Canada are fully as interested in this subject as those of our own country, and suggests the advisability of an extended tour among the smaller cities of Canada at some future time.

I had expected to lecture in Montreal, but owing to the disasters by fire which McGill University has recently sustained, it was thought advisable by Professor Penhallow to defer it. My tour came to an end June 6, when I spoke at the Murdock school in Winchendon, Massachusetts, with a large attendance of school children.

Although the total number of new members gained for the Wild Flower Preservation Society is not, perhaps, as large as might have been expected, I consider that the tour has been highly successful from an educational point of view. The leaflets printed by the Society and the linen posters issued by the Garden have been widely distributed, and an effort has been made in each locality to indicate the specific line of work that is most required.

It seems to me that we may already detect evidences of success in our campaign for plant protection, and that we may look forward to more important accomplishments in the future.

Respectfully submitted,

CHARLES LOUIS POLLARD,

Secretary-Treasurer,

Wild Flower Preservation Society of America.

NOTES, NEWS AND COMMENT.

Dr. and Mrs. N. L. Britton will sail for Jamaica August 24.

Professor F. S. Earle returned to Cuba August 10.

Mr. W. R. Maxon spent several days at the Garden during July and August studying the fern collections.

Mr. Charles L. Pollard has recently been appointed Curator of the Staten Island Association of Arts and Sciences. He will be located in the new Richmond Borough Building, to which the collections belonging to the Association will shortly be moved.

Dr. H. H. Rusby, Curator of the Economic Collections, has recently been appointed official expert in drug products to the United States Government, his chief duties being to determine whether or not importations are true to name and suitable for use in medicinal preparations. Dr. Rusby has for nearly two years occupied a similar position with the Department of Health of this city, in which the drugs and medicines sold here were tested and passed upon by him as to quality.

Among recent visitors at the Garden were Professor Douglas H. Campbell, of Stanford University, California; Dr. H. N. Whitford, of the Bureau of Forestry of the Philippine Islands; Dr. C. D. Howe, of the Biltmore School of Forestry, North Carolina; Dr. D. T. MacDougal, of the Carnegie Institution of Washington; Professor and Mrs. T. D. A. Cockerell, of Boulder, Colorado; Dr. J. McK. Cattell, of New York; Professor Duncan S. Johnson, of the Johns Hopkins University; and Professor William Bateson, of the University of Cambridge, England.

Mr. Samuel Henshaw, who served for some years as head gardener of the New York Botanical Garden, died on Staten Island on July 16. Mr. Henshaw was active in the preliminary work of developing the Garden, and was employed in 1895 to oversee the planting of a temporary nursery on the east side of the grounds near the site of the present nursery, and in 1896 did the preliminary planting of a portion of the border screen along the New York Central and Hudson River Railroad near the station. He was appointed head gardener in 1897 and served until the end of 1900, at which time he resigned. He served on the Commission of six experts appointed by the Board of Managers on July 17, 1896, to prepare a general plan of development of the grounds, this report having been submitted to the Board of Managers November 30, 1896, and approved December 14, 1896. In 1901 he was commissioned to proceed to the West Indies to obtain specimens of living plants for the conservatories.

Meteorology for July. — The total precipitation recorded for July was 1.66 inches. The heaviest rainfall (0.51 inch) occurred on July 2. Maximum temperatures were recorded of 88° on the 2d; and 93° on the 8th, 18th, and 25th; also minimum temperatures of 55° on the 3d and 13th; and 59° on the 21st and 26th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM JUNE 1 TO AUGUST 1.

ANDREWS, H. C. *The heathery; or a monograph of the genus Erica.* Ed. 2. London, 1845. 6 vols.

COMÈRE, JOSEPH. *Les desmidiées de France.* Paris, 1901.

DAUBENY, C. *Essay on the trees and shrubs of the ancients.* Oxford, 1865.

DE VRIES, HUGO. *Plant breeding; comments on the experiments of Nilsson and Burbank.* Chicago, 1907.

FARLOW, W. G. *On some impurities of drinking-water caused by vegetable growths.* Boston, 1880.

GAUTIÉ, ALBERT. *Les théories et les applications nouvelles de la greffe.* Paris, 1907.

HAMPEL, W. *Die moderne Teppich-gärtnerei.* Siebente Auflage. Berlin, 1907.

HANDEL-MAZZETTI, HEINRICH FREIHERR VON. *Monographie der Gattung Taraxacum.* Leipzig, 1907.

JOHNSON, CHARLES. *British poisonous plants.* London, 1856.

JOST, LUDWIG. *Lectures on plant physiology.* Authorized English translation by R. J. Harvey Gibson. Oxford, 1907.

JUNK, WILHELM. *Carl v. Linné und seine Bedeutung für die Bibliographie.* Berlin, 1907.

KLEBS, GEORG. *Über künstliche Metamorphosen.* Stuttgart, 1906.

KLÖCKER, ALB. *Fermentation organisms;* a laboratory handbook, tr. from the German by G. E. Allan and J. H. Millar. London, 1903. (Deposited by the Trustees of Columbia University.)

KNAPP, F. H. *Botanical chart of British flowering plants and ferns.* Bath, 1846.

KRAEMER, HENRY. *Text-book of botany and pharmacognosy.* Philadelphia, 1907. (Given by the Torrey Botanical Club.)

LAING, R. M., & BLACKWELL, E. W. *Plants of New Zealand.* Christchurch, 1906.

LOUDON, JANE. *The ladies' flower-garden of ornamental greenhouse plants.* London, 1848.

Maryland Geological Survey. Baltimore, 1907. 4 vols. (Given by Dr. Arthur Hollick.)

MENZEL, P. *Über die Flora der Senftenberger Braunkohlen-Ablagerungen.* Berlin, 1906. (Given by Dr. Arthur Hollick.)

MOLISCH, HANS. *Die Purpurbakterien nach neuen Untersuchungen.* Jena, 1907.

MÜLLER, GUSTAV. *Mikroskopisches und physiologisches Praktikum der Botanik für Lehrer.* Leipzig, 1907.

MYRICK, HERBERT. *Sugar: A new and profitable industry in the United States.* New York, 1897. (By exchange with the Library of Congress.)

NEWMAN, JOHN B., ED. *Illustrated botany.* New York, 1846.

SCHLEIDEN, M. J. *Die Pflanze und ihr Leben.* Sechste Auflage. Leipzig, 1864.

SCHWARZ, G. FREDERICK. *The longleaf pine in virgin forest.* New York, 1907.

SELBY, PRIDEAUX JOHN. *History of British forest trees.* London, 1842.

SMEE, ALFRED. *The potatoe plant, its uses and properties.* New York, 1847.

SMITH, JOHN. *Historia filicum; an exposition of the nature, number, and organography of ferns.* London, 1875.

SMITHSONIAN INSTITUTION. *Annual report of the board of regents of the Smithsonian Institution.* Washington, 1854–93. 27 vols. (Given by the Smithsonian Institution.)

WEISMANN, AUGUST. *Ueber den Einfluss der Isolirung auf die Artbildung.* Leipzig, 1872. (Given by Dr. J. H. Barnhart.)

WILBRAND, J. B. *Die natürlichen Pflanzenfamilien in ihren gegenseitigen Stellungen.*
Giessen, 1834. (Given by Dr. J. H. Barnhart.)

ZAHN, KARL HERMANN. *Die Hieracien der Schweiz.* Zürich, 1906.

MUSEUMS AND HERBARIUM.

20 specimens of ferns from Staten Island, New York. (Given by Dr. Philip Dowell.)

100 specimens of fungi from the Philippine Islands. (Given by Mr. A. D. E. Elmer.)

63 specimens of mosses from Japan. (By exchange with Mr. J. Cardot.)

86 specimens of flowering plants from Cuba. (Given by Professor F. S. Earle.)

1 specimen of *Rhododendron catawbienese* from eastern North Carolina. (Given by Professor W. C. Coker.)

26 specimens of mosses from Jamaica. (Collected by Miss Clara E. Cummings.)

6 specimens of Hepaticae from Vermont. (Given by Miss Annie Lorenz.)

30 colored drawings of fungi. (Given by Mrs. F. S. Earle.)

50 specimens "Uredineen," fasc. 42 and 43. (Distributed by Drs. H. and P. Sydow.)

360 specimens from Cuba. (Collected by Mr. W. R. Maxon.)

15 specimens of mosses from Jamaica. (Given by Professor D. S. Johnson.)

4 specimens of mosses from Costa Rica. (By exchange with Mr. J. Cardot.)

3 specimens of *Fomes roseus* from Newton, New Jersey. (Collected by Dr. N. L. Britton.)

6 specimens from the vicinity of Philadelphia. (Given by Mr. S. S. Van Pelt.)

1 specimen of *Phytophthora Phalictri*. (Given by Mr. Guy West Wilson.)

228 specimens from California. (Collected by Mr. A. A. Heller.)

18 specimens of North American Peronosporales. (Given by Mr. Guy West Wilson.)

60 specimens of mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

PLANTS AND SEEDS.

17 plants for conservatory pools. (Purchased.)

3 plants for conservatory. (Given by Mr. V. E. Rix.)

1 plant for conservatory. (By exchange with United States National Museum, through Dr. J. N. Rose.)

8 plants for conservatory. (Given by Miss Helen M. Gould.)

9 plants for conservatory. (Given by Mr. E. F. Cabada.)

27 plants for nursery. (Collected by Mr. R. C. Benedict.)

1 plant for nursery. (Given by Mr. P. H. Dowell.)

84 plants derived from seed from various sources.

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PUBLICATIONS

OF

The New York Botanical Garden

Journal of the New York Botanical Garden, monthly, illustrated, containing notes, news and non-technical articles of general interest. Free to all members of the Garden. To others, 10 cents a copy; $1.00 a year. [Not offered in exchange.] Vol. I, 1900, viii + 213 pp. Vol. II, 1901, viii + 204 pp. Vol. III, 1902, viii + 244 pp. Vol. IV, 1903, viii + 238 pp. Vol. V, 1904, viii+242 pp. Vol. VI, 1905, viii+224 pp. Vol. VII, 1906, viii + 300 pp.

Bulletin of the New York Botanical Garden, containing the annual reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations carried out in the Garden. Free to all members of the Garden; to others, $3.00 per volume. Vol. I, Nos. 1–5, 449 pp., 3 maps, and 12 plates, 1896–1900. Vol. II, Nos. 6–8, 518 pp., 30 plates, 1901–1903. Vol. III, Nos. 9–11, 463 pp., 37 plates, 1903–1905. Vol. IV, No. 12, 113 pp.; No. 13, 193 pp., 12 plates; No. 14, in press. Vol. V, No. 15, 105 pp., 1906; No. 16, 88 pp., 17 plates, 1906; No. 17, 115 pp., 1907.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies and Central America. Planned to be completed in thirty volumes. Roy. 8vo. Each volume to consist of four or more parts. Subscription price $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Vol. 22, part 1, issued May 22, 1905, contains descriptions of the order Rosales by Dr. J. K. Small, and of the families Podostemonaceae by Mr. Geo. V. Nash, Crassulaceae by Dr. N. L. Britton and Dr. J. N. Rose, Penthoraceae and Parnassiaceae by Dr. P. A. Rydberg.

Vol. 22, part 2, issued December 18, 1905, contains descriptions of the families Saxifragaceae and Hydrangeaceae by Dr. J. K. Small and Dr. P. A. Rydberg; the Cunoniaceae, Iteaceae and Hamamelidaceae by Dr. N. L. Britton; the Pterostemonaceae by Dr. J. K. Small; the Altingiaceae by Percy Wilson and the Phyllonomaceae by Dr. H. H. Rusby.

Vol. 7, part 1, issued Oct. 4, 1906, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by Professor G. P. Clinton.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII SEPTEMBER, 1907 No. 93

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

CONTENTS

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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VIEW IN THE NATURAL POND

JOURNAL

OF

The New York Botanical Garden

Vol. VIII. September, 1907. No. 93.

AUTUMN LECTURES, 1907.

To be delivered in the lecture hall of the museum building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

Oct. 5. "The Salton Sea and its Effect on Vegetation," by Dr. D. T. MacDougal.

Oct. 12. "Collecting Fungi in the Wilds of Maine," by Dr. W. A. Murrill.

Oct. 19. "The Forms and Functions of Leaves," by Dr. C. Stuart Gager.

Oct. 26. "The True Grasses and their Uses," by Mr. George V Nash.

Nov. 2. "The Giant Trees of California: Their Past History and Present Condition," by Dr. Arthur Hollick.

Nov. 9. "The Progress of the Development of the New York Botanical Garden," by Dr. N. L. Britton.

Nov. 16. "Edible Roots of the United States," by Dr. H. H. Rusby.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5:33 train from the Bronx Park railway station, arriving at Grand Central Station at 6:02 P. M.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railway to Botanical Garden Station, by trolley cars to Bedford Park, or by the

Third Avenue Elevated Railway to Botanical Garden, Bronx Park. Visitors coming by the Subway change to the Elevated Railway at 149th Street and Third Avenue.

WATER LILIES AND OTHER AQUATICS: THEIR RELATION TO HORTICULTURE.*

Why is it that aquatic gardening is not more frequently resorted to in landscape effects? Is it the fear that it may involve too great an expense, or that it may be difficult to secure plants for the purpose? In this as in many other things you can spend money, and plenty of it too, in developing a water garden, but beautiful results may be obtained with a comparatively small outlay of money, for many of the plants may be secured in the immediate neighborhood, the only expenditure necessary being one of time and patience. There are so many spots, now unsightly or adding but little to the beauty of the surroundings, that could be so vastly improved by even a little care in planting, that it seems incredible that they should be allowed to remain as they are. Many an old swamp or bog, or a pond or lake with unsightly shores, may be turned from a dreary waste of weeds and tangle into a thing of beauty, awaiting but the touch of the artistic hand to effect this transformation. Here may be found many plants, called weeds in their uncultivated condition, which, if but transplanted and given a chance, will respond quickly and well repay the care and attention bestowed upon them. This is the height of the horticulturist's art — to remove the enemies and unfavorable conditions, thus allowing each plant to tell its own story in its own way and bring its message to mankind.

With the site in view, the question arises, how shall we develop it into a water garden? If the old swamp be near a wood, as many of these old swamps are, the work is partly done for us, for this wood will make a delightful background, giving dainty modulations in green during the summer, and in the fall an ever-changing scheme of autumn tints. The absence of a wood need

* From a lecture delivered at the New York Botanical Garden, May 18, 1907.

not deter one, however, for much may be done in the planting of the margin of the water garden to supply this want. The question now arises, how shall we do this planting?

In the first place, what kind of water garden do we want — what kind of a water garden will lend itself to our surroundings? An old swamp or bog cannot be so developed without the expenditure of a considerable sum, for it may be necessary to build a dam to retain the waters of our spring-fed or brook-fed site, or it may require considerable digging and dredging, so the financial element must obtrude at times, and cause us to pause in our artistic impulses. If means are at hand, it is hard to imagine a more delightful occupation than turning one of these old neglected spots into a thing of beauty, and watching it develop day by day, as it more nearly approaches the ideal. Perhaps a pond is already at hand, and needs but a touch here and there to transform it. In such a case the task is much easier, and the expense involved comparatively light, for the purchase or transplanting of plants is the main item. Where an old swamp or pond is not available, an artificial pond may be made, and by properly locating this and exercising care in its planting, beautiful and natural effects may be secured. Or if only a small yard or lot is at one's disposal, let him not despair, for his love for aquatics may be indulged, to a limited extent of course, by building an aquatic tank of cement and brick; but let it appear as such, for frank artificiality is much to be preferred to poorly imitated naturalness, and in narrow quarters landscape effects are not natural. Even half barrels may be used as receptacles for aquatic plants, if these are sunk in the ground, and kept supplied with water.

Disregarding the smaller attempts at water gardening referred to above, let us consider the development of the larger efforts. In a well-arranged water garden there are two features which must be borne in mind, the fringe or margin, or what we should use as a frame for our completed picture, and the picture itself, or water garden proper. The first of these is by no means an unimportant factor, for upon the proper selection of plants to compose this frame much of the beauty of vista and harmony depends. Here we may fail at the start, especially if the site selected re-

FIG. 29. The old swamp as it was for years. The large tree on the right is a weeping willow, shown in its summer attire on the left of the following picture. The site of the dam is indicated by the old fence.

FIG. 30. The same swamp after its transformation, viewed from the opposite direction. The dam may be noticed running out from the weeping willow on the left.

quires the use of cement in forming the margins of our pond, for this well-defined artificial rim must be obliterated by the planting, if we hope for any but stiff and unnatural effects. We will assume that the drudgery of forming our pond is over, and that all is ready for the planting. Perhaps, if care has been exercised in the preliminary operations, we already have a number of shrubs on the edge of our pond; at all events, this must be our first consideration, for they are essential features in the scheme. It will not be possible here to enumerate all the plants which may be used in the making of a water garden, but some will be mentioned as suggestions for others. It is always well to bear in mind that many of the plants of the immediate neighborhood may be used to advantage for this purpose.

In the planting of the frame referred to above there is quite an array of shrubs from which to select. The smooth alder (*Alnus rugosa*) is one of these, with its mass of staminate aments borne in tassel-like profusion in March or early April, more attractive at that time from the lack of other signs of approaching summer. The American elder (*Sambucus canadensis*), more commonly known as the elder berry, deserves a place here for its profusion of flowers in early summer, followed by the large masses of purple-black fruit. Then the arrow-wood (*Viburnum dentatum*) may be used for its showy flowers; and the sweet pepper-bush (*Clethra alnifolia*) for the same reason and for the added charm of a delicious perfume. The swamp honeysuckle (*Azalea viscosa*) and the Carolina rose (*Rosa Carolina*) may both be added to our list of desirable plants, both old-time favorites of our swamps and lowlands. The Virginia winterberry or black alder (*Ilex verticillata*) should not be forgotten, its bright-red fruit being very attractive. The calico bush or mountain laurel (*Kalmia latifolia*) is too popular a favorite to need an introduction here, and its usefulness for this purpose is quite evident. The sheep laurel (*Kalmia angustifolia*), a small shrub of our swamps and low grounds, may be used where rose-colored flowers are wanted. The leather-leaf (*Chamaedaphne calyculata*), the privet andromeda (*Xolisma ligustrina*), and the stagger-bush (*Pieris Mariana*), all members of the heath family, are valuable for this purpose. The sweet bay (*Magnolia virginiana*, or *M. glauca* as it is sometimes called), itself an inhabitant of swamps, should not be forgotten in making our selection. Its flowers are of waxy whiteness and sweet-scented. The button-bush (*Cephalanthus occidentalis*), bearing its white flowers in ball-like masses, may be desired by some. The American holly (*Ilex opaca*), with its dark evergreen foliage and bright-red berries, will add much to the effect. There are, of course, many other shrubs which may be used, but from these a good selection may be made, or they may serve to suggest others.

It may be desirable to use a few trees, if the effect seems to require them. The sweet gum (*Liquidambar Styraciflua*), the leaves of which are 5–7-pointed and turn a deep crimson in autumn, is a favorite. The pepperidge or sour gum (*Nyssa sylvatica*), the swamp oak (*Quercus palustris*), and the red maple (*Acer rubrum*) suggest themselves here. The weeping willow (*Salix babylonica*) is effective where a tree with pendant branches is desirable.

Of herbaceous plants there are many which may be used in the composition of this frame. Any swamp or lowland will furnish a host of native species which will lend themselves admirably to the purpose. With our wealth of wild asters and goldenrods, sunflowers and daisies, tickseeds and coreopsis, an abundance of material is at our hand for the mere transplanting. Among others of our native plants may be mentioned our two common blue flags (*Iris versicolor* and *I. prismatica*); the pickerel weed (*Pontederia cordata*), that picturesque inhabitants of the swamps and river margins, often giving a blue tinge to the shore vegetation with its spikes of flowers; the lizard's-tail (*Saururus cernuus*), in contrast with the last with nodding spikes of white flowers; the marsh mallow (*Caltha palustris*) with its bright yellow starry flowers; the American white hellebore (*Veratrum viride*) with its stately stalks of green, adding a touch of variety; the swamp loosestrife or willow herb (*Decodon verticillatus* or *Nesaea verticillata*), a rampant grower, and especially well adapted to conceal an artificial margin; and last, but not least, the swamp rose mallow (*Hibiscus Moscheutos*), sending forth its bright pink blossoms in August, when it is exceedingly attractive.

Among the ferns which may be used are the American roya fern, the cinnamon fern, and Clayton's fern. Do not forget t add to these the stately ostrich fern. Some of our native orchid may be employed also. Among these are the yellow fringed orchis (*Blephariglottis ciliaris*), the small purple fringed-orchi (*Blephariglottis psychodes*), the grass-pink (*Limodorum tuberosu* or *Calopogon pulchellus*), and the showy lady's-slipper (*Cypripe dium reginae*). Of course there are many plants from other clime to select from. The Japanese iris (*Iris laevigata*, or *I. Kaemp feri*, as it is more frequently called) is a prime favorite amon these, its flowers being perhaps the largest and showiest amon the irises. It may be had in a host of forms, remarkable fo their beauty of coloring and shading. If a mass of purple i desired, nothing, perhaps, will give it more effectively than th spiked loosestrife (*Lythrum Salicaria*), an old-world plant, bu found sometimes quite commonly as an introduction here. Fo a rich-red effect nothing will excel that conspicuous plant of ou stream borders, the cardinal flower (*Lobelia cardinalis*). Thi planted in a mass with a border of green produces a most strikin effect. Its near relative, with blue flowers (*Lobelia syphilitica*) the great lobelia or "blue cardinal flower," is useful wher masses of blue are desired.

The aquatic garden would not be complete without the grasses Showy and ornamental kinds suitable for this purpose are no numerous. One of the most striking, an annual, is the wild rice or Indian rice (*Zizania aquatica*). This is a luxuriant growe and very decorative, its large panicles making their appearanc in August and September, and its bright green foliage addin a touch of spring freshness to the season. Another which ma be used is the common reed (*Phragmites Phragmites* or *P. com munis*) of our meadows here, with grayish-green foliage. Thi is a taller grower than the wild rice, and its inflorescence whe mature has a feathery effect, much resembling that of the old world reed (*Arundo Donax*), a much more vigorous plant, bu not as hardy here as its American relative. The Japanese reed grass (*Miscanthus sinensis*) and its various forms have the ad vantage of being late bloomers, when almost all else has failed

and hence are a decided addition to the frame. At all times they are graceful in their foliage effect, and later with their feathery plumes are very attractive objects. Among the sedges our choice is rather limited, and we must borrow our most effective plant from northern Africa. This is the Egyptian paper plant (*Cyperus Papyrus*, or *Papyrus antiquorum*), from which the ancients made their papyrus. It is a noble plant, of a deep rich green, raising its large inflorescences six to eight feet in the air. These are unusual in appearance, and give an aspect of uniqueness to the surroundings. It is not a hardy plant, requiring the protection of a greenhouse during the winter, and this is its one drawback. It is often desirable to produce an effect of upright lines, and for this purpose nothing is better than the cat-tails, which are so abundant in some of our marshes. Either or both species may be used, the one with the narrow leaves (*Typha angustifolia*) perhaps being more graceful than the broad-leaved form (*Typha latifolia*). For a decorative plant for the shallow water near the margin of the pond, one should not forget the arrow-heads (*Sagittaria*), of which there are several species available.

With the above plants to select from and such others as individual taste may choose, a varied and effective frame may be made for our water garden. If you wish to introduce something of a tropical effect into the surroundings, use some of the aralias, already referred to, to which add a few specimens of the castor-oil plant (*Ricinus communis*), its star-shaped leaves standing out against the other foliage. If you wish to carry this tropical effect still further, introduce a plant or two of the Abyssinian banana (*Musa Ensete*), a quick grower from seed, with ample broad leaves. The thalias (*Thalia dealbata* and *T. divaricata*) are available also. It is hardly necessary to state that all these plants, with the exception of the aralias, are tender, and need the protection of a greenhouse during the winter.

So much for the frame or fringe of our water garden. Now, what shall we use in the garden itself? Here we may explore the realms of horticultural knowledge and select some of the choicest plants. Of course the plants of first interest are the water lilies. The large royal water lilies of South America belong here also, but I will consider them later. The horticulturist's art has supplied many superb things by the careful perpetuation of occasional strains or by the creation of new ones through the medium of hybridization. I shall consider first only the hardy sorts, leaving the more tender kinds for consideration when I treat of the royal water lilies (*Victoria*), which require a similar treatment. Among the white-flowered forms, there is nothing more dainty or attractive than our own native pond lily or water lily (*Castalia odorata*), that graceful frequenter of our lakes and ponds or slowly moving streams. Its delicious fragrance and dainty form place it in the foremost rank. The tuberous water lily (*Castalia tuberosa*), also a superb white, but lacking the delicious perfume of the other, is a welcome addition. The collection is not complete without the little pygmy water lily (*Castalia tetragona*, or *C. pygmaea*), the smallest of its kind, with white flowers sometimes under two inches in diameter. In native hardy yellow lilies, we have the Florida plant (*Castalia flava*), unfortunately a shy bloomer, and less desirable for that reason ; and the Mexican lily (*Castalia mexicana*), a native of Mexico and western Texas, more desirable as it is equally hardy and blooms freely. The only pink lily we have native is a form of our common pond lily, known as the pink or Cape Cod water lily (*Castalia odorata rosea*). This differs from the white form only in its pink flowers.

When we approach those produced artificially we have a larger selection. And here the productions of that wizard of hardy water lilies, M. Latour-Marliac, a Frenchman, stand without rival. He astounded the world of horticulture between 1885 and 1890 with his creations, and since then has been making almost annual additions to his achievements. He guarded so well the secrets of parentage of his hybrids that little is definitely known about them. His yellows were perhaps derived from *Castalia mexicana ;* his pinks from *Castalia odorata rosea ;* those with red at the center from *Castalia alba rubra*, of northern Europe ; *Castalia tetragona* was certainly one of the parents of one, his dwarf yellow, *Castalia helvola ;* while *Castalia odorata* must certainly enter into the problem. With these factors he has produced combinations and

effects of color which have wonderfully broadened the field of ı
of these flowers in water gardens. All of the many beauti
things created by this genius cannot here be enumerated, but oı
a few of the choicest. Standing in the front rank is *Castalia M*
liacea chromatella, one of his first introductions, and perhaps t
most popular of all. It is perfectly hardy, a vigorous grow
and a free bloomer; its charming yellow flowers, always a
light, resemble in form those of our own native white lily. Y
low lilies are scarce, and this is a gem among them. It v
introduced about 1888 and was said by its creator to be a hyb
of *Castalia alba* and *C. mexicana.* Another desirable yellow
Castalia helvola, also said to have *C. mexicana* blood in it, t
other parent being *Castalia tetragona,* the pygmy lily. Certai
it has the yellow color and spotted leaves of the former, and
intermediate in size between the two. It is well worth growi

About 1889 Marliac introduced two pink forms, said to
hybrids between *Castalia alba* and *C. odorata rosea.* These
Castalia Marliacea carnea, and *C. Marliacea rosea.* They
very close, differing only in the deeper color of the variety *ros*
which is the preferable form.

With *Castalia alba rubra* apparently as one of the parer
Marliac produced a number of surprising forms, all being p
meated to a greater or less degree with the deep color of t
parent referred to above. The most pronounced of all of th
in the depth of color is *Castalia Wm. Falconer,* of a deep ri
claret, a lily which should grace all collections. Near to this
color is *Castalia James Brydon.* Those in which another e
ment becomes prominent, introduced perhaps by *Castalia me*
cana, have the center of the flower a deep red, with the ends
the petals yellow. *Castalia Seignoreti, C. aurora,* and *C. glori*
are of this kind, and are revelations among the water lili
There are other hybrids to be had, differing in color and ma
ings, so that individual tastes may be consulted.

Among the white-flowered lilies, next to *Castalia odorata*
C. alba candidissima, said to be a hybrid of *C. candida* and
alba, of Greece. It is a vigorous grower, and must be held
check or it will run wild. Another desirable white-flowered l

... background of trees. The **fringe** is made up in part of the natural vegetation, including asters and is *Castalia Gladstoniana*, with large flowers, said to be a variant from *Castalia alba*, and introduced by Mr. Richardson, of Ohio.

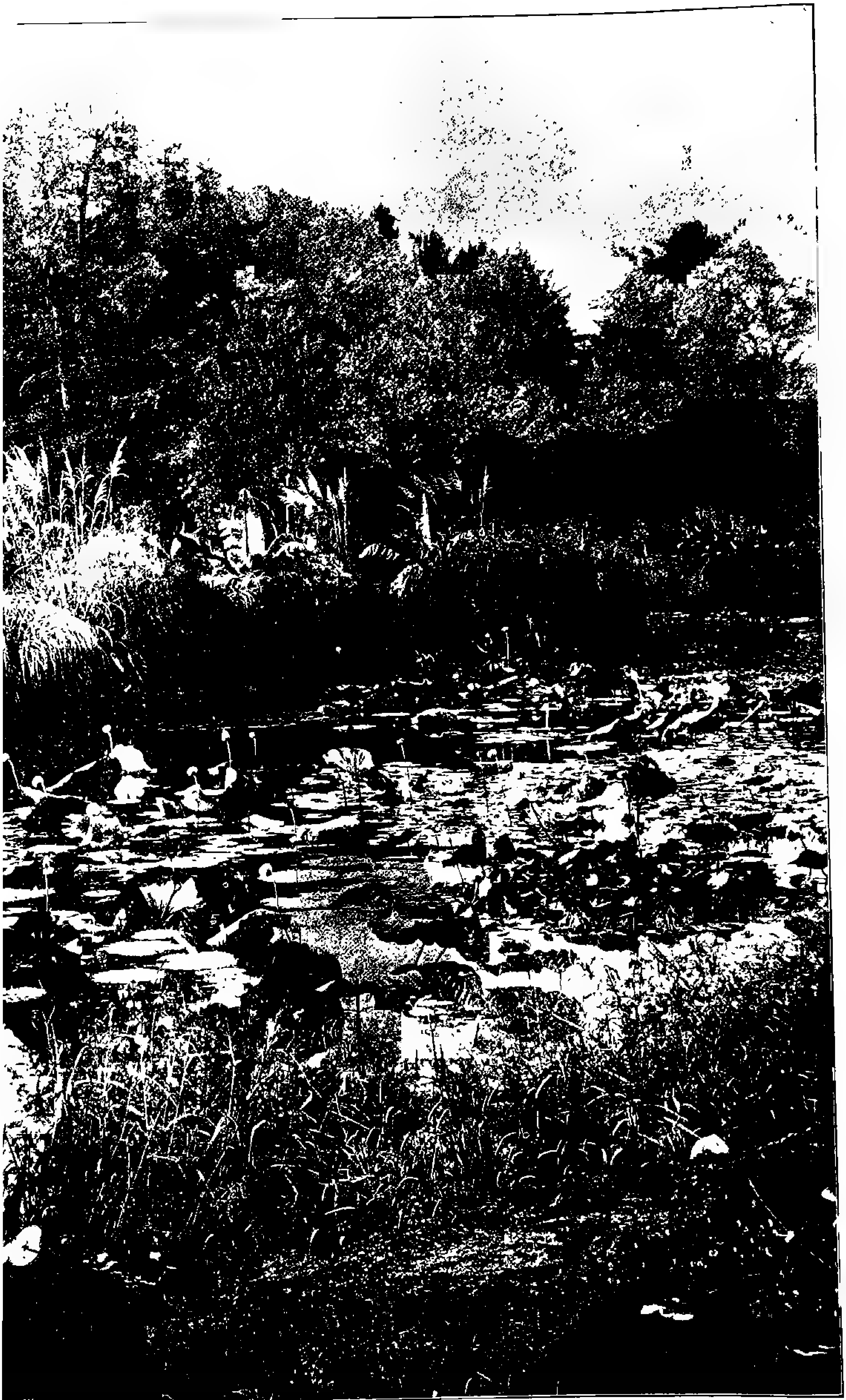
Belonging to the same family as the water lilies are the lotuses, that from the Old World (*Nelumbo Nelumbo*, or *N. nucifera*), and the representative from the New World (*Nelumbo lutea*). The former is frequently known as the Egyptian lotus, quite another plant, and should more properly be called the Japanese lotus. It was highly prized by the ancients, and was described by Theophrastus as growing spontaneously along the Nile, although not known to occur there at the present time. It is highly prized by both the Chinese and Japanese, and many forms, differing in color, have originated through the latter people. It is one of the most striking features of a water garden, its large peltate leaves, with the luster of satin, standing well out of the water, and swaying in every breath of air, presenting beautiful modulations of green. The large flowers ranging in different forms from the deepest pink to white, add a feature which must be wanting if this flower is left out. It is perfectly hardy and spreads rapidly; in fact it must be checked if its natural enemy the muskrat does not do this unasked, and sometimes too thoroughly. The American lotus (*Nelumbo lutea*) resembles its Japanese relative in general habit, but is far less attractive, its yellow flowers being eclipsed by its more showy rival.

All of the lilies referred to above are of the hardy sort and will withstand the rigors of our winters, of course with the natural protection of the water around them. There is another large class of water lilies which have been derived from species inhabiting tropical or warm-temperate climes. As the artificial heating of the water, especially during the early summer and spring, is of prime importance here, it is necessary to have constructed a tank or pond in which the water supply may be controlled, and the temperature raised considerably above that at which the hardy sorts will thrive. The construction of such a tank or pond is purely a mechanical process, and hardly enters into the scope of this lecture. Provided with a proper tank or pond, however, what shall we put into it in the shape of water lilies?

The tender water lilies available for this purpose are divided into two groups, one group containing those flowering in the day time, while the other comprises those in which the flowers appear at night. Taking up the day-bloomers first, one of great interest is the blue lotus of the Nile (*Castalia coerulea*), with light-blue flowers. Another and closely related species is the Cape of Good Hope lily (*Castalia capensis*, sometimes known as *C. scutifolia*), also with light-blue flowers. Still another of this day-blooming group is the Zanzibar lily (*Castalia zanzibariensis*), with fragrant flowers of the deepest blue. This is one of the best, a free bloomer and of easy culture. A marked form of this is the variety *rosea*, in which the flowers vary from carmine to pink. Among the hybrids of the day-blooming kinds *pulcherrima* and *Wm. Stone* are of great merit among the blues, while *Mrs. C. W. Ward* is a superb pink.

Among the night-blooming kinds we have the old favorite, and one of the first to attract attention, the Devonshire lily (*Castalia devoniensis*). It originated in the gardens of the Duke of Devonshire, hence its name. It is one of the best, being a free bloomer and of easy culture, with flowers of a brilliant rosy-red and sometimes a foot across. The Egyptian white lotus (*Castalia Lotus*) and the African white lotus (*Castalia Lotus dentata*) are both desirable sorts with white flowers. Another, a hybrid, is *Castalia Sturtevantii*, and very desirable. Its flowers are large and more cup-shaped than is usual in this type of lily. Others which may be used are *Castalia Omarana*, and a seedling variety derived from it, *Castalia George Huster*.

In addition to the water lilies, there are other aquatic plants which may be introduced into the collection. The blue water hyacinth (*Piaropus azurea*, commonly known as *Eichhornia azurea*) is a rampant grower, sending out its long stems in all directions. It is a free bloomer, its flowers being borne in large masses resembling in shape those of the hyacinth, hence its popular name. Another is the water hyacinth proper (*Piaropus crassipes*), of evil repute in Florida waters, with a more tufted habit and lavender flowers, and the petioles of the leaves swollen into large spongy organs which serve to keep the plant afloat. The water snowflake (*Limnanthemum indicum*), with its white star-like flowers, and



e natural pond, showing the background of woods, the Japanese lotus thoroughly at home.

the fairy water lily (*Limnanthemum trachyspermum*), also with white but smaller flowers, are useful. The water poppy (*Hydrocleys nymphoides*) is desirable for its bright-yellow flowers, and the parrot's feather (*Myriophyllum proserpinacoides*) is a charming plant, its feathery green foliage forming masses upon the surface of the water. The water lettuce (*Pistia Stratiotes*), that odd member of the same family to which our jack-in-the-pulpit belongs, forms floating masses of a peculiar light-green, and is welcome for this reason and for its oddity, All of the above are, unfortunately, tender and require the protection of a greenhouse during the winter, with the exception of the parrot's feather, which is hardy in water which does not freeze to the bottom.

If one has succeeded in growing the ordinary tender water lilies, his next ambition is to grow the queen of all aquatic plants, the royal water lily, *Victoria*. This, too, prefers the night in which to open its fragrant flowers, perfuming the air with an odor reminding one much of the pine-apple. Of this there are two species, one growing in the slow streams and lagoons from British Guiana to the Amazon region, and known as *Victoria regia*; the other a native of similar habitats in Paraguay, and called *Victoria Cruziana*, or usually by the much more recent name of *Victoria Trickeri*. The latter, being from a more southern region, and hence cooler, is much easier to grow than the former. For success with *Victoria regia* a temperature from eighty to ninety degrees must be maintained. For *Victoria Cruziana* success may be assured with a temperature considerably below this, but even then a little heat early in the summer, particularly if several days of cool weather occur, does not come amiss, and your plant will respond gratefully to this little attention. A noticeable difference in the two species is to be seen in the leaves. Those of *Victoria Cruziana* show the upturned margin, the unusual feature, almost as soon as they expand from the bud, even very young plants exhibiting this peculiarity. In *Victoria regia* the plant must have attained considerable size before this feature is in evidence, and each new leaf is slower in showing this development. For general purposes, therefore, it is better to choose, at least for the first experiment, *Victoria Cruziana*.

A digression here from the purely horticultural side to the historical may be of interest. The *Victoria regia* was apparently first discovered about the year 1801 by that unfortunate explorer, Haenke, who was sent out by the Spanish government to investigate the vegetable productions of Peru. He found it in the marshes by the side of the Rio Marmoré, one of the tributaries of the Amazon. There seems to have been no records preserved of Haenke's impressions on beholding this wonder of the vegetable world, but perhaps they were like those of Sir Robert Schomburgh, who, on behalf of the Royal Geographical Society of London, made extensive explorations in British Guiana in the year 1837. He remarks as follows: "It was on the 1st of January, 1837, while contending with the difficulties that nature interposed, in different forms, to stem our progress up the river Berbice (lat. 4 deg. 30 min. N., long. 52 deg. W.), that we arrived at a part where the river expanded, and formed a currentless basin; some object on the southern extremity of the basin attracted my attention, and I was unable to form an idea what it could be; but animating the crew to increase the rate of their paddling, we soon came opposite the object which had raised my curiosity, and, behold, a vegetable wonder! All calamities were forgotten; I was a botanist, and felt myself rewarded! There were gigantic leaves, five to six feet across, flat, with a broad rim, lighter green above and vivid crimson below, floating upon the water; while, in character with the wonderful foliage, I saw luxuriant flowers, each consisting of numerous petals, passing in alternate tints, from pure white to rose and pink. The smooth water was covered by the blossoms, and, as I rowed from one to the other, I always found something new to admire. The flower-stalk is an inch thick near the calyx, and studded with elastic prickles about three quarters of an inch long. When expanded, the four-leaved calyx measures a foot in diameter, but is concealed by the expansion of the hundred-petalled corolla. This beautiful flower, when it first unfolds, is white, with a pink center; the color spreads as the bloom increases in age; and, at a day old, the whole is rose-coloured. As if to add to the charms of this noble Water-Lily, it diffuses a sweet scent. As in the case of others in the same tribe, the petals and stamens pass gradually into each other, and many petaloid leaves may be observed bearing vestiges of an anther. The seeds are numerous, and imbedded in a spongy substance. Ascending the river, we found this plant frequently, and the higher we advanced, the more gigantic did the specimens become ; one leaf we measured was six feet five inches in diameter, the rim five inches and a half high, and the flowers a foot and a quarter across."

A lover of aquatics who has seen this queen of water lilies at its best in cultivation can appreciate the feelings of Schomburgh when he beheld this wonderful plant for the first time in all the beauty and novelty of its natural surroundings.

When the existence of this wonderful lily became known to the horticultural world, all were anxious to introduce it. The first perfect seeds which reached England were collected by Mr. Thomas Bridges, and were received at the Royal Gardens at Kew in 1846. The result from these seeds was two plants, which met an untimely end, after giving fair promise of success. Other attempts were made at introduction, both from seeds and from rootstocks, but all were unsuccessful. Finally, in 1849, seeds were secured at Kew from parties at Georgetown, Demerara. These arrived in excellent condition, and from them and several other consignments from the same parties about fifty plants were secured. One of these was sent to the famous gardens of the Duke of Devonshire, at Chatsworth. Mr. Paxton, of horticultural fame, was in charge of the gardens there, and to him belongs the honor of having flowered the *Victoria regia* in Europe for the first time, the first flower bud beginning to expand on the evening of November 8, 1849, marking the birth of this flower into the world of horticulture.

Now a word as to the enemies with which one must contend in his water garden. There is no pleasure unmixed with alloy, and the lover of aquatics cannot hope to escape this general law. He will find enemies on all sides, and these must be met and conquered. Perhaps his worst foe will be the wily muskrat. He may be caught in traps, or if too keen for this one may resort to shooting. The rootstocks of these plants seem to be very enticing to him, and this may be especially true of some choice and high-priced variety. He seems to be a connoisseur in such matters, and at times appears to select with unerring instinct the costly plants. The aphis, or green-fly, is sometimes troublesome, and is perhaps best disposed of by their natural enemy, the "lady bird." Syringing and spraying with tobacco water is also effective. Another troublesome pest is the leaf-miner, which makes unsightly furrows in the leaf surface. He can be pretty thoroughly exterminated with kerosene emulsion, applied in the same manner as with other plants. Fungous diseases, if they become troublesome, may be conquered with Bordeaux mixture.

To emphasize what I have said in the foregoing pages, permit me to call attention to the illustrations accompanying this article, which were made from photograghs taken some years ago by my father in his water garden at Clifton, New Jersey. On his place there was an old swamp full of tussocks and little pools of stagnant water, as old swamps are, and the breeding place of countless mosquitoes. The first illustration depicts this as it was. Taken in the winter time, it does not show the tangle of weeds which made this place unsightly during the summer. Through this swamp meandered a brook which had its origin in a swampy woods near by, and on either side gently sloping hillsides rose to the higher ground beyond. My father conceived the idea of developing this as a water garden, and I will let the succeeding illustrations tell the story of how well he succeeded in carrying out this conception. I will, however, add a word as to the general development of the tract. A dam was thrown across the lower end, backing the water up several feet. The tussocks were eradicated with the mattock, a laborious and costly operation, and one which experience has now shown can be done much more simply and with much less cost by merely keeping the leaves of the tussocks cut down as they appear at or near the surface, thus drowning the plants out, since such plants must have access to the air to live. The water of the pond thus formed was too cold for the more tender lilies and for the *Victoria regia.* That these might be grown, a cement pond, irregular in shape, was placed on one of the sloping sides of the swamp, sufficiently removed from the pond to permit the placing of a hot-water boiler between the two bodies of water. In the pond thus made were grown all the tender lilies and the *Victoria regia*, the latter to a perfection perhaps not surpassed elsewhere. I have spoken of the necessity of concealing the rim with plants in ponds artificially made. Let some of the photographs here reproduced illustrate how this may be done. The heating apparatus was placed in a small shed which was effectually concealed by the planting of vines, giving it the appearance of a mound near the water's edge.

This site was an ideal one for the purpose, but there are many others throughout the country equally well located. Here the two types of water garden were developed side by side : the one, the transforming of an old swamp into a beautiful lake by means of a dam ; the other, the creation of a pond out of a dry hillside by purely mechanical means and artistically concealing the mechanism.

Let me emphasize not only the beauty of water gardens, but their usefulness also. Old swamps, the breeding places of mosquitoes, and hence the birthplace of much malaria, may be transformed from these pest holes into objects of beauty — may be converted from tangles of bush and briar, and scattered pools of stagnant water, into little ponds or lakes, around whose margins may be grown some of the most beautiful of flowers, and whose waters may be decked with the daintiest and most attractive members of the aquatic plant world.

George V. Nash.

NOTES, NEWS AND COMMENT.

Dr. William L. Bray has resigned the professorship of botany in the University of Texas in order to accept the professorship of botany in Syracuse University, recently vacated by Dr. J. E. Kirkwood.

Mr. Homer D. House has resigned the associate professorship of botany and bacteriology in Clemson College, South Carolina, and will spend the coming year at the Garden.

Mr. Elmer D. Merrill, Chief Botanist of the Bureau of Science, Manila, Philippine Islands, spent some time at the Garden during September examining the Philippine collections.

Volume 25, part 1, of the North American Flora, appeared August 24, 1907. It contains descriptions of the family Geraniaceae by Miss L. T. Hanks and Dr. J. K. Small, the Oxalidaceae and Linaceae by Dr. J. K. Small, and the Erythroxylaceae by Dr. N. L. Britton.

Mr. Oakes Ames, of North Easton, Mass., well known as a student of the Orchidaceae, has presented his valuable collection of living orchids to the Garden. This collection is the result of many years work. It contains many valuable plants, some of great rarity, and is a valuable addition to the orchid collection of the Garden. A detailed account of this collection will appear in a later number of the Journal.

Some recent visitors. — Dr. J. N. Rose, of the National Herbarium, Washington, D. C.; Mr. J. L. Sheldon, of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.; Dr. E. W. Brown, of Mt. Kisco, N. Y.; Mrs. Flora W. Patterson, of the Department of Agriculture, Washington, D. C.; Mr. William Dilger, Assistant Commissioner of Parks, Detroit, Mich.; Miss A. Lens, of Utrecht, Holland; and Mr. W. G. Cowell, of Auburn, N. Y.

The collection of Agaves has recently been supplemented by a large plant of the species which grows on the island of Culebra, where it was studied by Dr. Britton in the spring of 1906, at which time he enjoyed the hospitality of the Naval Station, then in charge of Commander B. T. Walling. It was not practicable at that time to get a large plant shipped to New York, but Commander Walling thoughtfully left a memorandum with his successor, Commander G. R. Salisbury, who, in July, had one of these interesting plants boxed and sent to Norfolk, Virginia, on a government vessel, from which point it was shipped by freight and received at the Garden later in the month.

Meteorology for August. — The total precipitation recorded for August was 2.59 inches. Maximum temperatures were recorded of 92° on the 8th, 89.5° on the 18th, 89° on the 21st, and 80° on the 29th; also minimum temperatures of 62° on the 10th, 52.5° on the 15th, 55° on the 23d, and 50° on the 30th.

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. VIII OCTOBER, 1907 No. 94

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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Published for the Garden

At 41 North Queen Street, Lancaster, Pa.
by The New Era Printing Company

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JOURNAL

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The New York Botanical Garden

Vol. VIII. October, 1907. No. 94.

FURTHER EXPLORATION IN JAMAICA.

To the Scientific Directors,

Gentlemen: — In accordance with your authorization to continue botanical exploration in the West Indies, I sailed for the island of Jamaica on August 24, on the Royal Mail Steam Packet "Tagus," arrived at Kingston, August 29, was in the field until September 28, leaving Kingston that day on the "Trent" of the same line, and reached New York on October 2. I was accompanied by Mrs. Britton, who aided greatly in the collection and preservation of specimens.

On arriving at Kingston I at once called on the Hon. William Fawcett, Director of Public Gardens and Plantations, at Hope Gardens, and discussed with him plans for a month's work. He most obligingly detailed Mr. William Harris, Superintendent of Public Gardens and Plantations, to accompany us, and to this kind coöperation a large part of the success of the expedition is due, Mr. Harris's intimate knowledge of Jamaica and of its flora making field operations simple and without difficulties. Mr. Fawcett also spent nearly a week with us in the field and had plants and specimens sent to Hope from the field properly cared for. A kind invitation to breakfast the following morning with His Excellency, Sir Sydney Olivier, Governor of Jamaica, at King's House, gave me a delightful opportunity to discuss with him many features of our plans for field work, and I am grateful for his advice and suggestion; it was hoped that we were to have the honor of the governor's company in the mountains during the latter part of our trip, but official duties prevented the realization of this part of the program. We also discussed the tropical research laboratory at Cinchona, held by the garden under a lease from the Jamaican government, and it is most satisfactory to know that all damages to the buildings there, caused by the earthquake of last January, have been repaired by the government.

King's House, the gubernatorial residence, was wrecked by the earthquake to such an extent as to make it uninhabitable. I had learned that Sir Sydney and Lady Olivier had expressed some desire to occupy Cinchona for a time, the delightful and salubrious climate and the surpassingly beautiful mountain scenery of that part of Jamaica making it most attractive, and inasmuch as we have no students there at present I took great pleasure in requesting them on the part of the garden to use it as a residence.

The days August 29 and 30 were thus mainly occupied, though opportunity was taken to observe many interesting plants at Hope Gardens and in the gardens at King's House, and some botanical collecting was done on the hills near Constant Spring. I also found opportunity to read the proofs of my account of "The Sedges of Jamaica," written for the Bulletin of the Department of Public Gardens and Plantations and published as a supplement to volume 5 of that journal. This document will also be issued as No. 97 of "Contributions from the New York Botanical Garden."

The first region selected for exploration was the Santa Cruz Mountains, a range of limestone situated near the southern coast in the parish of St. Elizabeth, running northwest from the coast and reaching altitudes up to 2,580 feet, and the Pedro plains, lying between the mountains and the coast. Malvern, located on top of the range, was made the base of operations. We proceeded there by way of Mandeville, located on the Manchester Mountains, taking three days travelling by railway to Williamsfield and thence by carriage; considerable collecting was accomplished about Mandeville and on the way to Malvern, which was reached on the afternoon of September 2, and where we were joined in the evening by Mr. Fawcett and Mr. Harris, who had travelled by rail to Balaclava. The climate at both Mandeville and Malvern is delightful, the roads excellent and the accommodations good ; both are favorite resorts, both by Jamaicans and by tourists. The Manchester Mountains and Santa Cruz Mountains are separated by a low wide and hot valley ; the views from the mountain sides are most attractive and interesting and many of the plants seen were new to us, the climate being much drier than that of the parts of the island visited in 1906, and the vegetation conspicuously quite different. The most conspicuous floral feature was the low tree *Bauhinia porrecta*, of the Senna Family, covered with its showy white blossoms, its new leaves just unfolding. Several orchids and bromeliads were also of special interest. The vegetation of the summit and upper slopes of the Santa Cruz Mountains was studied at points all along from Lovers' Leap, a sheer cliff of 1,600 feet on the coast, to the inland end of the range, carriages being freely used in moving from one good collecting ground to another. Several tracts of woodland, not lumbered for many years, proved most attractive and yielded us specimens of many rare trees and shrubs. The special object of search on these mountains was the small tree *Peltostigma ptelеoides* of the Rue Family. This apparently extremely local species was obtained here in 1843 or 1844 by William Purdie, a collector sent to Jamaica from the Royal Gardens at Kew, England, and not since seen in Jamaica by botanists ; specimens of it are extremely rare, and were much needed in connection with the studies of Rutaceae by Mr. Percy Wilson for publication in the "North America Flora." We sought this tree for six days, examining a large area of the mountains, and were finally rewarded by finding it in considerable quantity on the southern side of a single wooded hill at Potsdam, nearly or quite at the summit of the mountain range. Our delight can be imagined, and the luck was quite equally divided, because while Mr. Harris was gloating over the prize near one end of the hill and endeavoring to make me hear him rejoice, I was experiencing quite the same enjoyment at the other, the two colonies being perhaps half a mile apart, though we subsequently found that they were irregularly connected. The tree was in young fruit and bore some of the old fruits of last year, but no flowers could be had, and a visit to the locality at another time of year, presumably in July, will be necessary to obtain them. We prepared a large number of herbarium specimens, cut down a tree for wood specimens, and pulled up seedlings, which were abundant, for growing at Hope Gardens and at the Bronx. Our thanks are gratefully tendered to A. E. Harrison, B. A., Head Master of the Potsdam School, and Mrs. Harrison for their aid and hospitality while exploring this woodland, which is fortunately the property of this well-known school, ensuring the preservation of the *Peltostigma;* also to Miss C. Gertrude Pearman who aided in the collecting of specimens there.

Lovers' Leap, already mentioned as a precipice at the coastal end of the Santa Cruz Mountains, is on the Yardley Chase estate, the property of Mr. W. Panton Forbes. The rock cliffs support a variety of interesting plants and we made a large collection there and in the vicinity. One of my principal objects in exploring the dry south side of Jamaica was to study the native cactuses and obtain additional specimens of them, and here we found one of the large species, the Jamaican *Pilocereus*, a branched columnar plant 15 feet high, in quite an unexpected position on the cliffs at 1,600 feet altitude. We had not previously observed it growing at more than 200 or 300 feet altitude above the sea, and I think this must be the greatest elevation known for any plants of this genus in the West Indies. Pedro Bay, situated across the Pedro Plains south of the Santa Cruz mountains, was described to us as a cactus region and three days were devoted to collecting there and in the vicinity; this work was made convenient and comfortable by the kindness of Mr. W. Panton Forbes who gave us the use of his cottage on the shore. This is a region of very low rainfall, and the cacti thrive exceedingly, forming extensive groves, though we found no different species from those growing along the coast near Kingston, though many other plants were of much interest, notably the rare wand-like shrub *Lasiocroton macrophyllus* of the Spurge Family, which grew in honeycombed limestone. We thought that we might find here the little yellow-flowered cactus *Mamillaria simplex*, of special nterest as the type of its genus, and which Grisebach credits to Jamaica in his "Flora of the British West Indies" as found by Dr. Patrick Browne about the middle of the eighteenth century and not since seen in Jamaica, but we were unsuccessful. Search and inquiry were also made here and later further west along the coast for two other rare or perhaps dubious plants of Jamaica, one a Cycad, *Zamia integrifolia*, accredited to Jamaica by Grisebach "in arid places along the coast," on the evidence of a specimen in the museum at Kew, the other a low palm with prickly leaf-stalks, *Copernicia tectorum*, the occurrence of which in Jamaica is also indefinite.

The work on the Santa Cruz Mountains was brought to a close on September 11 by a visit to the forests on the Stanmore Hill estate, toward the northwestern end of the range, from which we had been driven out by rain on a previous visit a few days before. Permission to explore these interesting woods had kindly been given by the proprietors, the Hon. John V. Calder and Mrs. Calder, who have carefully preserved them in a natural state; they contain many rare or unusual trees, some of which were in bloom at the time, and some are probably new to science. One of the most interesting is the tall Smooth Mountain Pride, *Spathelia glabrescens*, with its columnar unbranched trunk over sixty feet high, crowned by a tuft of pinnately compound leaves, of which we secured the fruit, hitherto unknown. These Stanmore Hill woods will well repay further exploration, inasmuch as we observed a number of trees in leaf only which neither Mr. Harris nor I could recognize.

Our second base was made at Newmarket, a small market town at an elevation of about 1,150 feet, located near the boundary of the parishes of Saint Elizabeth and Westmoreland, conveniently situated for the exploration of the morass and coastal regions of western Saint Elizabeth and eastern Westmoreland and the hills adjacent. We travelled to Newmarket from Malvern by way of Black River, a seaport town where parts of two days were given to a study of the coastal flora. Our thanks are gratefully tendered to Dr. A. R. Todd for information, and for guidance to Longacre Point west of Black River, and vicinity, where considerable collections were made, perhaps the most interesting plant being a tall palm of the sand dunes, a species of *Thrinax*, known there as Bay Thatch and Pimento Thatch, with bright green, stiff leaves, apparently quite different from the *Thrinax excelsa* of the hills and mountains ; good fruiting specimens and a number of seedlings were secured. A morass on the property of Dr. Todd yielded many interesting marsh plants, and in a ravine along the road on the way to Newmarket we collected some hillside species not elsewhere observed.

Newmarket was made a base of operations from September 13 to September 21. Collections were made in the immediate vicinity and in the hills of eastern Westmoreland especially about Darliston and Beaufort where we found a very interesting flora. This region is much wetter than the Santa Cruz Mountains, and showers were experienced nearly every afternoon. A fine bromeliad of the genus *Hohenbergia* was abundant on trees and good living specimens of it were obtained ; it is either a rare or undescribed species and is an important addition to our collection of these interesting air-plants ; several fine orchids were also secured and a large flat-stemmed drooping cactus of the genus *Rhipsalis* growing on rocks and trees was a prize which pleased us greatly. Several species of trees were new to us, and the cabbage palm and long-thatch palm grow there in great perfection and large size. We are indebted to Mr. H. W. Farquharson for permission to explore the woodlands on his Hopeton estate near Darliston, where a rare leafless ground orchid, perhaps new to science was obtained.

From Newmarket two trips were made by carriage to the lowlands. One of these was to the valley of the Black River at Lacovia, where we secured the services of a negro with a dug-out canoe and explored the river-banks for about two miles above the town. The stream is arched over by many kinds of tropical trees with vines hanging from them, and the experience was a delightful one, although obtaining specimens from the canoe was not without difficulty. Another of the long-sought Jamaican trees was found here in considerable abundance ; this is the leguminous species described by Grisebach under the name *Crudya spicata*, previously recorded as growing in the great morass of Westmoreland ; it has pinnate leaves and large, flat roundish pods. A fine white-flowered *Crinum* grows in the muddy banks and specimens for cultivation were obtained. On the same day we visited Mr. M. H. M. Farquharson's estate, Cornwall, near Lacovia, in order to see the pond where the Yellow Lotus of Jamaica (*Nelumbo*) was known to grow; we were received with great cordiality, and Mr. Farquharson personally conducted us to this interesting pond and marsh. The *Nelumbo* was both in bloom and in fruit; specimens were carefully prepared for comparison with the similar plant of the United States, and seeds, kept in water to make their germination likely, were taken for planting at Hope Gardens and at the Bronx. A number of other interesting marsh and pond-shore plants were collected here.

The other low-land expedition was to the Font Hill estate, near Luana Point, a few miles west of Black River. Dr. Todd had kindly arranged with Mr. Charles E. Isaacs, in charge of this estate in the absence of the owner, the Rev. Samuel Spencer-Smith, that we might breakfast with him, and we were given delightful hospitality. Our collecting here was mostly on the coastal sands and rocks and we had an excellent opportunity to study the littoral flora.

We left the Newmarket base on the morning of September 22, and drove to Bluefields, passing through the beautiful ravine known as Tea Gully, which abounds in ferns and mosses, and from Bluefields to Black River, collecting some specimens along the way. The next day we drove from Black River to Lacovia, passing along the western side of the large morass at Middle Quarters. An elegant tall palm, resembling the cabbage and royal palms, had been observed by us in this morass on our previous trip to Lacovia, but access to it at that time seemed impossible. On this occasion, however, a tree was seen in flower and fruit at no great distance from the road, and after securing the guidance of a negro who could climb trees, I finally made my way to it through the swamp and was ultimately rewarded by securing good specimens, including seeds for planting, together with material of other marsh plants not previously seen by us.

Arriving at Lacovia, we sent the carriage along some five miles to Santa Cruz, and made a further study of the banks of the Black River, this time in a rowboat belonging to Mr. Farquharson, and ascended the stream for about seven miles to Elham wharf, where we arrived at dark; our special search was for the vine *Combretum Jacquini*, another rare Jamaican plant, the peculiar four-winged fruits of which we had found floating on the water during our previous canoe-trip; we finally encountered the vine just about dusk, a short distance below Elham wharf, but could obtain only its foliage, its flowering time being evidently earlier in the year. We reached Santa Cruz during the evening.

Return from those interesting regions was made by way of Mandeville, where we arrived on September 24, reaching Kingston the next day. September 26 and 27 were passed at Hope Gardens in the delightful hospitality of Mr. Fawcett. The last collecting done was in the valley of the Hope River, below August Town, where Mr. Fawcett, Mr. Harris, and I spent the afternoon of September 27. Here we were also much interested in observing the land-slides caused by the earthquake of last anuary, on the sides of Long Mountain and Mona Mountain, where the Hope River runs through a narrow gorge, and where the fallen debris of rock and earth has dammed the stream, forming a long narrow lake.

The expedition has added much to the knowledge of the Jamaican flora and the plants and specimens secured are important additions to our collections. Nearly 1,000 field numbers represent some 2,000 specimens for the museums, herbarium and greenhouses, and, in addition to these, are the collections made by Mr. Harris, of which we will receive the duplicates. The work was made possible by the kind liberality of Mr. D. O. Mills, President of the Garden.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

THE ABSENCE OF UNDERGROWTH IN THE HEMLOCK FOREST.

The contrast in the character of the forest floor in evergreen and in deciduous forests is a familiar fact. In a forest where narrow-leaved, evergreen conifers predominate the floor is almost wholly devoid of the shrubs and herbs of low habit, which form so conspicuous a feature of the floor in a forest of broad-leaved, deciduous trees. In walking through a hemlock forest for example, one passes unhampered over a carpet formed of the dry, brown, fallen leaves. This leaf-cover is broken only at irregular and rare intervals, and usually where the sun has easy access, by small groups or isolated individuals of herbaceous plants. But, walking through a deciduous forest, one can often scarcely take a step without treading on the green herbs.

In the photograph (Fig. 34) this contrast is shown in a striking manner. The picture was taken from a path that passes through the forest near the recently constructed rubble bridge. The area to the left marks the edge of the hemlocks, that to the right the beginning of the deciduous trees. Under the conifers there is a practically entire absence of shrubs and herbs, while under the broad-leaved trees they grow abundant and varied. *Falcata comosa*, *Parthenocissus quinquefolia*, *Rhus toxicodendron*, *Aster*, *Solidago*, *Ambrosia trifida*, *and Deringa canadensis* predominate. The boundary between the two types of floor is clean-cut and conspicuous, and the invitation it presents to strollers through the woods has been generously accepted. This is attested by the well-worn path along the edge of the undergrowth, and the path serves to further emphasize the contrast. Scarcely an herb is found in the area under the hemlocks. The illumination of the two areas, especially where they adjoin, is, to all appearances, practically the same.

This difference in the undergrowth of the two kinds of forest is probably due to a combination of causes. Difference in illumination may be a factor, but this alone cannot account for the difference, for the seedlings of the hemlock, which is a tolerant, or shade-bearing species, do not normally come to maturity

under the shade of the parent tree, nor of neighboring trees of that species. This fact suggests that conditions in the soil are also a factor. The suggestion is rendered all the more probable by the fact that hemlocks are frequently not among the plants growing in the open areas, and especially by the fact that hemlock seedlings readily develop under the white pine (*Pinus strobus*), so that the latter species is sometimes replaced by hemlock.*

The fact that white pine seedlings will not develop under hemlock may be explained, in part at least, by the fact that the white pine is an intolerant, or light-demanding, species. It fails to develop under the shade of oaks, chestnuts, etc., as well as under hemlocks, while hemlock develops easily under the shade of those species.

It has been asserted † that the seeds of hemlock "cannot germinate under the trees that bear them." This certainly is an erroneous notion as can be demonstrated by careful observation. In the hemlock forest in the New York Botanical Garden young seedlings may be observed in the spring in abundance under the trees, even to within less than a foot of the trunk. In no case however, has the writer ever found these seedlings attaining a height of more than eight or ten centimeters (three or four inches). Some cause interferes with their further development. Since the species is a tolerant, or shade-loving one, and since the seedlings may develop into vigorous saplings in the shade of a broad-leaved, deciduous forest, the conclusion seems warranted that their failure to develop near the parent trees is due partly to conditions in the soil.

It is a well-known fact that many plants, grown in a substratum of soil or other nutrient medium, excrete into the substratum substances that are deleterious to that species, so that it is difficult or even impossible, to grow a second or third crop of the same species in the same soil. Thus Livingston ‡ found that wheat seedlings grown in clean glass sand in which wheat had previously

* Pinchot, Gifford. A primer of forestry. Part I., p. 33. Washington, 1903.

† The Hemlock Grove on the Banks of Bronx River. Trans. Bronx Acad. Arts & Sci. 1, Pt. I.: 6. 1906. Also, Cont. N. Y. Bot. Garden, No. 83, p. 6. 1906.

‡ Livingston, Burton Edward, Bull. 28, Bur. of Soils, U. S. Dept. Agric. 1905.

grown for twenty-one days, attained a growth less than one half that attained by wheat seedlings similarly grown in clean glass sand not previously thus used. More recently Shreiner and Reed * have shown that "healthy growing plants excrete from their roots substances which have a deleterious effect upon the growth of the root."

It seems not improbable that in these facts may lie a partial explanation of the failure of hemlock seedlings to reach any considerable development under trees of the same species.

C. STUART GAGER.

A RARE SEEDLING AT THE PROPAGATING HOUSES.

Through the kindness of the Director of the Royal Gardens, Kew, we have been so fortunate as to secure several seeds of the wonderful "Tumbo," or *Welwitschia mirabilis.** The seeds were planted early in April, and at present there are two healthy seedlings, that give every indication of becoming strong and robust examples of their kind.

The upper half of the accompanying photograph (Fig. 35) shows the first two seed-leaves, or cotyledons, as they are called. These are narrow spatulate leaves about one and one half inches long

* Shreiner and Reed, Bull. Torrey Club 34 : 279. 1907.

† Owing to an unfortunate error the above name cannot be used for this plant. In a letter to the Linnaean Society, Dr. Welwitsch, its discoverer, suggested that it be called *Tumboa*, from its vernacular name of "Tumbo." To this Sir Joseph Hooker demurred. He asked, and received, permission from Welwitsch to name it *Welwitschia mirabilis*, in honor of its collector.

Shortly afterward a Mr. T. Baines sent in some plants that were erroneously supposed to be different from the plant of Welwitsch, and temporarily received the name of *Tumboa Bainesii*, during the discussions of the society. The results of this controversy were published in the regular minutes of the society, appearing in the Gardeners Chronicle, together with a note to the effect that the plant was subsequently to be described by Hooker in the Transactions of the Linnaean Society. Two years later a comprehensive monograph was published, in which the Welwitsch and Baines plants were proved to be identical. The name, as previously decided upon, was *Welwitschia mirabilis*, but, according to the rules of nomenclature now in use, a name once allowed to slip into print is considered a definite publication, whether it was the intention to really name and describe the plant or not.

We must in the future, therefore, refer to this remarkable plant as *Tumboa Bainesii.*

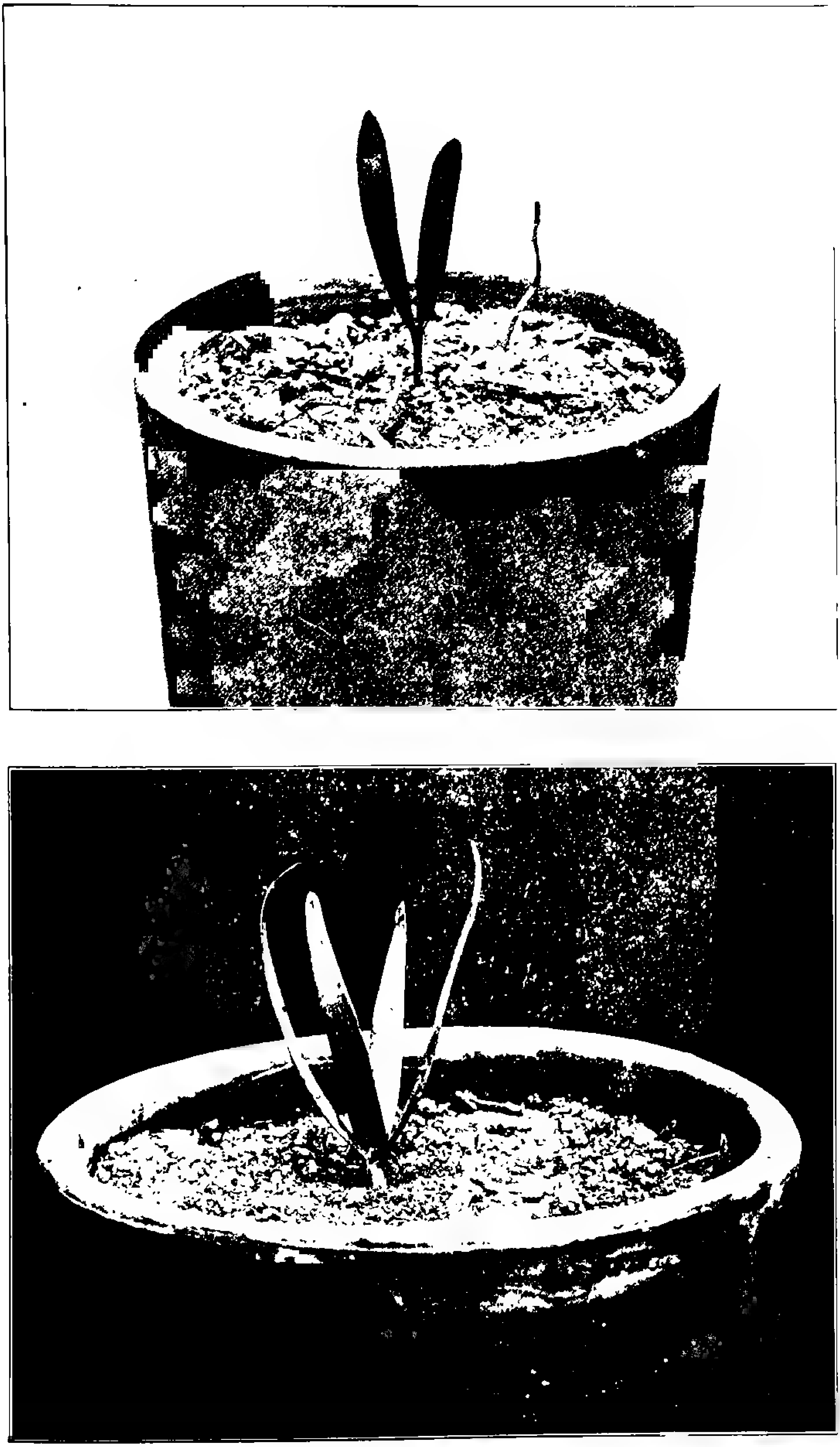

FIG. 25. Seedling of *Tumboa Bainesii.*

and three eighths of an inch broad. In the original description of the plant it is stated, on the authority of Welwitsch, its discoverer, that these are the only leaves that are ever produced during the conjectural one hundred years of the plant's life. This was a somewhat gratuitous assumption, as neither Dr. Welwitsch nor Sir Joseph Hooker had ever seen a seedling.

What really happens is that after the seed-leaves are about a month old, a second pair of leaves springs out from between the first, and opposite them. These later ones develop into the only adult leaves that the plant ever produces. The lower figure shows the two pairs of leaves when the plant is about six months old.

One is apt to question, in view of these pictures and the description, why the plant should ever have been called remarkable; for at this stage it seems to be a very ordinary little seedling. Little does one suspect that this inconspicuous plantlet will develop into a gigantic vegetable monstrosity, weird in its unique ugliness, and well deserving the discussion and amazement that its discovery occasioned.

The mature "Tumbo" * is a "tree" with a "trunk" about two feet long shaped much like an inverted cone. Almost all the "trunk" is below the surface of the ground, the visible part rarely exceeding a few inches. But the remarkable feature of the stem is that it is often fourteen feet in circumference, and becomes more or less two-lobed in age. The stem looks more like a great mass of "the burnt crust of a loaf of bread," to quote Dr. Welwitsch's letter, than the trunk of a tree. The underground portion becomes greatly elongated and its continuation is the tap-root of the plant. This goes down several feet, in its effort to get the few drops of water that the arid conditions of the country permit.

There are never more than two leaves after the seed-leaves drop off, and very curious leaves they are. Starting from a groove on opposite sides of the depressed mass, they stand straight

* "Tumbo" is also a name used for a number of other plants in Portugese West Africa. There are also several other names applied to our plant, notably "Ghories" (Hottentot) and "Nyanka-Hykampop" (Damara).

out on both sides of the plant. They are often six feet long and two feet wide and usually split into ribbons that undulate over the ground in a way strikingly suggestive of the tentacles of an octopus. With its great ugly body and its tentacle-like leaves, it is no wonder that it should have been the most remarkable plant novelty of the last century. The flowers are borne in scarlet cones on a cymose inflorescence coming from the crown of the "trunk." *

Tumboa Bainesii belongs to the Joint-fir family, or Gnetaceae, and is known only from Portugese West Africa and Damara Land. This is a region that seldom gets any rain, and desert conditions prevail almost completely, except for the sea fogs. The "Tumbo" is thus a desert plant *par excellence* and it is only by a close approximation of these very arid conditions that we can hope to cultivate it. It is exceedingly rare in cultivation and there seem to be scarcely any recorded cases of its successful germination under glass, nearly all the previously cultivated specimens having been brought directly from Africa.

NORMAN TAYLOR.

NOTES, NEWS AND COMMENT.

Dr. C. B. Robinson, assistant curator, spent two or three weeks of his summer vacation in making collections at the Bay of Seven Islands, Saguenay, Quebec.

Mr. Allen H. Curtiss, well known as a collector and student of the plants of the southern United States and of the West Indies, died in Jacksonville, Florida, on September 1, in the sixty-third year of his age.

Mr. W. D. Hoyt, of Baltimore, Maryland, spent some time at the Garden during September and October examining the collections of marine algae.

Dr. Heinrich Hasselbring, assistant in botany in the University of Chicago, has been appointed assistant botanist at the Cuban Agricultural Experiment Station, at Santiago de las Vegas.

* There are good illustrations of *Tumboa Bainesii* in the Botanical Magazine and in the Transactions of the Linnaean Society of London for the year 1863.

An international conference on plant hardiness and acclimatization was held in this city October 1, 2 and 3, under the auspices of the Horticultural Society of New York. On October 3 the members of the conference were guests of the garden; the forenoon being devoted to the reading of papers and the afternoon to the inspection of the collections. Luncheon was served in the laboratories.

A very interesting fungus was recently presented to the garden by the China and Japan Trading Company, of this city. A bale of cotton cloth, made in this country, stored for a year in Shanghai, China, and lately returned to New York by a Suez steamer, was wet in the voyage home, and, standing in the warehouse of the company here, developed the fungus. The fruit-body is about ten inches broad, six inches long, and four inches high. It consists of a mass of pure white, overlapping, leaf-like portions arising from a common point of attachment on the outside of the bale and connected with the vegetative portion of the fungus (mycelium), which permeates the inside of the bale in the form of numerous minute white threads. The plant is readily recognized as belonging to the genus *Pleurotus*, of the fleshy fungi, but the species has not yet been determined.

Some Recent Visitors. — Professor C. F. Austin, of the Cuban Agricultural Experiment Station; Mr. P. L. Ricker, of the National Herbarium, Washington, D. C.; Mr. Charles E. Monroe, of Milwaukee, Wis.; Major E. W. Woodward, of Oakland, Cal.; Mr. H. C. Irish, of the Missouri Botanical Garden, St. Louis; Professor N. E. Hansen, of Brookings, S. D.; Mr. E. M. East, of New Haven, Conn.; Mr. W. H. Evans, of Washington, D. C.; Professor W. A. Munson, of Morgantown, W. Va.; Professor H. L. Hutt, of Guelph, Canada, and W. T. Macoun, of Ottawa, Canada.

Meteorology for September. — The total precipitation for the month was 7.93 inches. Maximum temperatures were recorded of 80° on the 1st, 81° on the 7th, 85° on the 15th, 89° on the 21st, and 79° on the 23d; also minimum temperatures of 59° on the 7th, 55° on the 13th, 53° on the 19th, and 34° on the 27th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

58 specimens of mosses from Salisbury, Connecticut. (By exchange with Mr. Geo. E. Nichols.)

77 specimens of ferns and flowering plants from tropical America. (By exchange with the U. S. National Museum.)

1 specimen of *Gentiana Douglasiana* from British Columbia. (Given by Professor James Fletcher.)

2 specimens of *Androsace* from New Mexico. (Given by Professor E. O. Wooton.)

17 mosses from Hayti. (By exchange with Mr. F. Renauld.)

9 specimens of flowering plants and ferns from New Jersey. (Given by Mr. Macy Carhart.)

3 specimens of flowering plants from Canada. (Given by Mr. J. M. Macoun.)

19 specimens from Colorado. (Given by Mr. H. L. Shantz.)

1 specimen of *Rosa Maximiliani* from Colorado. (Given by Professor T. D. A. Cockerell.)

2 specimens of mosses from Madagascar. (By exchange with Mr. F. Renauld.)

4 specimens of *Solidago* from Staten Island. (Given by Dr. A. Hollick.)

1 specimen of *Quercus* from Connecticut. (Given by Professor L. M. Underwood.)

2 specimens of fungi from Bronx Park. (Collected by Mr. R. C. Benedict.)

5 specimens of fungi from Redding, Conn. (Given by Professor L. M. Underwood.)

10 specimens of fungi from Connecticut. (Collected by Mr. R. C. Benedict.)

3 fungi from the Conservatories of the New York Botanical Garden. (Collected by Dr. W. A. Murrill.)

12 specimens of fungi from Ithaca, New York. (Given by Mr. C. J. Humphrey.)

1 fungus from Maine. (Given by Mr. C. C. Hanmer.)

1 fungus from China. (Given by the China and Japan Trading Company.)

1 specimen of *Porodiscus pendulus* from Guatemala. (Given by Prof. W. A. Kellerman.)

50 specimens of fungi from North Carolina. (Given by Miss Gertrude S. Burlingham.)

PLANTS AND SEEDS.

1,530 orchids for conservatories. (Given by Mr. Oakes Ames.)

6 plants for conservatories. (Given by Mrs. H. L. Britton.)

14 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 plant for conservatories. (Given by Commander Salisbury.)

5 plants for conservatories. (By exchange with La Mortola Gardens, Italy.)

10 plants for herbaceous grounds. (Collected by Mrs. E. G. Britton.)

10 plants for conservatories. (Given by Mr. Pratt.)

8 plants for conservatories. (Given by Miss Helen M. Gould.)

5 plants for conservatories. (By exchange with Bureau of Plant Industry, U. S. Department of Agriculture.)

9 plants for conservatories. (Given by Mr. E. F. Cabada.)
13 plants for conservatories. (Given by Mr. F. F. von Wilmowsky.)
3 plants for conservatories. (Given by Dr. Hochreutiner, Geneva, Switzerland.)
1 plant for conservatories. (Given by Mr. A. Müller.)
67 plants for nursery. (Collected by Mr. R. C. Benedict.)
1 plant for nursery. (Given by Mrs. J. E. Messenger.)
1 plant for conservatories. (Collected by Mr. W. E. Broadway, Trinidad.)
6 plants for conservatories. (Given by Mr. Gilbert A. Albury.)
1 plant for conservatories. (Given by Mrs. Beckwith.)
6 plants for conservatories. (Given by Mr. G. E. Barre.)
1 packet of seed. (Given by Dr. Hochreutiner, Geneva, Switzerland.)
4 packets of seed. (Given by Mr. F. F. von Wilmowsky.)
2 packets of seed. (Given by Dr. H. H. Rusby.)
2 packets of seed. (By exchange with Dr. C. F. Baker, Cuba.)
316 plants derived from seed from various sources.

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Vol. VIII NOVEMBER, 1907 No. 95

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assistant

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PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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THE BOULDER BRIDGE.

The bridge built during the last year on the site of the old wooden structure across the Bronx River at the northern end of the hemlock grove, was completed in September, under the contract awarded by the Commissioners of Parks on October 18, 1906, to M. J. Leahy. It consists entirely of boulders, selected from old stone walls, and unearthed during grading operations; very nearly all these stones are trap-rock (diabase), brought by the glaciers of the ice-period from the Palisades of the Hudson, which lie directly in the line of the glacial movement, as evidenced by grooves cut in the ledges of gneiss and schist, so abundantly exposed in parts of the Garden grounds and beautifully illustrated on the ledges along the western side of the valley of the herbaceous garden, where a path has been laid so as to cross one of these exposures. At this point the direction of the glacial groovings is seen to be a few degrees to the east of south, and this line continued northward would strike the Palisades about opposite Yonkers. These trap-rock boulders are the most abundant large stones in the glacial drift of Bronx Park and the surrounding country, and in places they are exceedingly numerous, so abundant in fact as to make grading operations difficult and expensive. During our first grading work we hauled a great many of these boulders into low grounds which had to be filled, but it occurred to us several years ago that a bridge might be built of them, and Mr. John R. Brinley, landscape engineer of the Garden, made a study for such a structure, which was subsequently approved by the Board of Managers, by the Commissioner of Parks, and by the Art Commission. After this had been determined, the boulders were saved rather than buried, and the result is now to be seen, complete, in so far as the stone work is concerned. The bridge is unique, we believe, for this part of the country, and it fits into its natural surroundings as well, or perhaps better, than any other type of structure would have done. The total length of the bridge is 172 feet, the width of the pathway across it 15 feet, and the three central arches and the two arches at the ends of the bridge are 16 feet wide. In order to insure sufficient area in the cross-section of the valley for freshets, the bridge has been built eight feet higher in the center than the wooden structure which it has replaced, and, as a further precaution, the path approach from the east will be built at a low elevation in order to permit flood water to pass over it, which is not apt to happen more than once in several years, and it may be that the arches will take it all even at the periods of greatest flood.

The bridge foundations rest, like those of the three driveway bridges, on a stratum of gravel and coarse sand which underlies the whole northern end of the Garden from the lakes to Williamsbridge at just about the same level, being some six feet below the surface of the river at average flow. The presence of this excellent material on which to build these heavy structures is very fortunate, and no better basis could be desired; a careful inspection of the three driveway bridges shows no trace of settling in any of them.

The method adopted by Mr. Leahy for building the arches in such a way as to get a boulder finish on the under-side was ingenious. The wooden centers were first erected and the boulders were placed in a layer of sand about six inches thick and thoroughly groutted together with strong cement; after this had set, and the centers were taken away, the sand fell to the ground, leaving from four to six inches of the underside of the stones exposed, when a small amount of trimming of the rough cement edges gave the desired finish. The beauty of this, and indeed of the entire structure, is largely due to the care and ingenuity of Mr. John Baxendale, the foreman of the work; scarcely any of the boulders have been nicked or otherwise damaged, and Mr. Brinley's design has been carried out most accurately.

A temporary earth and ash path has been laid across the bridge so that it can be used, and a permanent surface, with path approaches, may be built next spring after the filling needed at the east end and between the arches has settled down. Mr. Brinley's landscape design for the surroundings of the bridge calls for an excavation under the eastern of the three larger

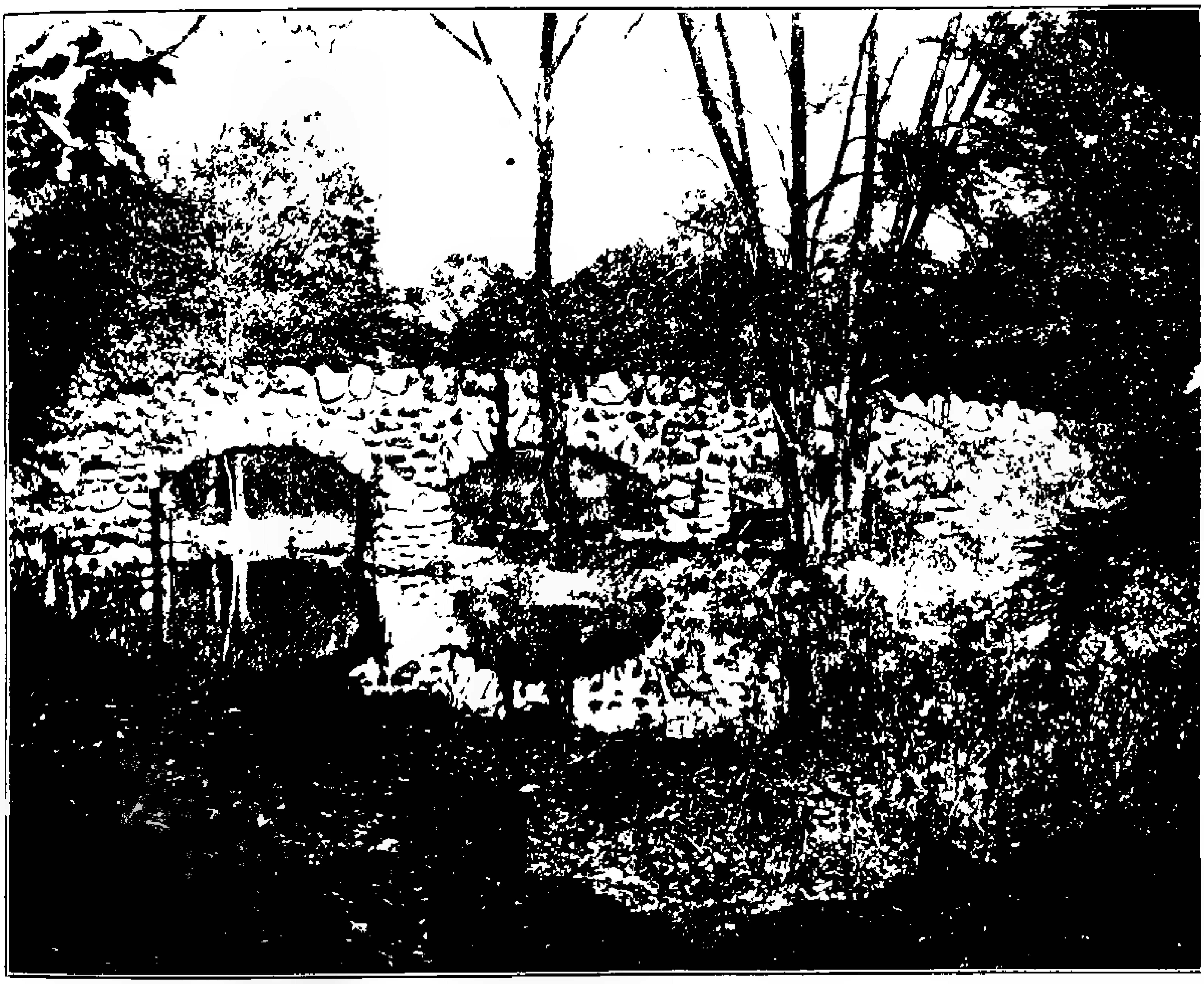

FIG. 36. The Boulder Bridge.

arches so as to permit the river to flow through all three of them, and the continuation of this excavation southward through a swale leaving a narrow island, about two hundred feet long, south of the bridge: the plan also contemplates the excavation of the marshy ground north of the bridge on the east side of the river for the establishment of a small lake to be used for water-lilies and other aquatic plants, the cultivation of which at this point, however, can only be satisfactorily accomplished when the river valley is freed of muskrats, on which a more or less continuous war has been waged for several years and large numbers of the animals taken by traps, but, while less numerous than a few years ago, they are still very troublesome, and find in the rootstocks of *Castalia* one of their favorite foods.

The contract price for the bridge was eleven thousand dollars; the cost of path approaches, excavation for the river, and for the pond, will probably amount to fifteen hundred or two thousand dollars.

N. L. Britton.

THE AMES COLLECTION OF ORCHIDS.

In the September number of this Journal reference was made to this valuable collection of orchids, recently acquired. The collection has now been temporarily arranged so that it has been possible to study and briefly describe it.

Early in September Mr. Oakes Ames offered this collection to the Garden, and the writer immediately went to North Easton, Mass., to superintend its proper packing and transportation. This work was greatly facilitated by the assistance of Mr. Ames, who not only gave his own time in going over the collection and carefully inspecting the labels, furnishing such as were missing, but also the service of his men in packing and shipping the plants. The collection was, until last summer, located at his greenhouses at North Easton. At that time, however, it was removed to a range of houses located some five miles from that place. To transport over this distance a collection of such size was not a small undertaking. It took six wagon-loads to accomplish it, the wagons being arranged to accommodate two tiers on each trip. Arrangements were made with the railroad company for a freight car which was placed on a siding. Staging was placed in the car, as the floor space was by no means adequate to accommodate the collection. Two tiers of staging were placed in one end and one in the other, and the smaller plants, packed in boxes, were placed on these. The larger plants were packed in hay on the bottom of the car. Unfortunately the selection of the car was a poor one, as it broke down in transit, and was located in a disabled condition at New Haven, where the contents were transferred to another car. The collection finally reached the Garden just one week after its shipment, fortunately suffering no harm whatever from the delay.

Owing to the crowded condition of the conservatories, this collection has been divided, a part of it, mainly the venus's-slippers (*Paphiopedilum* and *Phragmidepium*) and the cattleyas, being placed on the central bench in house no. 15 of the conservatories, while the remainder, for the present, is located in house no. 3 of the propagating range.

This collection, brought together at much expenditure of time and money, hardly needs comment as to its value. It is exceedingly rich, not only in genera and species, a feature of especial interest to a botanical garden, but also in hybrids, among which may be numbered some of great beauty and rarity. Among other interesting plants are many secured by Mr. Ames in his personal explorations in Cuba and in the southern parts of Florida, or by collectors whom he sent out especially in search of orchids. Many things have come to him from Mexico and other parts of Central America; and from the Philippines he has received many plants, some of these being the types of new species which Mr. Ames has recently described. All these interesting and valuable species are included in the gift to the Garden.

The collection is particularly rich in forms from the New World, this region being represented by about fifty-five genera and over four hundred species and varieties. Among the New World genera rare in cultivation are, among others, the following: *Hexadesmia*, *Schlimia*, *Mesospinidium*, *Aspasia*, *Trichocentrum*, *Trigonidium*, *Lockhartia*, *Cirrhaea*, *Amblostoma*, *Scuticaria*, *Dichaea*, *Lanium*, *Eriopsis*, and *Anguloa*. Those from the New World which are represented by five or more species or varieties are the following: *Maxillaria*, 24; *Cattleya*, 72; *Epidendrum*, 65; *Miltonia*, 7; *Schomburgkia*, 5; *Oncidium*, 40; *Sobralia*, 5; *Stanhopea*, 8; *Odontoglossum*, 22; *Brassavola*, 5; *Laelia*, 26; *Lycaste*, 10; *Phragmipedium*, 53; *Pleurothallis*, 17. This will indicate the value of the collection for a comparative study of forms from the new world.

The Old World is also well represented by about thirty-one genera and three hundred and sixteen species. Among those unusual in cultivation are: *Ceratostylis*, *Mystacidium*, *Spathoglottis*, *Listrostachys*, *Tainia*, *Neobenthamia*, *Otochilus*, and *Oberonia*. The following genera are represented by five or more species or varieties: *Eria*, 13; *Cirrhopetalum*, 10; *Sarcanthus*, 5; *Cymbidium*, 12; *Platyclinis*, 5; *Bulbophyllum*, 25; *Angraecum*, 14; *Coelogyne*, 20; *Dendrobium*, 52; *Vanda*, 11; and *Paphiopedilum*, 108. The genus last named contains the largest representation in the whole collection, and embraces some plants of great value, now rather difficult to obtain.

Of genera which are common to both the Old World and the New are: *Polystachya*, *Liparis*, *Vanilla*, *Spiranthes*, *Eulophia*, and *Microstylis*.

The entire collection contains about 1,530 plants, representing nearly 100 genera and about 750 species and varieties. A number of the genera and many of the species were not previously in the Garden collections. It is hardly necessary to state that the acquisition of this material adds greatly to the value of the Garden collections, not only for the purposes of study, but also from the viewpoint of beauty and decoration.

GEORGE V. NASH.

THE SELF-PRUNING OF TREES.

The natural pruning of trees has long been well known. By natural pruning is meant the loss of certain branches after their death, caused usually by overshading and consequent poor nutrition. Thus is explained the lack of lower branches on trees growing close together in a forest. In this process the tree remains passive until the branch is dead, after which the dead branch is cut off by the formation of a "collar" of tissue by the cambium. Trees that have been pruned by "nature," that is, as the result of the action of environmental forces outside the tree, yield lumber that is much freer from knots than that cut from trees growing in the open, where the lower branches have persisted, but natural pruning appears to be of little advantage in the economy of the plant.

Many trees, however, prune themselves. This phenomenon, though described by Foerst * in 1893, and more fully by Schaffner and Tyler, in the "Ohio Naturalist" for 1901, appears to be not widely known. This *self-pruning* is distinguished from natural pruning in that the tree itself is throughout the active agent in the process. The branch dies as the result of the pruning, rather than being pruned after it is dead. In some trees there is formed at the base of certain branches an abscission layer, like that formed at the base of petioles in leaf-fall, and thus the branch is severed from the tree.

A striking demonstration of self-pruning may now be had along the walks leading up to the museum building. The sapling poplars (*Populus deltoides*), that alternate with the tulip-trees on either side of the walk, are vigorously pruning themselves, and the fallen branches are so numerous as to attract general attention. Most of the pruned branches are two years old, though some are older and some younger. They bear numerous, well-formed winter buds, and in some instances many leaves still remain on the branch.

Self-pruning, in some families, is accomplished in other ways than the one mentioned above. In the willow, for example, instead of the abscission-layer, a brittle zone is formed at the base of the branch. Out of about twenty-five genera where self-pruning occurs, *Catalpa*, *Ailanthus*, horse-chestnut, elm, lilac and mulberry, may be mentioned as illustrative examples in the garden.

The significance of self-pruning seems to be quite analogous to that of artificial pruning, *viz.*, to get rid of superfluous or of weak branches. It does not seem to be a means of vegetative propagation, for in most cases the branches cut off either do not take root, or do not fall into conditions suitable for that. Some trees, as, for example, the red and the sugar maples, and the

* Bull. Torrey Club 19: 267. 1892. Ibid. 20: 157. 1893.

American elm, are self-pruned in the spring or early summer, while others, as the poplar, postpone the process until fall.

C. STUART GAGER.

THE TARDY DEFOLIATION OF THE TREES.

The significance of leaf-fall as a protection against excessive drought rather than against extreme cold, as is popularly supposed, is well shown in the late persistence of the foliage this fall. Normally, most of the deciduous trees and shrubs in the Garden are almost entirely barren of leaves by the last of October, but this year the foliage, though richly colored with autumn tints, has persisted until the last week in October, with almost no sign of falling. Some of the maples, the hornbeams, sweetgums, and even the plane-trees (which have already been once defoliated this season by a fungus disease attacking them in the spring), show, at a distance, almost no loss of foliage.

This fact is doubtless largely due to the copious precipitation during September. Seven and ninety-three hundreths inches of rain were recorded at the Garden last month, or almost one fifth of the entire average annual precipitation. Thus tardy leaf-fall is correlated with a tardy autumn and winter drought, and the several frosts that have occurred have not appreciably hastened defoliation. Of course loss of water by transpiration ceases some time before the leaf actually falls.

C. STUART GAGER.

NEW MUSEUM CASES.

The crowding of specimens resulting from the naturally uneven growth of the different parts of the museum during the last few years has necessitated an increase in the case equipment for both the public exhibits and the study collections. To meet this condition, a number of cases were recently constructed and set up under a contract of the Department of Parks. These represent several standard units, and are built of quartered oak to match the cases of their respective styles.

Six cases for displaying fossil plants have been placed in the west hall of the basement. These occupy positions relatively the same as similar cases in the east hall. Thus the entire exhibition space of the basement will be used for the display of fossil plants. As the space in the new cases is equivalent to that of the old ones, many of the more valuable and characteristic specimens of fossil plants that have accumulated for several years in storage, can now be put on exhibition.

Sixteen cases have been placed in the west wing of the economic museum. They were arranged to complete the eight standard blocks consisting of six cases each, thus using up the available space in that wing. The collections displayed in that portion of the museum can now be more satisfactorily developed. The added space will be taken up mainly by the exhibits of plant constituents, oils, beverages, spices, and tanning material.

Forty-one cases were added to the equipment on the top floor. As many cases as possible were placed in the main herbarium room in order to relieve the congested condition of the herbarium of flowering plants, which has been brought about chiefly by the addition of specimens secured by means of exploration and exchange. However, the majority of the new herbarium cases were arranged in the room at the extreme western end of that floor. Here the entire fungus herbarium is being installed, while the cases in the room formerly devoted to fungi will be used for the rapidly growing fern herbarium. This addition of cases enables us to arrange the public exhibits and the study collections of the Garden to much better advantage than was possible heretofore.

J. K. Small.

NOTES, NEWS AND COMMENT.

The bi-weekly botanical conventions of the Garden were resumed on November 6, and will be continued until June 1.

Mr. H. S. Jackson, of the State Experiment Station, Newark, Delaware, was at the Garden from November 4 to 6, consulting the herbarium.

Dr. L. M. Underwood, Professor of Botany in Columbia University and Chairman of the Board of Scientific Directors of the Garden, died at his home in Redding, Connecticut, on Saturday, November 16.

Dr. Raymond H. Pond, who has been studying at the Garden during the past year, sailed for Europe on November 7 to spend several months in visiting German botanical laboratories.

Dr. Murrill visited the Biltmore Forest School, at Biltmore, North Carolina, in October, where he secured collections of Polyporaceae and made some observations on diseases of trees.

Dr. M. A. Howe and Mr. Percy Wilson sailed for the Bahamas on November 15. They have planned to spend several weeks there in botanical exploration.

Dr. C. B. Robinson, assistant curator of the Garden since July 1, 1906, has been appointed economic botanist of the Bureau of Science of the Government of the Philippine Islands, and is planning to sail for Manila early in the coming year.

The regular autumn exhibition of the Horticultural Society of New York was held at the Garden on November 13 and 14. An attractive display of varieties of apples was a feature of the exhibition. At the meeting on November 13 addresses were made by Messrs. Hedrick and Fullerton.

Professor C. F. Baker, for three years past chief of the department of botany in the Estación Central Agronómica, at Santiago de las Vegas, Cuba, has been appointed curator of the herbarium and botanic garden at the Museu Goeldi, Para, Brazil. His special work there will be the further development of the herbarium and garden at Para, and the botanical exploration of some of the most interesting parts of the Amazon valley. Professor Baker visited the Garden on November 20, on his way to Brazil.

The brook running through the center of the herbaceous grounds, which was becoming wider than first designed by the squeezing out of soil from its sides into the water by the crowds of people walking along its banks, making it necessary to deepen it continually for several years, has been made permanent this fall by the construction of a loose stone wall along each side rising to about the water level; this construction will make the care of the grounds adjoining the brook much easier, and does not interfere in the least with the planting of aquatics.

A contract for the construction of the park wall and fence on the southwestern side of the Garden, extending from the Elevated Railway station to the Southern Boulevard entrance along the property line of Fordham University, was awarded by the Commissioners of Parks in October to Guidone and Galardi, who plan to begin work during November. The structure will consist of a low rubble stone wall surmounted by an iron fence broken at intervals by granite columns. A fence along this boundary line has long been greatly desired, inasmuch as the path running parallel with this line from the Elevated Railway station is used by thousands of people and the old stone wall which is at present there is no barrier. The contract price is $17,000, the total distance being about two thousand feet. The fence will be stepped at intervals in order to conform to the natural grades as much as possible, each section being horizontal. It was designed by Mr. John R. Brinley, landscape engineer of the Garden, in consultation with Mr. Samuel Parsons, landscape architect of the Department of Parks, and the design was approved by the board of managers of the Garden and by the park commissioner.

The total precipitation recorded at the Garden for October was 4.44 inches. Maximum temperatures were recorded of 74° on the 4th, 73° on the 7th and 18th, and 61° on the 23d; also minimum temperatures of 40° on the 2d, 34° on the 10th, 31° on the 21st, and 28° on the 27th. The first fall frosts occurred during the first week of the month.

ACCESSIONS.

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HOOKER, JOSEPH DALTON. *Himalayan journals.* London, 1854. 2 vols.

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KIRSCHLEGER, FRIEDRICH. *Prodrome de la Flore d'Alsace.* Strasbourg, 1836–38.

KIRSCHLEGER, FRIEDRICH. *Statistique de la flore d'Alsace et des Vosges, qui font partie de cette province.* Mulhausen, 1831.

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KOCH, WILHELM DANIEL JOSEPH. *Synopsis der deutschen und schweizer Flora.* Zweite Auflage. Leipzig, 1846–47.

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SMITH, JOHN BERNHARDT. *Economic entomology*. Second edition. Philadelphia, 1906.

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WOODS, JOSEPH. *The tourist's flora*. London, 1850.

MUSEUMS AND HERBARIUM.

8 specimens of Piperaceae from tropical America. (By exchange with the U. S. National Museum.)

6 specimens of *Pimpinella magna* from eastern Pennsylvania. (Given by Professor C. L. Gruber.)

2 specimens of *Aralia hispida* from Quebec. (Given by Brother Louis Arsene.)

13 mosses from New Hampshire. (Given by Mr. H. H. Bartlett.)

1 specimen of *Solidago juncea* from Pennsylvania. (Given by Dr. Philip Dowell.)

3 mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

1 specimen of *Polygonum tenue* from Minnesota. (Given by Mr. L. R. Moyer.)

5 specimens of ferns and mosses from Grenada, West Indies. (Collected by Mr. W. E. Broadway.)

2 mosses from Brazil. (By exchange with Professor V. F. Brotherus.)

207 mosses from the tropics. (Distributed by Mr. F. Renauld.)

2,000 specimens from Jamaica, West Indies. (Collected by Dr. and Mrs. N. L. Britton.)

14 specimens of flowering plants from Long Island. (Given by Dr. R. M. Harper.)

30 specimens "Musci Acrocarpi Boreali-Americani." (By exchange with Professor J. M. Holzinger.)

19 specimens of flowering plants from Colorado. (Given by Mr. H. L. Shantz.)

9 specimens of flowering plants from the Old World. (Given by Mr. H. D. House.)

6 mosses from the West Indies. (By exchange with Mr. J. Cardot.)

1 specimen of *Razoumofskia pusilla* from Maine. (Given by Mr. J. Loring Arnold.)

2 specimens of *Fissidens* from Japan. (Given by Mr. E. B. Chamberlain.)

3 mosses from New England. (Given by Miss Annie Lorenz.)

54 specimens from South Carolina and Alabama. (Given by Messrs. H. D. House and W. C. Dukes.)

65 specimens of fungi from Biltmore, North Carolina. (Collected by Dr. W. A. Murrill.)

359 specimens from the Philippine Islands. (Collected by Mr. A. D. E. Elmer.)

PLANTS AND SEEDS.

102 plants for herbaceous grounds. (By exchange with Prof. W. J. Beal.)

1 plant for conservatories. (By exchange with Dr. J. N. Rose, through United States National Museum.)

43 plants for conservatories. (By exchange with Dr. C. F. Baker, Cuba.)

1 plant for conservatories. (Given by Miss A. M. Clark.)

2 plants for conservatories. (Given by Dr. Philip Dowell.)

1 plant for nursery. (Given by Mr. H. G. Rugg.)

3 plants for nursery. (Collected by Mr. R. C. Benedict.)

25 plants for herbaceous grounds. (Given by Mrs. W. Spalding.)

58 plants for conservatories from Jamaica. (Collected by Dr. and Mrs. N. L. Britton.)

20 plants for nursery. (Given by Mrs. K. L. Prentiss.)

3 packets of seed. (Collected by Mr. G. V. Nash, at Portage, N. Y.)

16 plants for conservatories. (Given by Mr. M. A. Saville.)

1 packet of seed. (Given by Dr. D. T. MacDougal.)

2 rootstocks for conservatories. (Collected by Dr. and Mrs. N. L. Britton in Jamaica.)

1 bulb for conservatories. (Collected by Dr. and Mrs. N. L. Britton in Jamaica.)

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Vol. VIII DECEMBER, 1907 No. 96

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

First Assissant

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AT 41 NORTH QUEEN STREET, LANCASTER, PA.
BY THE NEW ERA PRINTING COMPANY

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LUCIEN MARCUS UNDERWOOD.

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Vol. VIII. December, 1907. No. 96.

THE WORK OF PROFESSOR LUCIEN MARCUS UNDERWOOD.

The success of a life work is measured by the character and extent of its influence. When this work is embodied in the form of such voluminous records for permanent reference as have been left by Professor Underwood, it is important that its characteristics should be generally recognized. This is the more necessary in the present instance, because interest in many of the subjects treated by this author is yet in its infancy, and the work known to but few in comparison with those who will in future require its assistance.

A complete bibliography of Professor Underwood's writings is in course of preparation by another; it is the purpose of the present contribution to make use of only such references as shall illustrate the peculiar character and value of his work in general.

Professor Underwood was born on the 26th of October, 1853, at New Woodstock, New York, of John Lincklaen and Jane H. (Smith) Underwood. He died at his home in Redding, Connecticut, November 16, 1907, and was buried in the Redding cemetery. A copy of his latest photograph, taken a short time before his death, is shown in the frontispiece. His boyhood was passed upon the farm and his subsequent love of natural history was here foreshadowed in his interest in living things and in the keen and inquiring intelligence with which he observed them. During his student days these propensities were notable to his schoolmates, even to those who were not interested in the same subects. His natural history collecting might be said to have begun spontaneously, in his boyhood, before he knew anything of such work as a pursuit. It began systematically as soon as his student life had given him a knowledge of this branch of study, and, before he had received his collegiate degree, his collections were already of considerable extent and of no little local value. The wide range of these collections, through animate and inanimate nature, plainly indicated the character of his mind and the nature of his future work as a teacher and investigator. His interest in the inorganic world extended to chemical composition, so that chemistry early became one of his favorite studies, and he spent some time in teaching it. When he took the degree of Ph.D. at Syracuse University in 1879, he was recognized by both faculty and students as a young man of many broad attainments. These facts are here dwelt upon by virtue of their relation to what the writer regards as Professor Underwood's special characteristic, breadth of view.

From these habits of study, it resulted that his superiors felt able to assign him, at different times, to a wide variety of teaching duties. He once informed the writer, with a smile of amused reminiscence, that he had taught about everything that could, with any degree of grace, be crowded within the range of work of any one teacher. The many positions which he occupied as a teacher indicated neither restlessness nor incompetence, but a determination to settle only where there was opportunity for the pursuit of his real life work. This opportunity he secured in 1896, when he became Professor of Botany at Columbia University, and assumed important associated relations with the New York Botanical Garden as a member of its Board of Scientific Directors, of which he became Chairman in 1901. His opportunities here were enhanced by the possession of unexcelled assistance in the teaching department of the University, making it possible for him to work in freedom from many of the distractions which often impede the work of the scientific investigator.

Professor Underwood's first actual scientific publication seems to have been an account of original observations of the evergreen wood fern (Bulletin Torrey Botanical Club, October, 1878).

This published observation was but one of the many which he had treasured, and, the ice being now broken, he became disposed to direct attention to the ferns generally as he knew and loved them, which he did in 1881, through a small volume entitled "Our Native Ferns." The volume was dedicated to his sister, and its title page bore the following quotation from Coleridge:

> "He prayeth best who loveth best
> All things, both great and small,
> For the dear God who loveth us,
> He made and loveth all."

The work contained synoptical descriptions of 147 species, and its object was to guide to their study as well as to their classification. This work has passed through six editions, the fourth of which represents a notable advance in the author's view and in his treatment of the subject; it includes the fern allies, and adopts a modern classification and a rational nomenclature. That it created a widespread interest in the study of ferns is shown by the successful career of the Fern Chapter and Fern Bulletin, both of which profited largely thereby. A more striking evidence is the great number of fern specimens that soon poured in upon the author from students in all parts of the country, which enabled him to accumulate a very valuable collection, now possessed by the New York Botanical Garden.

During the progress of his work on ferns, Professor Underwood became impressed with the need for some systematic presentation of the North American Hepaticae, which, serving as a convenient guide, might lead to the more general study of this neglected group. This project was carried out in 1883, when he published his descriptive Catalogue of these plants in the Bulletin of the Illinois State Laboratory of Natural History.

One of his most cherished objects was the publication of an elaborate Index Hepaticarum, and in 1893 its first part, on bibliography, appeared. It is characteristic of the author that this first part is presented so that it can form a convenient basis for the continuation of the work by another. In 1894, he published a highly scientific paper on the evolution of the Hepaticae.

Professor Underwood's natural tendency to breadth of study was illustrated in his relations with the work of the Indiana Academy of Sciences. This society was established in 1885 and the publication of its Proceedings was begun in 1891, the first volume containing two papers by him. In that year he proposed the undertaking of a biological survey of the state. The following year he was made chairman of a committee to provide for its organization, with the result that in 1893 the Proceedings contained a report of work covering 192 printed pages. Of these, 55 were by Underwood, and the remainder by a number of contributors, indicating his influence in enlisting the interest of others, an ability that characterized his entire career. In this first report, he published a map of Indiana, with those counties shaded in blue from which no collections of ferns or fern-allies had been reported, the area thus covered representing about three fifths of the state.

The same idea of making provision, where none existed, for encouraging new interest in little-worked fields of study led him in 1899 to publish a work entitled "Moulds, Mildews and Mushrooms." The author's idea was expressed in the following prefatory statement: "The increasing interest that has been developed in fungi during the past few years, together with the fact that there is no guide written in the English language to the modern classification of the group and its extensive but scattered literature, has led the writer to prepare this introduction for the use of those who wish to know something of this interesting series of plants." In accordance with this idea, guides to the literature here accompany his exposition of all the groups. Two years earlier, he had published his "Preliminary List of Alabama Fungi." It would perhaps be too much to say that the author's interest in fungi had been incited by economic considerations, but these unquestionably had much to do with his special study of them. The publication of his studies of the cedar-and-apple rust proved of great interest in horticultural circles. In 1896, he published, in coöperation with Earle, an important paper on the "Treatment of Fungous Diseases," in the Bulletin of the Alabama Agricultural Experiment Station. About 1902, he became interested in the establishment of mycological clubs throughout the country, the work of these organizations being largely economic. It is doubtless due to the fact that most of Professor Underwood's work dealt with groups having few economic relations that his interest in vegetable economics was not more generally known. The writer is better informed, through long and intimate acquaintance, and has been for several years past impressed with a belief that he contemplated some important publication on economic botany.

During the entire period that these other studies, so fruitful of results, were occupying his attention, Professor Underwood was making steady progress in his investigations of the ferns. It is this which we regard as his special work, and it is to it that we must look for our best knowledge of him as a scholar. We have seen how, in the fourth edition of his fern manual, he broke from old traditions and thenceforth pursued his work with greater freedom to discover the truth and intelligibly present it. It was a momentous change, and one that marks the beginning of his best work. It gave to his views concerning the inter-relations of the North American ferns that unique value, the recognition of which weighs us down with the special sense of our loss, in that we shall never see the full results of its influence in their systematic arrangement. It forced him to go backward as well as forward in his researches, one of which was represented by a critical paper published in 1899 on the genera of ferns proposed prior to 1832. A little gem, which may be credited to the same impulse, was his paper of 1905, entitled "A Glimpse at Early Botanical Literature"; it had led him in 1901, in a paper entitled "A Changed Conception of Species," to say the following: "Two pernicious principles early invaded the study of botany in this country, and some traces of the spirit they engendered still persist in conservative settlements, along with other provincialisms strikingly un-American: (1) the habit of regarding as many American species as possible identical with European congeners . . . ; (2) the more or less blind acceptance of European writers on American plants as 'authorities.'" This position was more definitely stated a year later in a paper entitled "Some Features of Future Fern Study." Herein he refers to observations carefully recorded at Kew in 1898, and treats of the advance that will be made in the future study of our American ferns, viz.: "the delimitation of closely allied species that have hitherto been tied up in specific groups under single names." He speaks also of what will be "a very conspicuous feature of the fern study of the next few years," that is, of the early stages of our native ferns. He refers to the value of anatomical studies as casting light upon systematic relationships. The writer had knowledge of much deeper problems concerning the significance of fern anatomy which occupied our author, problems indicating such questions as "What is the frond," and "What is the relation of the fern caudex to the ordinary stem." In the paper here considered he speaks of the broadening of our present limited conceptions of American ferns by including those of the American tropics. "But these thoughts," he says, "take us far beyond the original intent of my subject; yet they only emphasize the fact that the world is a unit, and that even in fern study we will do well to bear in mind not to become too narrow in our conceptions."

The attitude of Professor Underwood toward fern study at the time of his death is to be seen in the following quotation from his very last paper: "The two ferns of the genus *Lindsaea* here to be described, one from Colombia, the other from Cuba, we regard as very distinct and readily recognizable; otherwise we should hesitate to add to the list of names in a genus so thoroughly in need of careful revision."

As a summary, from a careful review of this whole field of labor, it may be said that Professor Underwood's systematic study of the ferns was one of the most profound in its class, and was performed in a manner to compel the admiration of all competent critics. Convinced that the existing views of inter-relationship among the ferns were not only confused, but wrongly founded, and that correction could be accomplished only through a general readjustment, he undertook this enormous task without faltering, although he did not in the least lack appreciation of its magnitude. Although he dissected unsparingly the work of others, his sense of responsibility as a critic was so keen as to save him from any tinge of offensiveness, and he was never known to yield to the personal in viewing either another's work or his own. In his studies, he was equally appreciative of the general and the detailed, and he balanced the two in a way that is very rare among systematists.

In work of this kind, every conclusion reached becomes the key to other questions, so that the publication of a group always represents the accomplishment of much more than appears in the publication. It is thus true that by far the larger part of Professor Underwood's results are recorded only in the herbarium cases where his annotated specimens are arranged. When one shall appear who is ready and able to take up this work where Professor Underwood has left it, he will find it no light task to prepare himself by traversing the ground already covered and by bringing himself to a point where he can compass Professor Underwood's view.

H. H. Rusby.

THE EVAPORATING POWER OF THE AIR AT THE NEW YORK BOTANICAL GARDEN.

In May, 1900, three meteorological stations were established in the Garden.* Station 1, located in the herbaceous garden, was equipped with a standard rain-gauge, a thermograph, and a set of maximum and minimum thermometers. Station 2 was on a low ridge in the center of the hemlock forest, and station 3 in the central portion of the elevated plain of the fruticetum. The last two stations were equipped with thermographs only.

Late in September, 1904, these three stations were abandoned.† The catchment basin of the rain-gauge was installed on the roof of the Museum building over the physiological laboratory, and, by means of a lead pipe extending down through one of the supporting pillars, it was connected with the gauge at the base of the pillar, inside the laboratory. The amount of precipitation recorded at the new station was found to be approximately the same as at the old one. The thermometers and thermographs were all transferred to a shelter house located within the experi-

* Journal N. Y. Bot. Garden 1: 76. 1900.

† Journal N. Y. Bot. Garden 5: 211. 1904.

ment-garden, near the propagating-houses, on the eastern border of the garden.

Until June, 1907, the meteorological records at the Garden include only the dates and amounts of precipitation, and the temperature of the air and that of the soil at two depths. The amount of precipitation, however, is not an index of the amount of water available to vegetation. Part of the meteoric water drains away through the soil before it is used, while a portion of it evaporates from the surface of the soil into the air. It is the ratio between annual precipitation and evaporation that chiefly determines how nearly a given region approaches to either a swamp or a desert. In a swamp evaporation is less than precipitation, while in a desert the reverse is true.

It is a well-known fact that the rate of evaporation from a given area depends upon the relative humidity of the surrounding air. Relative humidity, in turn, varies with the temperature of the air, and with the environment. Thus, for a given air-temperature, the rate of evaporation from a given water-surface will vary with the area of the surface and with the depth of the water, and the rate of evaporation from moist substances will be modified by the nature of the substance, and with the amount of moisture it contains. Thus, for example, water will evaporate more rapidly from one square foot of water-surface than from two square feet, and more rapidly from one square foot with a depth of, say, one quarter of an inch, than it will from the same area over a depth of one foot. Also the same amount of water will evaporate at different rates from clay-soil and from sand-soil. Shrubbery and foliage tend in several ways to increase the relative humidity of the surrounding air, thus retarding evaporation.

The experiments described in this paper form part of a more extended investigation, inaugurated by Dr. Burton E. Livingston, of the Desert Botanical Laboratory, of the Carnegie Institution, at Tucson, Arizona. Evaporimeters of uniform pattern, and standardized, have been distributed to some twenty-seven stations in the United States, ranging from Orono, Maine, on the east, to California, on the west, and from Bozeman, Montana, on the north, to Gainesville, Florida, on the south, covering a wide range of altitude and of nearness to large bodies of water. Of these instruments, those received at the garden were Nos. 28, 30 and 34. It is hoped by means of the investigation, to be able to establish a unit for measuring evaporation.

On the sixth of June, 1907, the evaporimeters were installed at three stations within the Garden. These instruments consist of a pint fruit jar, tightly corked with a cork stopper soaked in paraffine. Through the stopper a glass tube extends from the bottom of the jar up and through a second cork, which tightly closes the opening into a porous clay thimble. The glass tube extends to the top of the thimble. For further protection against the entrance of water from without a paraffined piece of cloth was fitted tightly around the glass tube, and extended as a roof over the top of the fruit-jar.

The jar was filled with distilled water up to a zero mark, and the porous thimble and the glass tube were also filled with distilled water. Each evaporimeter was sunk into the ground to the level of the top of the fruit-jar. As evaporation took place from the surface of the thimble the water rose from the jar up through the glass tube, thus keeping the thimble full and lowering the surface of the water in the jar. The rate of evaporation varied with the relative humidity of the surrounding air, and the amount was measured by carefully pouring more distilled water into the jar from a graduate, until the water-surface in the jar rose again to the zero mark. The amount of water necessary to accomplish this was the measure of the amount of evaporation for the given period.

Station 1 (evaporimeter No. 28) was west of the propagating houses on a dry, rocky knoll, covered with only a thin layer (one to two feet) of soil, and well drained. The instrument was shaded on all sides by tall saplings of red cedar and *Ailanthus*, and numerous small herbaceous plants and vines such as *Smilax rotundifolia*, and ferns. The surface of the ground was covered with twigs and dead leaves. Station 2 (evaporimeter No. 30) was about fifty feet south of the stable, near the eastern border of the garden. The ground is low, poorly drained, and marshy during the spring and other periods of "wet weather." The instrument was surrounded with unmoved grassy sod, shaded by a tall sapling of alder on the west, and by tall shrubbery (*Forsythia*, etc.) on the east. Station 3 (evaporimeter No. 34) was about six feet east of the instrument shelter in the experiment garden (Fig. 37). On the north and west was sod, on the east and south

FIG. 37. Evaporimeter-Station 3. (*Instrument No. 34*) New York Botanical Garden. Facing nearly due west. The photograph shows the above-ground portion of the evaporimeter near the tall fence post. Evaporation takes place only from the upper (whiter) part of the porous clay thimble. The top of the fruit-jar which is sunk into the ground is covered by the paraffined cloth "roof," through which the glass tube passes from the jar up into the clay thimble.

cultivated ground, with evening-primroses growing within two feet. The soil here is loamy and well drained.

The instruments were all standardized by Dr. Livingston, so that, after applying the correction for each instrument, the respective readings were strictly comparable, varying only with the external conditions that control evaporation. Readings, taken every week on Monday morning from June 6 to October 14, and standardized by applying the necessary correction constant, are given in the following table:

Week ending,	6/10	6/17	6/24	7/1	7/8
No. 28,	66	77	99	60	77
No. 30,	48	48	51	29	47
No. 34,	—	129	147	106	137
Week ending,	7/15	7/22	7/29	8/5	8/12
No. 28,	99	60	130	98	82
No. 30,	55	37	56	37	46
No. 34,	129	124	185	133	142
Week ending,	8/19	8/26	9/2	9/9	9/16
No. 28,	126	105	118	47	74
No. 30,	89	64	85	32	41
No. 34,	188	131	128	41	85
Week ending,	9/23	9/30	10/7	10/14	
No. 28,	50	50	99	68	
No. 30,	27	—	32	—	
No. 34,	58	35	80	61	

It has been ascertained by Dr. Livingston that an evaporation of 6.05 c.c. from the evaporimeters corresponds to 1 mm. of depth, or, in English units (since it is customary to measure precipitation in inches), 153.67 c.c. of evaporation equals 1 inch of depth. For the purpose of ascertaining these data comparisons were made between the evaporation from the evaporimeters and from a chemical water-bath, 25.6 inches in diameter, with the water standing 11 cm. deep when the surface is at zero on the scale. "It stands," writes Dr. Livingston, "with the water-surface level with the middle of the evaporimeters to be tested, and about two meters away from them. It is about 15 cm. from the ground to the water-level. This level is about 5 mm. below the level of the dish at the beginning of a period, and the vessel is refilled once a day when the readings are made."

The total precipitation registered at the Garden from June 10, 1907, to September 23, 1907, was 9.32 inches. This amount will be approximately the same for all three evaporimeter stations. Therefore, taking the difference between the amount of precipitation in inches and the amount of evaporation from the evaporimeters in inches, we have:

For No. 28 (at the propagating house)	9.32 in. —	8.47 in. =	.85 in.
For No. 30 (at the stable)	9.32 in. —	4.84 in. =	4.48 in.
For No. 34 (at the experiment garden)	9.32 in. —	12.10 in. =	— 21.42 in.

That is, at the propagating house precipitation was .85 inch in excess of the loss from the evaporimeter, at the swampy region near the stable, 4.48 inches; while in the experiment garden during the same period the evaporating power of the air was 2.78 inches in excess of the precipitation recorded.

Now it should be kept in mind that the loss of water from the evaporimeters is not a measure of the amount of water lost by the soil through evaporation, but is *only an index of the evaporating power of the air* for the given station. For the same locality the rate of evaporation from soil and from evaporimeter will materially differ, being less from soil and varying with its nature and condition, as well as with the surroundings above the soil-surface.

The purpose of the above data, therefore, is not to give a measure of the amount of precipitation that remains in the soil, or that becomes available to the plants, but, as already emphasized, to give a measure of the evaporating power of the air in different localities. The above record, then, gives *numerical expression* of the fact that, of the three localities studied, the evaporating power of the air is greatest in the experiment garden, least at the swampy area near the stable, and intermediate on the elevated, shaded, and well-drained rocky knoll.

C. STUART GAGER.

NOTES, NEWS AND COMMENT.

Mr. George V. Nash, Head Gardener, delivered a lecture on Water Gardens before the Bronx Society of Arts and Sciences December 6.

Bulletin No. 14, containing an enumeration by Henry H. Rusby of plants collected in Bolivia by Miguel Bang, with descriptions of new genera and species, was issued December 7, 1907. This number also contains an index to Vol. 4, which it completes.

A tuber of *Ibervillea Sonorae*, a member of the gourd family, collected in Mexico in February, 1902, and placed in the museum here soon afterwards, has shown signs of life again this season by sending up a slender stalk, which still appears green and to some extent active. This curious desert plant may be seen on the second floor of the museum building near the main stairway.

The road leading from the eastern end of the Long Bridge northward along the Bronx River to the Newell Avenue entrance at the Williamsbridge end of the Garden was completed and thrown open for use in November, a steam road roller being obligingly detailed for its completion by the Hon. Joseph I. Berry, Commissioner of Parks. This portion of the driveway system is a little over 2,000 feet in length and the roadway has been built 25 feet wide. It will be possible to broaden it in the future in case this should be found necessary, but it is not expected that it will be used as much as the main 40-foot driveways and it is hoped that the 25-foot width will answer all purposes. Considerable grading of banks has been done from time to time along this road, but much of this work still remains to be accomplished. The road skirts the river north of the Long Bridge for about 700 feet and beyond that skirts the eastern side of the north meadows. The opening of this road completes the driveway system of the northern part of the ground.

The paths through the shrub collection on the plain north of the lakes, and those encircling the lakes, were completed during the autumn, a total length of over a mile of finished path being thus added to the system. Nearly all the grading necessary along the sides of these paths had previously been done. The paths through the economic garden and connecting this plantation with the paths leading to the museum building and to the systematic herbaceous plantation, a total length of nearly 2,000 feet, were also completed, as well as the path leading from the herbaceous garden in a southerly direction to the Bronx Park in the woods at the southern boundary of the Garden, a distance of about 800 feet. This work was all made possible by securing a boat load of fine trap rock screenings through the Department of Parks. The same boat load of trap rock screenings furnished material for the resurfacing of the driveways first built in the Garden from the Bedford Park Boulevard entrance past the museum building, and northward to the lakes, and southward to a point east of the public conservatories; a considerable amount of the earlier built paths about the public conservatories being also resurfaced. The entire road and path system of the grounds, constructed up to the present time, may now be reported to be in first class condition. The portion of the main driveway at the Lake Bridge, which has remained unfinished since the building of that structure awaiting the complete settling of the earth and rock filling, a length of about 250 feet, was also completed during November, as well as the paths leading to that bridge both from the north and from the south.

Meteorology for November. — The total precipitation recorded for the month was 5.03 inches. Maximum temperatures were recorded of 62° on the 3d, 58.5° on the 5th and 10th, 54° on the 17th, 58° on the 22d, and 55° on the 28th; also minimum temperatures of 29° on the 1st, 30° on the 5th, 23° on the 15th, 32° on the 20th, and 25° on the 30th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

432 specimens from North Dakota. (By exchange with Dr. J. Lunell.)

3 specimens from Virginia. (Given by Mr. E. B. Bartram.)

3 specimens of hepatics from New England. (Given by Miss Annie Lorenz.)

1 specimen of the wood of *Cotinus americanus* from Alabama. (Given by Dr. R. M. Harper.)

1 specimen of European spruce gum from Poughkeepsie, New York. (Collected by Mr. Percy Wilson.)

39 specimens from Colorado. (By exchange with Mr. George E. Osterhout.)

99 specimens of ferns from the Eastern States. (Given by Mr. R. C. Benedict.)

2 specimens of ferns from Chapel Hill, North Carolina. (Given by Professor W. C. Coker.)

1 specimen from Colorado. (Given by Professor T. D. A. Cockerell.)

7 specimens of mosses from New England. (Given by Miss Annie Lorenz.)

1 specimen of *Cercospora pachyspora* from Ohio. (By exchange with Professor W. A. Kellerman.)

2 specimens of polypores from Ithaca, New York. (Given by Professor George F. Atkinson.)

36 specimens of fungi from Virginia. (Collected by Dr. W. A. Murrill.)

1 specimen of *Solidago* from Michigan. (Given by Mr. William T. Wallace.)

2 specimens of *Lactarius* from Gainesville, Florida. (Given by Mr. H. S. Fawcett.)

3 specimens of polypores from Rockville, Indiana. (Given by Mr. Geo. T. Howell.)

1 specimen of *Porodaedalea Pini* from Forked River, New Jersey. (Given by Mr. W. H. Ballou.)

34 specimens from Colorado. (Given by Mr. H. L. Shantz.)

25 specimens of fungi from various localities. (Given by Miss S. L. Clarke.)

2 specimens of polypores from Staten Island, New York. (Given by Mr. S. C. Edwards.)

1 specimen of *Fissidens minutulus* from Cambridge, New York. (Given by Mr. Frank Dobbin.)

9 specimens of mosses from Connecticut. (By exchange with Mr. Geo. E. Nichols.)

45 specimens of violets from Connecticut. (Given by Mr. W. W. Eggleston.)

PLANTS AND SEEDS.

4 plants for conservatories. (By exchange with Dr. Treub, Java.)

59 plants for conservatories. (Given by Mrs. George Such.)

1 plant for conservatories. (Collected by Mr. L. J. K. Brace.)

1 plant for nursery. (Given by Mr. Sturtevant.)

1 plant for conservatories. (Given by Prof. P. H. Rolfs.)

2 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 plant for conservatories. (Given by Dr. H. H. Rusby.)

48 plants for conservatories. (By exchange with Estación Central Agronómica, Cuba.)

48 plants derived from seed from various sources.

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Members of the Corporation.

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